Educational (instructional) design models

Daniel K. Schneider (ed.)

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CRESST learning model

Draft

Definition

The CRESST learning model has been proposed by Baker (1995) of the Center for Research on Evaluation, Standard, and Student Testing (CRESST) to describe “the range of cognitive learning in which students engage”. The "cognitive types of learning" are a composite of taxomomies and theories from by Gagné, Merrill and others.

Five *families* are used to describe the kinds of learning that can take place.

Content-specific activities:

- **Content understanding** - learning of domain specific material. Activities may include student explanations, concept map builiding.
- **Problem solving** - processes and strategies engaged to acheive a goal that has no apparent solution, including the trasfer of content-understanding and use of metacognition to the resolution of an unfamiliar problem.

Content-independent activities:

- **Collaboration** - learning to work with others, acquiring interpersonal skills, including *teamwork* (group performance on task) and *taskwork* (individuals' effectiveness within the group) (Morgan, Salas, & Glickman, 1993)
- **Communication** - learning to express thoughts and ideas effectively, written and/or verbally within the content domain (use appropriate terminology to explain content.
- **Metacognition** - learning to regulate one's cognitive activity through awareness, knowledge of cognitive strategies, planning and self-monitoring.

CRESST publishes handbooks for creating assessment materials to assess performance in each of these families. The handbook for assessing content understanding is available as a free sample (PDF) [1].

CRESST is also proposed as a method to analyse the cognitive demands of a technology by evaluating the extent to which each family of learning is activated through the use of a particular technology (Baker, O'Neil, & Klien, 1998).

References

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- Baker, E.L. , O'Neil, H.F., & Klien, D.C.D. (1998), A Cognitive Demands Analysis of Innovative Technologies, CSE Technical Report 454, National Center for Research on Evaluation, Standard, and Student Testing (CRESST), UCLA.
- Morgan, B.B, Jr., Salas, E., & Glickman, A.S. (1993). An analysis of team evolution and maturation. Journal of General Psychology, 120, 277-291.

4C/ID

Draft

Definition

- 4C/ID is an instructional design model by van Merriënboer and others.
- "4C" means "four components", "ID" means "Instructional Design". It also can be found in Merrill's first principles of instruction.
- According to Martin Ryder [1], the The 4C-ID instructional model is characterized by four components: (1) Learning Tasks, (2) Supportive Information, (3) Procedural Information and (4) Part-Task Practice. The tasks are ordered by task difficulty and each task offers at the beginning a lot of scaffolding which is reduced as the learner progresses.

See also: Elaboration theory (a much earlier model from Reigeluth).

The design

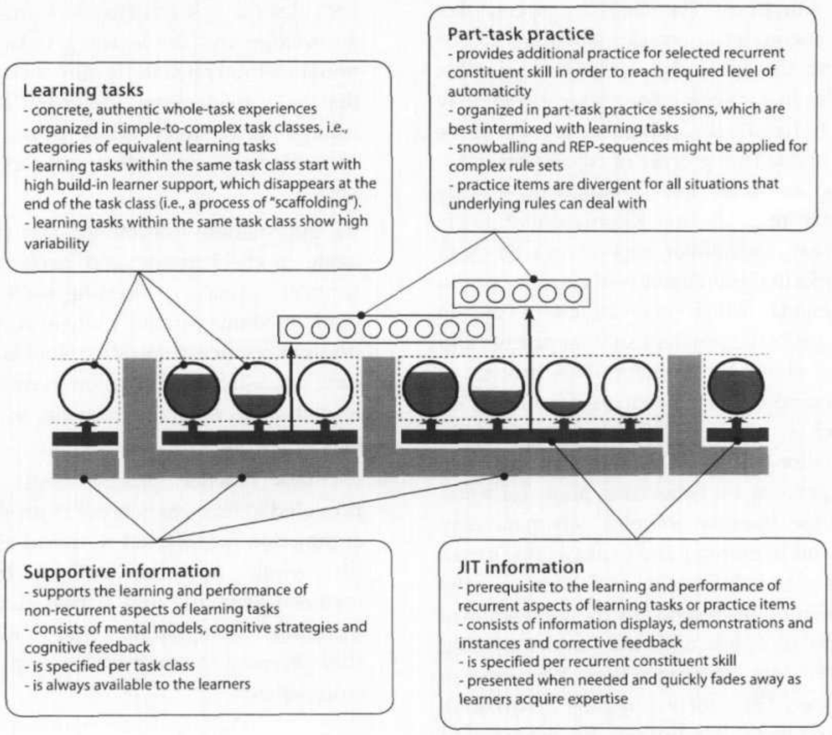
4C/ID is what I call a "main-stream" Instructional Design Model that addresses the issue of how to teach complex skills, i.e. solid know-how that can be applied to real problem problems.

According to Merriënboer et al. (2002): “ The 4C/ID-model [....] addresses at least three deficits in previous instructional design models. First, the 4C/ID-model focuses on the integration and coordinated performance of task-specific constituent skills rather than on knowledge types, context or presentation-delivery media. Second, the model makes a critical distinction between supportive information and required just-in-time (JIT) information (the latter specifies the performance required, not only the type of knowledge required). And third, traditional models use either part-task or whole-task practice; the 4C/IDmodel recommends a mixture where part-task practice supports very complex, "whole-task" learning.”

According to Merrill (2002:56), the model is clearly problem-based although not in the sense of typical problem-based learning models. “ At the heart of this training strategy is whole-task practice, in which more and more complex versions of the whole complex cognitive skill are practiced. In ... the analysis phase ... the skill is decomposed in a hierarchy of constituent skills; ... classified as recurrent constituent skills, which require more-or-less consistent performance over problem situations, or nonrecurrent constituent skills, which require highly variable performance over situations" (p. 8). "While learners practice simple to complex versions of a whole task, instructional methods that promote just-intime information presentation are used to support the recurrent aspects of the whole task while, at the same time, instructional methods that promote elaboration are used to support the non-recurrent aspects of the task" (p. 10).”

The four components are described in detail in Merrienboer (2002) [2] and from which this picture is taken:

Figure 2 ☐ A graphical view on the four components: (a) learning tasks, (b) supportive information, (c) just-in-time (JIT) information, and (d) part-task practice.



Some features of 4C/ID

This section are made from notes taken during a van Merriënboer keynote talk on March 14 2013 [3].

4C/ID can be described as a method that will describe the backbone of a curriculum where each element is connected and does have a function with respect to the whole. It addresses two problems:

- Students can't apply "knowledge"
- Students and life-long learners are not self-directed learners

There is research-based evidence that transfer is improved when using a 4C/ID design.

Learning tasks

Create a "spiraled2 sequence of tasks, based on **induction**

- Provide variability in each task
- Provide task classes i.e. sequences of easy to difficult tasks. Each task should be meaningful right from the start. Make sure to offer several variants for each class, i.e. a series of task that address the same learning outcomes at same difficulty level.
- Provide guidance: Scaffolding should be provided in each task. However, for task set, define a Zone of proximal development using a sawtooth pattern: First task in a class uses a lot of support, last task in a class should have no support. If learners are successful, then move them to a higher level.
- Typical learning technologies for task support: Simulated/real task environments and development portfolios

Supportive information

Is information that helps learnings getting the tasks done. It shows how the domain is organized (e.g. anatomy in medicine) and shows how to approach a task. Design of supportive information is based on knowledge **elaboration** and is linked to all tasks in a given class. An other class may require more simple or more difficult information.

- Can be provided before (tell "theory") or during a task sequence (typically in project-oriented designs)
- "What should I study in order to be able to....." (self-directed learners)
- Typical learning technologies: Hypermedia and Internet in General

Procedural information

Refers to knowledge needed to solve parts of the task. Based on **knowledge compilation** and may require drill and practise (see next item)

- Routine aspects
- How-to information that is used "just-in-time"

Part-task practice

Based on **strengthening**

- Repetition and drill
- However, part-time practice should only be presented within a cognitive context, i.e. a whole task
- Sometimes more practice is needed for procedure learning

Use of simulation, real tasks and video

This section are made from notes taken during a van Merriënboer keynote talk on March 14 2013 [4]. 4C/ID also can be used as model for vocational training

Merriënboer presented three projects from which we point out a few highlights:

(1) STEP portfolio project with hairdressers.

Steps:

- Simulation in school
- Select and do a task in the work context
- Fill in a portfolio page that includes an evaluation grid, i.e. collect assessment information on each task
- Coaching meeting in regular intervals (e.g. once per week) with the teacher

Positive:

- Both students and teachers like

Negative:

- Teacher's complain about missing time (e.g. time for coaching meetings)

A mobile app project called "PERFECT" tries to implement a self-coaching approach.

(2) Care Village project, targeting nursing education:

- Web application
- Provides tasks to complete in various contexts
- A task describes a patient first, then defines 2 tasks one for the school and one for the workplace
- Again, all tasks can be scored in a portfolio

(3) CRAFT - Mechatronics project:

- Serious game
- In the virtual world, simulated machines can be explored

- In a virtual workplace, parts are made and then integrated into an attraction park
- In the real workplace, parts are made and the student can obtained credits for the game

Implementation

How to implement a 4C/ID design:

Work with a team:

- more than one teacher
- professionals (of the subject area)
- one or more students
- Media/technology specialists if needed

... i.e. have all stakeholders participate

Cost-effectiveness is an issue, ... being investigated now.

References

- Merrill, David, First Principles of Instruction, ETR&D, Vol. 50, No. 3, 2002, pp. 43-59 ISSN 1042-1629. Preprint version [5]
- van Merriënboer, J.J.G (1997). Training complex cognitive skills: A four-component instructional design model for technical training. Englewood Cliffs, NJ: Educational Technology Publications
- van Merriënboer, Jeroen.J.G, Richard E Clark, Marcel B M de Croock, (2002) Blueprints for complex learning: The 4C/ID-model, Educational Technology, Research and Development. 50 (2);39-64, DOI: 0.1007/BF02504993, Abstract/PDF [6] (*Access restricted*).
- Frederick Kwaku Sarfo & Jan Elen, Powerful Learning Environments and the Development of Technical Expertise in Ghana: Investigating the Moderating Effect of Instructional Conceptions, IEEE Explore, ??? PDF [7]
- van Merriënboer, J.J.G & Kirshner, P. (2007). Ten Steps to Complex Learning [8]. Erlbaum.

Links

- http://www.tensteps.info

5e Learning cycle

Definition

The 5e learning cycle is an instructional design model that defines a learning sequence based on the on the experiential learning philosophy of John Dewey and the experiential learning cycle proposed by David Kolb. Attributed Roger Bybee of the Biological Science Curriculum Study (BSCS)[1], the model presents a framework for constructivist learning theories and can be effectively used in teaching science.

The model

Engage

Here the task is introduced. Connections to past learning and experience can be invoked. A demonstration of an event, the presentation of a phenomenon or problem or asking pointed questions can be used to focus the learners' attention on the tasks that will follow. The goal is to spark their interest and involvement.

Explore

Learners should take part in activities that allow them to work with materials that give them a 'hands on' experience of the phenomena being observed. Simulations or models whose parameter can be manipulated by learners, so that they can build relevant experiences of the phenomena, can be provided. Questioning, sharing and communication with other learners should be encouraged during this stage. The teacher facilitates the process.

Explain

The focus at this stage is on analysis. The learner is encouraged to put observations, questions, hypotheses and experiences from the previous stages into language. Communication between learners and learner groups can spur the process. The instructor may choose to introduce explanations, definitions, mediate discussions or simply facilitate by helping learners find the words needed.

Elaborate/Extend

Using the understanding gained in the previous stages, now learners should be encouraged build and expand upon it. Inferences, deductions, and hypotheses can be applied to similar or real-world situations. Varied examples and applications of concepts learnt strengthen mental models and provide further insight and understanding.

Evaluate

Evaluation should be ongoing and should occur at all stages, in order to determine that learning objectives have been met and misconceptions avoided. Any number of rubrics, checklists, interviews, observation or other evaluation tools can be used. If interest in a particular aspect or concept is shown, further inquiry should be encouraged and a new cycle can begin that builds upon the previous one. Inquiries may branch off and inspire new cycles, repeating the process in a spiralling fractal of interrelated concepts, where instruction is both structured and yet open to investigation.

Examples

- [2] 5e Model Lesson - 3 science lesson plans using the model
- [3] Designing Constructivist Lesson Using the 5 E Model - Instruction on how to use the model and rubric for evaluating student performance during each stage

Related articles

- 7e Learning cycle
- 5e's of education

References

- Anthony W. Lorsbach, The Learning Cycle as a Tool for Planning Science Instruction, Illinois State University (accessed June 15, 2006) [4]
- 5 E's Lesson Components, The Maryland Virtual High School of Science and Mathematics (accessed June 15, 2006) [5]
- Miami Museum of Science (2001). Constructivism and the Five E's, The pH Factor, (accessed June 15, 2006) [6]

5e's of education

Draft

A variation of the 5e Learning cycle was developed (and copyrighted) in the 90's by the MG Taylor Corporation. It takes a constructivist approach to learning, cradling *expectations*, *examples* and *explanations* within *experience* and *exploration*

The 5e's are:

- experience
- expect
- explore
- exemplify
- explain

From MG Taylor's website [1]:

As already noted, the model implies that explanations and examples form the foundation of education, but this doesn't mean that they necessarily come first in the process of education. Perhaps exploration and some experience come first--then out of the experience the learner can extract explanations and develop a systematic approach to hunt for further examples to confirm, deny, or expand their conclusions. The clear explanation, in a way, is the LAST step in the process. Only a master of a concept can explain it. Only a master has the experience and exploration behind her to do so.

> *The E's in this model correspond to the elements that make up the 5e Learning cycle but their order is different. Placing the explanation at the end bases this model more on experiential learning than the 5e Learning cycle or the 7e Learning cycle*

7e Learning cycle

Draft

The 7e Learning cycle is an expansion of the 5e Learning cycle.

Comparison of the 5e and 7e learning cycles

5e Learning cycle	7e Learning cycle
engage	elicit engage
explore	explore
explain	explain
elaborate/extend	elaborate
evaluate	evaluate
	extend

The model differs from the 5e Learning cycle in two ways. The *engage* element is expanded into *elicit* and *engage*. This places a greater emphasis on prior experience and eliciting tacit knowledge that can be used as a foundation for the learning to come.

Elaborate and *evaluate* are expanded into *elaborate*, *evaluate* and *extend*. This mostly aims to differentiate between the 2 types of 'elaboration' possible in the 5e model. The *elaboration* phase of the 7e Learning cycle is limited to elaborating on the current situation (e.g. introducing/changing parameters), while the post-evaluation *extend* phase involves transfering newly acquired skills and knowledge to new situations within the domain.

Links

- A good overview and example of the 7e Learning cycle from the man who developed it [1]

8 learning events model

Draft

Definition

Developed by Leclercq and Poumay (2005) at the University of Liège, the Eight learning events model is an instructional design model for describing "the activity of the learner (receives, prectices, creates, etc)" (Leclercq & Poumay, 2005) in a learing situation that is independant of the content.

All learning events fall roughly into eight different activities through which a learning event can occurr and are paired with teaching events i.e. the teacher or coach's activity or role. In thier publication The 8 Learning Events Model and its principles. [1] Leclercq and Poumay define each type of activity below and provide an outline dedescribing the teacher or trainer's role, the domains of learning best governed by the activity, where the activitty can be situated, how it usually occurs in a classroom context, associated words and the learning theory tthat supports the event.

The 8 Learning Events are

The eight Learning Events

Learner Activity	Teacher Activity	Domain of Application	Related Learning Theory
Imitate	Provide a model	Movements, Noises, Words, Melodies, Postures etc	Social Learning (Bandura)
Receive Information	Transmitt Information	Many Domains (except: Mastery of skills, Adoption of values, sensory-Motor...)	Verbal Learning (Ausubel)
Exercise	Guide, Feed-back	Sensory-Motor, Music etc...	Law of Effect (Thorndike), Reinforcement (Skinner)
Explore	Provide Access to Data	History, Geography, Personal Relations etc...	Theories related to conceptual maps
Experiment	Provide Environment for Experimentation, Supervise	Sciences, Computer Sciences, Social Relations etc...	Cognitive Learning (Piaget, Polya and De Bono)
Create	Facilitate	Arts, Learning Technologies	Divergent Production Concept (Guilford), Criteria for Creativity (Torrance)
Self-Reflect	Co-Reflect	Intellectual, Relational or Sensory-Motor	Metacognition (Flavell, Brown, Leclercq)
Debate	Animate	Complex Mental Models, Construction of Mental Representations	Social Interaction (Doise, Perret-Clermond), Cognitive Learning (Piaget)

A learning strategy (comparable to a lesson plan or pedagogical scenario) is any combination of learning events.

Links

Leclercq, D., Poumay, M. (2005) The 8 Learning Events Model and its principles. [1]. Release 2005-1. LabSET, university of Liège. (accessed January 30 , 2008 at http://www.labset.net/media/prod/8LEM.pdf [1].

ABAHCOCOSUCOL

Definition

- ABAHCOCOSUCOL get's the prize for the longest acronym and has been invented by Michele Notari.
- **ABAHCOCOSUCOL** means Action Based, Hypertext - Constructive, Computer Supported, COLlaborative

The model

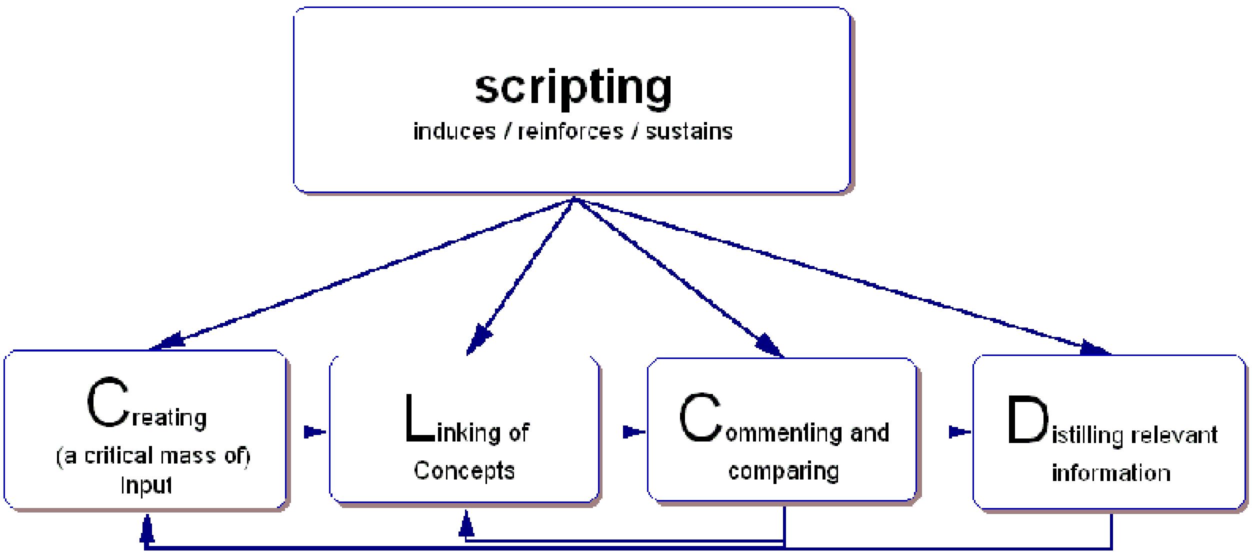
From (Notari 2003) "cut and paste":

Scripting for ABAHCOCOSUCOL can be cut in four phases:

1. Initiation
2. Comparison
3. Re-grouping
4. Discussion

An initiation phase leads students into the problem and gives them an indication for an appropriate first action. For this phase, there is no big difference between an ABAHCOCOSUCOL and conventional teaching. The comparison phase is very important and should start immediately after the unit is up and running. Here a difference from conventional constructive learning can be seen, where a comparison between the work of all members of the learning community is difficult to set-up, and such an environment of commenting and comparing cannot be easily created. The comparison phase then leads into the re-grouping of the produced work, which aids in the construction of mental models of the different concepts and is fruitful for learning. This sets the stage for the discussion phase, and the feedback and comment culture described above leads to a re-grouping of the content.

These phases can be repeated more than once. At the end of the learning unit a discussion should give students the opportunity to formulate and discuss different opinions or concepts. The positive feedback cycle of production, comparison, and re-grouping can also be formulated in the following way:



The scripting input leading to the creation of input is important at the beginning of the unit. Here we call it creation of a critical mass of input. Students should immediately compare and comment the works of the other to augment the interactions between the learning community. Scripting should induce students to publish what they have produced as soon as possible and it should be mentioned that there will be an 'evolution' of the text during the unit due to the comments and questions of the other members of the community. The 'critical mass' of input at the beginning is important for the start of interactions and creation of the communication culture. Of course other 'creating inputs' can be made during the learning unit for instants when new questions rise.

The linking of concepts is important for the awareness of the common goal and the cross-linkage of the treated concepts of the unit. The learning community creates one collaboratively elaborated hypertext where the different pages are interwoven and linked together. Creating links sustains the awareness of the community and gives a basis for the comments and comparisons produced as a further action of the students. Finally the distillation and re-grouping of relevant information leads to an self evaluation of the product of the learning community.

Technology used

A wiki

The unstructured collaboration tool was well-adapted to our needs. It turned out to be easy enough to use after a 20 minute introduction, it was stable enough to permit the focalisation of content production, and it was open enough to adapt its structure and strategies while the units were running. Furthermore, it permitted a good level of collaboration without other communication tools such as forums or chat groups, and it could be adapted to different subjects, and to fit the needs of the different classes. Students liked to publish articles but they did not like so much to comment the work of other members. The creation and support of a feedback culture turned out to be important for learning success. Scripting should intervene here and support the communication culture. Swiki turned to be an optimal tool for small and medium projects. We did not test any bigger learning projects with long inputs about different subjects. We can imagine that such project need different conception and a more structure within the produced document. We tried to sustain input quality and quantity without regarding structure. (Notari 2003: 103)

Tips for teachers

The following guidelines should be considered by teachers who are setting up a Swiki for ABAHCOCOSUCOL:

- Watch the structure of the entry page
- Be aware of editing conflicts
- Give a short introduction to the tool
- Be careful of signatures and references, and mention it whenever it is possible
- Prepare the main inputs and the guiding scripts
- Build a hypothetical framework of core mechanism(s) to foster the pedagogical goal and the actions of the students for every sub unit of you course
- Create a feed-back culture from the beginning on. Induce students to interfere and intervene in a constructive way in the actions of other members of the class

The size of the Project has a big impact on the structure of the constructed hypertext. While for smaller projects (one or two classes working for five to eight lessons) no specific structuring is necessary for larger projects it is important to steer the development of the hypertext in order to build up indicators for main concepts and additional information.

References

- Michele Notari (2003),

Scripting Strategies In Computer Supported Collaborative Learning Environments [1], Mémoire présenté pour l'obtention du DES STAF, TECFA FAPSE, Université de Genève

- Notari, Michele (2006). How to use a Wiki in education: 'Wiki based effective constructive learning', *Proceedings of the 2006 international symposium on Wiki*, PDF [2]. (Similar ideas 3 years later, unfortunately he dropped this very unusual acronym...)

ARCS

Draft

Definition

- ARCS is an instructional design model developed by John Keller and that focuses on motivation.
- ARCS stands for: Attention, Relevance, Confidence, Satisfaction

This model is particularly important for distance education, since motivation seems to be a key factor that determines if learner's complete their training. Motivation is a diametral responsibility for learners and teachers, and so it has to be boost over the entire learning process respectivly the developing of an learning environment.

Basic aspects

The significance of motivation was early developed by some scientists. The implementation of multimedia elements isn't enough to reach permanently motivational goals. So the ARCS Model was developed in the 80s by John Keller, for the systematically boosting of motivational aspects. It contains four main categories.

- **A**ttention - Getting and Holding Learners's Interests and Attention
- **R**elevance - The learning has to show a kind of usefulness. The learner should reach personal goals.
- **C**onfidence - The user has to espect success and should have the possibility to controll his learning process Self-regulation
- **S**atisfaction - There has to be attractive acts, rewards, feedback, and Self-Assement.

(Niegemann 2008) See also: Super motivation

The ARCS Model of Motivational Design

(This needs to be rewritten sometimes, it's basically just a potpourri from links you can find below - Daniel K. Schneider 23:26, 14 August 2007 (MEST))

Attention (perceptual arousal, inquiry arousal, variability)

As in Gagné's model (nine events of instruction) one must gain the learner's attention and keep it. A few pedagogic methods are:

- Provide variety (e.g. in the teaching materials used and within these materials, e.g. see textbook writing tutorial
- Create mystery by presenting interesting case problems.
- Use different methods to instruction
- Engage learners in active participation, e.g. questions, role-play
- Use interesting examples or cases (in particular some that run contrary to learner's expectations)
- Use humor
- Avoid distraction

- Boost inquiry learning
- Short Instructions
- Variate the format of pictures

Practical implementation: The attention can be boost through contents, which are unexpected, surprising, conflicting or ambiguous. So they unexpected appearance of a water fountain, if you do a "Mentos" into a "Cola Bottle" can bring the learners to interest to chemical aspects. So a learning environment could contain interesting multi media elements with interesting and unexpected experiments. (Niegmann et. al. 2008)

Relevance (goal orientation, motive orientation, familiarity)

The learner has to believe that learning is relevant. A few pedagogic methods are:

- Relate new information to something the student is familiar with, in particular how they reuse previous knowledge and skills.
- Make sure that the learner can relate instruction to personal learning goals.
- Working together with Collaboration / Cooperation
- Language has to be coherent
- Show things, which are similar und things which are equal

Practical implementation: The learner has to know why he has to learn the stuff. So it's advisable to use adequate games and simulations, to make this aspect visible. If the learners abilities are very similar (heterogeneity), it could be good to offer similar learning methods and similar learning goals In an interactive language journey, learner have to possibility to choose there own learning goals. It depends of there similar goals. Some want to learn for an exam, others want to train there pronunciation. (Niegemann et. al 2008).

Confidence (learning requirements, success opportunities, personal control)

Learners should feel that they could achieve the learning goals. A few pedagogic methods are:

- Provide opportunities for success
- Go from the simple to complex stuff
- Make clear what kind of sub-learning goals are expected and make clear that learning may involve climbing small steps.
- Give learners some control over their own learning
- Provide precise feedback
- Control the Learning Process through canceling and jumping over some chapters.
- No automatically change between pages on the monitor.

Pracitical Implementation Learners should search a challenge, but the risk to don't pass a challenge should be limited. The criterias of assement has to be clearly visible. Furthermore they should know in a exam, how many time they have and how many items they have to solve. (Niegemann et. al 2008)

Satisfaction (intrinsic reinforcement, extrinsic rewards, equity)

Learners should receive awards. A few pedagogic methods are:

- Let learners apply newly acquired skill
- Assess with a score and hand out praise (if deserved)
- Learn > Practice > Test
- No exceeding praise

Practical Implementation In according to the point "Learn> Pracitce > Test", learners have to use abilities they learn into the learning environment in gaming or simulated situations. (Niegemann et al. 2008).

Subcomponents

According to Huang (2006),

the ARCS model is mostly applied as a design guideline for developing effective motivational strategies (Song & Keller, 2001). In addition to the four ARCS components (i.e., attention, relevance, confidence and satisfaction), there are sub-categories attached to each component to facilitate the design process. Small (2000) summarized all four components and sub-categories as follows.

- Attention: perceptual arousal, inquiry arousal and variability;
- Relevance: goal orientation and motive matching;
- Confidence: learning requirements, success opportunities and personal responsibility; and
- Satisfaction: intrinsic reinforcement, extrinsic rewards and equity.

See also: Flow theory

Methods

The Instructional Material Motivational Survey (IMMS) (Keller, 1933) contains is a 36 Likert-scale statements. Each statement measures an individual ARCS component.

Huang et al. (2006), published a modified version, which they claim to be more appropriate for studies in higher education. Here is sample of 4 items:

- When I first looked at (M-Tutor), I had the impression that it would be easy for me. (confidence)
- There was something interesting at the beginning of (M-Tutor) that got my attention. (attention)
- Completing the exercises in (M-Tutor) gave me a satisfying feeling of accomplishment. (satisfaction)
- It is clear to me how the content of (M-Tutor) is related to things I already know. (relevance)

Niegemann et al. adds, that not every aspect of the ARCS Modell has to be consider. It's impossible, that a planner or designer chooses the aspects which are important for the individual project. (Niegemann et. al 2008)

Links

- arcsmodel.com [1] John Keller's official ARCS Website.
- John Keller's academic website [2]
- Attribution Theory and Keller's ARCS Model of Motivation [3] by Jerry T. Fernandez, George Mason University.
- Motivating Distance Learning Students Using the ARCS Method [4], a Netnet page
- Developing Instruction or Instructional Design [5]
- ARCS Model of Motivational Design (Keller) [6] at Learning-Theories.com.
- The Magic of Learner Motivation: The ARCS Model [7] by Kevin Kruse, e-learningguru.com.

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Advance Organizer

Draft

Definitions

- An *'advance organizer* is a cognitive instructional strategy used to promote the learning and retention of new information
- “ An advance organizer is information that is presented prior to learning and that can be used by the learner to organize and interpret new incoming information (Mayer, 2003).”, cited by Advance organizers [1]
- “ These organizers are introduced in advance of learning itself, and are also presented at a higher level of abstraction, generality, and inclusiveness; and since the substantive content of a given organizer or series of organizers is selected on the basis of its suitability for explaining, integrating, and interrelating the material they precede, this strategy simultaneously satisfies the substantive as well as the programming criteria for enhancing the organization strength of cognitive structure." (Ausubel, 1963:81)” cited by Subsumption Theory (D. Ausubel) [2], retrieved 19:35, 2 October 2006 (MEST).
- “ An advance organizer is not an overview, but rather a presentation of information (either verbal or visual) that are "umbrellas" for the new material to be learned.” Advance Organizers [3], retrieved 19:35, 2 October 2006 (MEST).

The *avance organizing* principle is compatible with many modern instructional design models like Merril's first principles of instruction.

The framework and the instructional design model

- “ According to Ausubel, learning is based upon the kinds of superordinate, representational, and combinatorial processes that occur during the reception of information. A primary process in learning is subsumption in which new material is related to relevant ideas in the existing cognitive structure on a substantive, non-verbatim basis” Subsumption Theory (D. Ausubel) [2], retrieved 19:35, 2 October 2006 (MEST).
- “ Ausubel suggests that advance organizers might foster meaningful learning by prompting the student regarding pre-existing superordinate concepts that are already in the student's cognitive structure, and by otherwise providing a context of general concepts into which the student can incorporate progressively differentiated details. Ausubel claims that by presenting a global representation of the knowledge to be learned, advance organizers might foster "integrative reconciliation" of the subdomains of knowledge - the ability to understand interconnections among the basic concepts in the domain.” (Ausubel's Advance Organizers [4], retrieved 19:35, 2 October 2006 (MEST))

Advance organizers are used in good "transmissive" teaching, e.g. direct instruction. Such teaching is different from simple rote learning, since learners are encouraged to relate new knowledge to old knowledge (what they already know).

According to Joyce et al. (2000), the advance organizer model has three phases of activity:

Phase I (includes presentation of the advance organizer)

- Clarify the aimes of the lesson
- Presentation of the advance organizer
- Prompting awareness of relevant knowledge

Phase II (includes making links to/from the organizer)

- Presentation of the learning task or learning material

- Make organization and logical order of learning material explicit

Phase III (strengthening of the cognitive organization)

- Integrative reconciliation and active reception learning (e.g. the teacher can ask learners to make summaries, to point our differences, to relate new examples with the organizer).
- Elicit critical approach to subject matter (have students think about contraditions or implicit inferences in the learning material or previous knowledge)

The simple principles behind advance organizers are that:

1. Most general ideas should be presented first in an organized way (not just a summary) and then progressively differentiated.
2. Following instructional materials should integrate new concepts with previously presented information and with an overall organization.

Therefore, advance organizers present a **higher level of abstraction**. They are not just simple overviews, illustrating examples etc. ! But they share with such techniques the idea, that they must be integrated with other teaching/learning activities.

“ Advance organizers provide the necessary scaffolding for students to either learn new and unfamiliar material (an expository organizer which provides the basic concept at the highest level of generalization) or to integrate new ideas into relatively familiar ideas (a comparative organizer which compares and contrasts old and new ideas). Ausubel contends that these organizing ideas, which may be single concepts or statements of relationship, are themselves important content and should be taught because they serve to organize everything that follows. Advance organizers are based on major concepts, generalizations, principles, and laws of academic disciplines.” (The Advance Organizer [5], retrieved 19:35, 2 October 2006 (MEST)).

Variants

- Novak and Gowan's hierarchical cognitive maps.
- K-W-L group instructional strategy (Ogle)

Technology

- concept maps or other kinds of concept drawings
- Text and talk passages

Links

- The Advance Organizer [5] (Methods in secondary social science).
- Cues, Questions and Advance Organizers [6] from Focus on Effectivements - Integrating Technology into Research-Based Strategies [7] (includes a good bibliography [8])
- Creating and Using Advance Organizers for Distance Learning [9] by NetNet
- Advance organizers [1], A wiki page.
- Subsumption Theory (D. Ausubel) [2], A TIP [10] entry.
- Ausubel's Advance Organizers [4]
- Minds On Science: How Students Learn Science [11], including Meaningful Learning Model [11]
- Advance Organizers [12]
- Advance & Graphical Organizers: Proven Strategies Enhanced through Technology [13] by John Hendron
- Do We Really Need All that Glue? [14] by JoAnn Hackos, PhD [15]. An interesting article that discusses the use of advance organizers in technical manuals and the difference between simple TOC bullets and "real" advance

organizers à la Ausubel.

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Advance backward design organizer

The **Advance backward design organizer** (ODBA) method is a hybrid of the backward design and advance organizer methods. In the ODBA method, you begin with the end in mind. You tell the students where you're going. You show them why it's neat (or how it can be applied). Then you show them why it's cool (or why it works).

Example

In teaching derivatives, instead of the traditional limits -> tangent -> derivative sequence, an educator would teach the students how to do derivatives first, show them how it's useful (e.g., to calculate the slope of a line tangent to a function), and then show them why it works (using limits).

Aesthetic principles for instructional design

Draft

Definition

Aestehtic principles for instructional design refer to a high level instructional design model and associated instructional design methods like coUML proposed by Patrick Parrish et al.

First principles

1. Learning experiences have beginnings, middles, and endings (i.e., plots)
2. Learners are the protagonists of their own learning experiences
3. Learning activity, not subject matter, establishes the theme of instruction
4. Context contributes to immersion in the instructional situation
5. Instructors and instructional designers are authors, supporting characters, and model protagonists

Links

- Beauty and Precision in Instructional Design [1] (slides). Derntl, Michael; Pat Parrish & Luca Botturi, EdMedia 2008.

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Agile learning

Draft

Definition

Agile learning is a relatively recent buzzword that can take several mearnings. There seems to be quite a confusion between "agile planning of instruction" (as one may find on commercial e-learning web sites), introducing "agile design methodology" in the project-oriented and/or reflective classroom and finally introducing "agile thinking" in a given population (e.g. a company).

- Using agile design methodology for instructional design, as for example in the rapid prototyping approach. I.e. we talk about an "agile professor" who will design and redesign a course in function of emerging "parameters". E.g. see the R2D2 model.
- A similar idea is to favor dynamic planning of learner activities in teaching. Many inquiry-based learning settings require dynamic (agile planning) for both the teacher and his students. An very typical example would be the knowledge-building community model.
- Agile learning also can to refer to running a class like a development group. This implies that one has to provide students with practice in agile development, regardless of their subject area and to use agile principles in working together with students to achieve the learning objectives of the module.
- Agile learning also can refer to supporting emerging individual learning path, i.e. how students progress through a set of learning objects in traditional e-learning. From the teaching perspective, this can be summarized as "give students what they need when they need it".
- Agile learning can refer to introducing agile thinking in companies. This perspective is frequently found in talks and papers that deal with innovation and organizational learning.

Links

Agile learning as proposed by CS and management people

- Agile learning - an alternative learning model Agile learning and teaching with wikis: building a pattern [1] Marija Cubric,
- PDF of the Poster [2]

Agile development

- Agile Manifesto [3]
- Open Agile [4] is a simple agile method designed to be broadly applicable to many different types of work. It includes a basic definition of a process, roles, artifacts, and basic practices as well as a glossary and comparisons to other methods of working.
- Agile software development [5] (Wikipedia)

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Anchored instruction

Draft

Definition

- **Anchored instruction** “ refers to instruction in which the material to be learned is presented in the context of an authentic event that serves to anchor or situate the material and, further, allows it to be examined from multiple perspectives.” (Barab 2000:5)
- “ Anchored instruction is a major paradigm for technology-based learning that has been developed by the Cognition & Technology Group at Vanderbilt (CTGV) under the leadership of John Bransford.” (Anchored Instruction [1], retrieved 13:24, 21 July 2006 (MEST))
- “ Anchored instruction lies within the social constructivist paradigm since small groups work together to understand and solve realistic problems. Anchored instruction is most closely related to the goal-based scenario model. While anchored instruction may also resemble problem-based learning (PBL), it is less open-ended.” [2]

The model

Draft

- Learners are presented "stories" (a case study, a problem, etc.) that encourages learners to perceive / formulate problems.
- This material and further materials then serve to "anchor" subsequent learning. It also should encourage exploration.

Jasper

Jasper [3] was the main anchored instruction project at Vanderbilt.

The Jasper series is based on the assumption that thinking is enhanced by access to powerful concepts and not simply through access to a general set of thinking skills. Therefore, Jasper is designed to teach thinking in contexts that are rich in content as well as in the need for general strategies.

Jasper's close cousins are case-based learning, problem-based learning, and project-based learning. More specifically, Jasper series represents an example of problem-based learning that has been modified to make it more useable in K-12 settings. These modifications include the use of a visual story format to present problems, plus the use of "embedded data" and "embedded teaching" to seed the environment with ideas relevant to problem solving. Jasper is also designed to set the stage for subsequent project-based learning. Its overall goal is to help students transform "mere facts" into "powerful conceptual tools."

(Jasper in More Detail [4], retrieved 13:24, 21 July 2006 (MEST))

Technology

- Jasper Adventure Player and Adventure Maker software programs (available somewhere ??)
- Delivery System: initially videodisks then CD Roms

Links

- Anchored Instruction [1] from the TIP database.
- The Adventures of Jasper Woodbury [3]. *'The* anchored instruction project.

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- The Cognition and Technology Group at Vanderbilt (1997), The Jasper Project Lessons in Curriculum, instruction, Assessment, and Professional Development ISBN: 0-8058-2593-2

Backwards design

Definition

- **Backwards design** (or backward design) is an instructional design method invented by Wiggins and McTighe and is part of their larger *Understanding by Design* framework.
- “ Backward design begins with the end in mind: What enduring understandings do I want my students to develop?” ([1]). It is particularly suited for teacher designers who think in terms of what they wish to achieve.

The model

The model has 3 stages:

1. Identify desired results (learning outcomes)
   - “ What should students know, understand, and be able to do? What is worthy of understanding? What enduring understandings are desired?” ([2])
2. Determine Acceptable Evidence (means to assess if learners have learnt)
   - “ How will we know if students have achieved the desired results and met the standards? What will we accept as evidence of student understanding and proficiency?”([2])
3. Plan learning experiences and instruction. This includes:
   - definition of knowledge (know-that), skills and procedures (know-how) students ought to master
   - definition of materials
   - definition of learning /teaching activities (scenarios).

Wiggins and McTighe insist a lot on enduring understandings and that go beyond simple facts and skills to include larger concepts, principles or processes.

Variants

There exist other variants, e.g. below is a set of steps adapted to specific schoolteachers in a specific environment (see Backward Design Overview & FAQ [1]:

1. Decide on the themes, enduring understandings and essential questions for the unit.
2. Design a summative for the end of the unit.
3. Align the unit with the New York State ELA Standards and choose outcomes, strategies and best practices to teach them.
4. Choose resources to create a rich and engaging multi-genre thematically-linked unit.
5. Weave back and forth across the curriculum map to make revisions and refinements.

Links

- Developing Goals and Objectives [3]
- Understanding by Design Exchange [4]. This is the Website sponsored by Grant Wiggins & Jay McTighe. Includes resources.
- Understanding by Design [5] (PDF Slides by Ellen.B Meier)
- Principles of Backward Design [6]
- Backward Design [1] (Overview & FAQ at B. Ladwig and K Pagano-Fuller's English Language Arts Site.)
- Backward design process [7] at DigitalLiteracy (include a nice 1-page summary in PDF [8].
- Principles of Backward Design [6] (Short overview and some pointers).

- Janice Christy (2004), Teaching for Understanding [9] (This short article gives and overview of the larger context "learning by design").

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C3MS project-based learning model

Draft

Author: Daniel K. Schneider, TECFA, University of Geneva

Definition

This article is **Part 1** of the TECFA SEED Catalog. It is a summary of Conception and implementation of rich pedagogical scenarios through collaborative portal sites: clear focus and fuzzy edges [1] and Conception and implementation of rich pedagogical scenarios through collaborative portal sites [2]. It also takes into account recent technological developments.

The **C3MS project-based learning model** is a project-oriented design that engages students in frequent content-production as well as collaboration through collective activities. In addition it attempts to build "community". C3MS stands for **Community, Collaboration and Content Management System** and refers to both a design (a conceptual system) and to C3MS, a kind of portalware.

Since the emergence of web 2.0, we also can argue that webtops would support a **C3MS 2.0** variant of the model. Examples described in here were technically implemented with the PostNuke portalware, but with some modifications they also could have happened within a "Web 2.0" space. E.g. sharable webtops such as pageflakes could replace the integrating function of a portal.

The model

Activity-based and production-based teaching

At the core of the model is the idea that some forms of learning rely a lot on "activity-based teaching" strategies that orchestrated, scaffolded and monitored by the teacher.

Activity-based teaching and learning can be tied to various socio-constructivists thoughts. Our definition of socio-constructivism is quite large. First of all as an understanding of learning that stresses the importance of knowledge construction based on previous knowledge and interaction with the social environment, e.g. theories that have grown out of constructivism (Piaget) and socio-culturalism (Vygotsky). Second as a set of pedagogies that use strategies like project-, problem-, case-based learning. These pedagogical models favor "production or construction-based" teaching, since both internal meaning and external artefacts are to be constructed (see also: writing-to-learn). We call them "activity-based", since the teacher has to design, to facilitate and to monitor **student activities**.

Socio-constructivist pedagogies present a certain amount of differences, but it is possible to isolate common denominators. For instance, Wilson (2000) distinguishes three key principles for an efficient use of the Internet for learning:

- Provide access to rich sources of information
- Promote fruitful interaction with contents
- Get learners to overcome challenges, support each others and answer to others' inputs

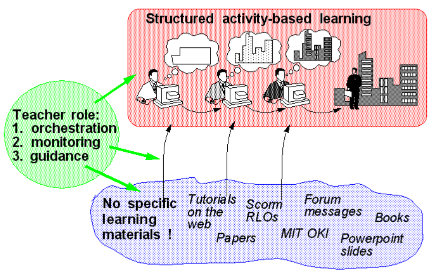
Powerful learning environments that aim at the development of general problem skills, deeper conceptual understanding and more applicable knowledge include according to Merriënboer and Pass (2003) the following characteristics:

"(1) the use of complex, realistic and challenging problems that elicit in learners active and constructive processes of knowledge and skill acquisition; (2) the inclusion of small group, collaborative work and ample opportunities for interaction, communication and co-operation; and (3) the encouragement of learners to set their own goals and provision of guidance for students in taking more responsibility for their own learning activities an processes."

Our own common denominators are:

- A certain kind of task authenticity, including information richness
- (repeated) student productions leading to a final "product"
- exchange and discussion
- some openness regarding the solution process, e.g. the student has to do some goal setting

Socio-constructivist pedagogical strategies including project-based and collaborative learning do not guarantee automatic results. Framing and support by teachers is crucial to their success. Both learners and teachers are frequently "lost" and it therefore is important that teachers do not just propose "projects to do" and provide "help whenever needed". In other words, effectiveness is not guaranteed by adapting vague pedagogical strategies. One way to achieve pedagogical effectiveness is to use somewhat structured scenarios where the teacher fulfills a triple role of **orchestrator** (designer), **facilitator**, and **manager** of pedagogical scenarios.



The teacher's role in a C3MS design

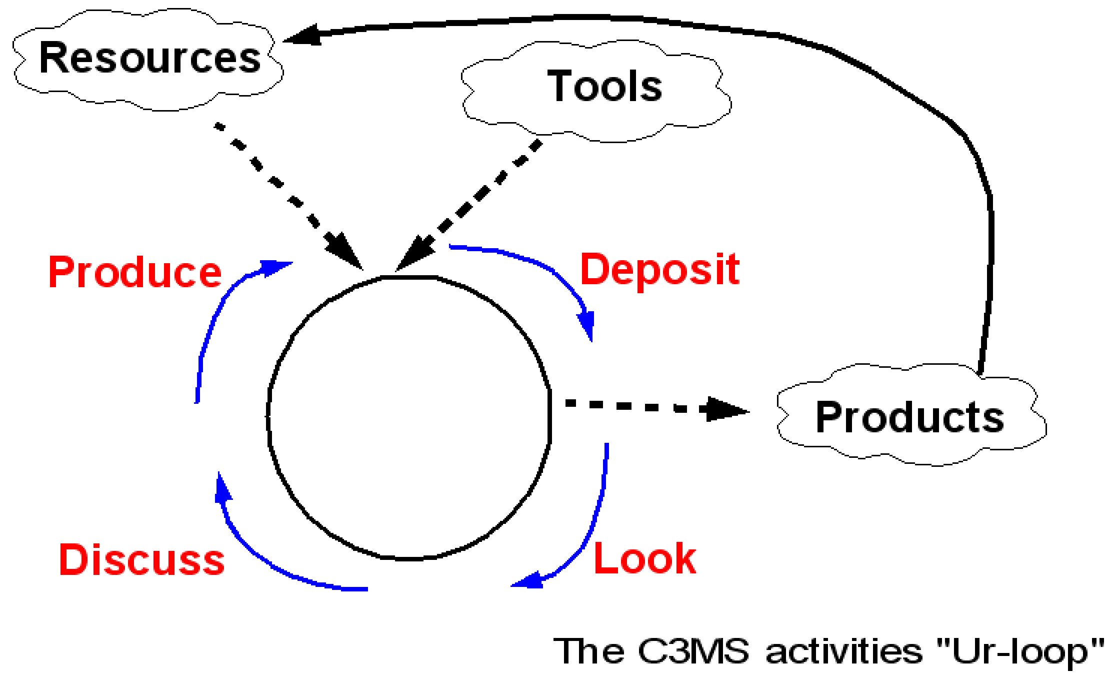
As we shall explain below, design of appropriate environments are not courseware centered, although some courseware may be used to tutor individual students according to emerging needs. What we need are tools to support this "structured activity-based learning" and that includes a lot of writing activities as we shall see.

We believe that our C3MS approach also be useful to teachers who favor more instructionalist (behaviorist designs). Our concerns also can be expressed in more classical instructional design theory. For instance, Merril's first principles of instruction identify the following five components:

- Learning is facilitated when learners are engaged in solving real-world problems.
- Learning is facilitated when existing knowledge is activated as a foundation for new knowledge.
- Learning is facilitated when new knowledge is demonstrated to the learner.
- Learning is facilitated when new knowledge is applied by the learner.
- Learning is facilitated when new knowledge is integrated into the learner's world.

What is common between more socio-constructivist design and modern instructional theory à la Merril or Merriënboer and that can be found in influential readers like Reigeluth (1999) is the idea that learners have to "do" things and that "doing" must be meaningful. The major difference is that more cognitivist approaches usually apply higher guidance including direct instruction during initial phases of a project-oriented course. Daniel K. Schneider believes that this "C3MS" model is compatible with both. After all, it only claims that a project-oriented design should be segmented into smaller scenarios (activities) which should be structured and lead to inspectable/discussable products and the whole thing should happen within a computer-supported environment that also favors building a community of learning (see the end of this article).

The workflow "Ur-loop" (to be adapted of course to specific scenarios) is the following:



The C3MS activities "Ur-loop"

Details of the model and supporting technology

Overview

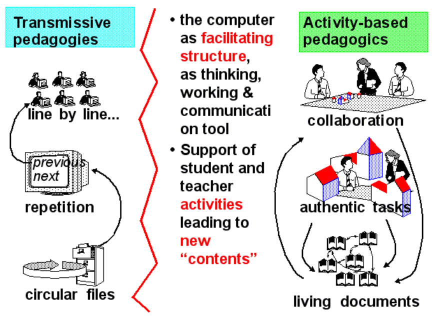
Pedagogical story-boarding with a C3MS follows a simple principle. The teacher creates a pedagogical scenario (activity) by defining different phases of the work process. Each phase contains at least an elementary activity which in turn should be supported by a tool (portal or web 2.0 brick). Larger projects can contain *several* smaller scenarios. See the Catalog of simple scenarios for some suggestions.

The scenario building bricks are elementary activities, e.g. something like "search on the Internet", "insert a link", "make a comment", "coedit a text", "vote for something", "enter an item to a glossary". See the Catalog of elementary activities for a list of these.

Supporting software

Any computer-supported activity-based pedagogy needs tools that are different from traditional learning management systems. There are many choices, e.g. to implement scenarios in the spirit of IMS Learning Design one could use a system like LAMS. However, the C3MS approach is a bit a different: There is less emphasizing of story-boarding and activities happen in more open project-oriented atmosphere. Basically, students engage in writing activities in various forms of collaboration (single, group collaborative, class collective) and we need a system that supports this.

The following figure points out the differences between a system needed for simple transmissive e-learning ("learning I" in Baumgartner and Kaltz) and software needed for a project-oriented design ("learning III"). Main-stream e-learning requires that teaching materials are well prepared in advance (by either a teacher or a content expert) and that it is used "as is". Learners usually are supposed to digest this material (repetitively if needed) in a rather isolated way. The same contents are used over many classes, unless something needs to fixed. Activity-based pedagogies assign a more diverse role ICT and to the document. Learners generally select the documents they need by themselves from a larger choice (which includes the whole Internet). More importantly, they actively participate in the production of documents, some of which can be reused later on. They also should be allowed to annotate documents, i.e. enrich them by their own experience. In more general terms, activity-based teaching needs a computer mainly as a facilitating structure, a thinking, working & communication tool and not as a content transmission device. Accordingly, most student and teacher activities should be supported by computational tools and lead to new "contents". Within this perspective we can see that activities and roles are defined in a collaborative expressive digital media framework



Learning management systems vs. Living document and collaboration systems

A living document and collaboration system can be as simple as a wiki, but a integrated set of several tools may turn out to offer some advantages, i.e. we claim that different kinds of writing and collaboration activities may be better scaffolded by different tools. Environments that integrate various useful tools are portals or webtops, and also some software developed in educational technology research labs. In this context we stick to popular open source or web 2.0 open access software since it is software that is both teacher-enabling (they have control) and "street proven".

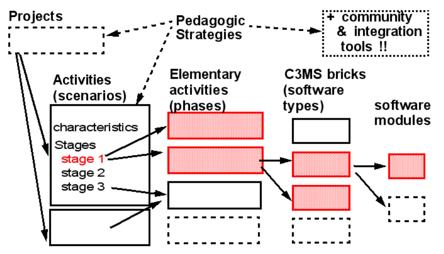
Such environments should provide at least the following functionalities:

- Access to rich information sources (not just stream-lined e-learning blocks) by various means, e.g. browsing, searching by categories or popularity, searching by keywords.
- Affordable interaction with various types of information contents (including annotation).
- Rich interactions between actors, that are facilitated by awareness mechanisms (who did what, what is new, etc.)
- Simple integration of these activities through a "place".

Of course these environments can not provide all the tools than can be imagined (e.g. data analysis), but it should be planned that at least the products of activities should be posted on-line, in order to discuss, annotate and reuse them.

Story-boarding with a C3MS

Pedagogical story-boarding with a C3MS follows a simple principle. The teacher creates a pedagogical scenario (activity) by defining different phases of the work process. Each phase contains at least an elementary activity which in turn should be supported by a tool (portal brick). Larger projects can contain several smaller scenarios. The scenario building bricks, i.e. elementary activities are something like "search on the Internet", "insert a link", "make a comment", "coedit a text", "vote for something", "enter an item to a glossary".



Designing courses with the C3MS model

Integration of scenarios and activities

In large project-oriented design, various scenarios need to be integrated. Since neither C3MS nor webtops provide integrated workflow capabilities, the teacher must select one or two special announcement tools in order to "drive" a scenario or a larger project. The easiest solution for scenario management (i.e. setting tasks, describing resources and providing feedback) is to use a News engine, Forums or a Wiki.

Of course, once could imaging that richer integration modules could be programmed. In the SEED project, we actually did develop a few prototype tools.

ePBL is a "Project-Based e-Learning" module and it provides the following functions: (1) Scaffold students during their projects by "forcing" them to fill in their project specification (through an XML grammar); (2) help students write their final article and (3) help teachers monitor easily several projects in parallel and give them feedback on time. We will describe an example course using ePBL later .

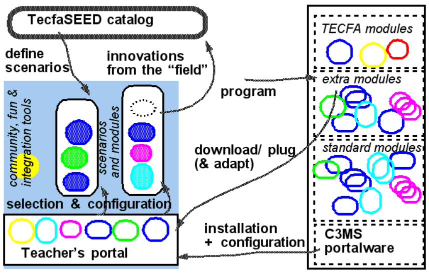
pScenario was a prototype tool inspired by Moodle and that allows teachers to assemble scenarios for various pedagogical formats (face-to-face, at distance or mixed) and to associate student activities with other tools. It is up to teacher to clearly identify needed tools and to combine pScenario with other PostNuke tools (e.g. Wiki, Links manager, News Engine or special educational tool) into a teaching portal. pScenario also could be used to administer a typical American graduate course that features readings, short exercises and a term paper. Finally, the CRAFT laboratory at EPFL developed a project management tool that allows a teacher to run larger project-based courses. See

Since the project ran out in 2004 and we lack resources, these modules haven't been further developed. It's the common story of edutech projects. Therefore, we suggest to teachers to use the News Engine or a blog to drive scenarios. An other alternative is to look at recent (2007) developments like CeLS and LAMS that are activity-based pedagogical workflow engines. IMS Learning Design engines, once implemented also are of interest to teachers who whish to work with a formalized environment that supports workflows.

The TECFA SEED Catalog

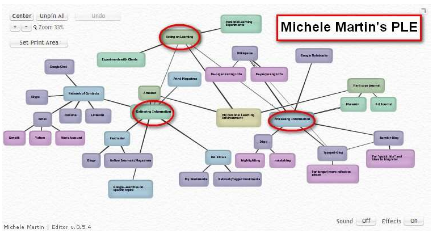
Since both C3MS portalware and modern webtops have a modular and an extensible architecture, they can be adapted/combined/ configured to many specific usage scenarios. Our hope was to create some sort of educational modules economy with the PostNuke platform. The next figure shows the model of such a "scenarios and portal modules" economy. It did not happen in education, i.e. not many new specifically educational modules came to existence. However, since we only came up with the idea in 2001, it is too early to call the idea a failure. Innovation usually takes longer and other initiatives like the educational user community for Drupal may have more success. On the other hand, creative educational repurposing of all sorts of Internet technology (including portals and web 2.0 tools) did and does happen. Creative teachers use **any** software that helps them teaching, and Daniel K. Schneider often has the impression that tools not made for education are popular than the ones made for education and for various reasons we will not develop here.

By "modules economy" we mean that a teacher installs some portalware (not too difficult) or a sharable webtops (easy) and that he expands this environment by adding modules in order to support various teaching scenarios. Below is figure dated 2003.



Portal configuration and modules economy

Now compare this diagram with Michele Martin [3]'s diagram of her personal learning environment.



Michele Martin's PLE

What she did for herself could inspire a teacher:

- He could have his private environment (webtop page) or individual tools
- An environment share with a class (webtop page) or individual tools
- Have students create their individual, group or class environments that are shared with the teacher
- Encourage students to create their own private space.

The whole thing then would be a networked C3MS from his teaching perspective, but with the additional benefit that learners may have their own personal environments and that they could customize their productions as learning e-portfolios. “With the increase of teachers using blogs and wikis, and students networking and utilizing online tools, the demand for easier and more efficient ways of learning is on the rise.” Brian Benzinger [4], retrieved 19:15, 1 June 2007 (MEST)).

I made a little mockup with pageflakes to demonstrate the principle.

To jump start your own scenarios

The TECFA SEED Catalog

To make things a bit easier for teachers, we created in 2001 the TECFA SEED Catalog. It is split into three sub-catalogs in this wiki:

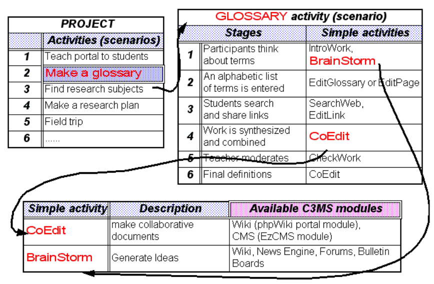
1. Some simple example activities are described in the Catalog of simple scenarios (also called catalog of activities). Each scenarios is composed of a certain amount of steps that can be described in terms of generic elementary educational activities.
2. We labelled this generic simple activities described in the Catalog of elementary activitieswith a tag like "BrainStrom" or "SubmitComment".
3. Technical "C3MS bricks" are described in Catalog of C3MS bricks support most of these labeled generic activities. A recent addition is the list of web 2.0 applications which is a more modern alternative to using portalware.

A teacher can plan educational scenarios with the help of a more abstract vocabulary that will help him to choose from a set of supporting technology. But this is **not a necessity**. He also can just make up a scenarios and the browse through portalware modules repositories and/or web 2.0 module catalogues and see if there is a set of tools that might support a design.

Example 1 - A scenario template at high-school level

Let's examine a small scenario template that illustrates the basic principles of scenario planning that could happen in a specialized biology class a high school level. Imagine a class where students have to study wild-life of the area. One could imagine that each student can select an animal for study (including more "exotic" genres like insects and fish) and that for each animal a certain amount of options remain open, e.g. study of habitat, behavior with humans, reproduction, etc.

Each project should be defined individually, but the general approach could remain similar for all participants as expressed in the figure. There also could be a certain amount of collective activities, like the construction of a glossary that defines essential terms. If the teacher considers glossary making important for reasons like "students will better understand terms if they search and write and discuss them" or "students really should put some effort into understanding the vocabulary of a domain before they work within", then he can look at our template and fit it to his own needs which are driven by constraints such as education level, time constraints and available technology.



Glossary scenario within a larger project

This collaborative glossary template is just a suggestion. It is important to state again that we only provide ideas regarding the different phases and that we do not even suggest a single mapping to elementary activities nor a single mapping of elementary activities to a technical module. In other words, the teacher must be in control throughout the whole design process. Daniel K. Schneider believes that educational technologists should only offer "half-baked" solutions. Ideally, teachers have to adapt a pedagogical-technical implementation to their conceptual and technical skills and to what they have available. There is also a technical compromise to made between selecting the best tools for each task and not to overwhelm the students with too many tools to be used within a scenario. This example nicely shows some of the "open decision space" teachers may have. After examining the situation he may for instance come with the following solution (table below). As one can see, our hypothetical teacher winds up with 3 tools (Wiki, Links Manager and the News Engine):

	Phase	Tools	Instructions to students
1	participants identify interesting "words"	Wiki	After discussion in the classroom, each student has to select three terms and enter them to the wiki as homework (first come, first goes)
2	agree on a provisional list	Wiki	In the classroom, the list is discussed and cleaned up and each student will receive 3 items to work on.
3	search for information and share links	Google,Links manager	Each student has to produce 4 links (day 1) and comment 2 other links (day 2 of homework)
4	synthesis and editing	Wiki	Each students receives 2 links and has to edit them. Students are encourages to link to other items and external links.
5	teacher feedback	News engine	Teacher writes a feedback article which is also discussed in class.
6	editing of final definitions	Wiki	Students make final modification to their work and will be evaluated on this.

This example illustrates the structure of exploratory scenarios. Generally speaking, a teacher should think about the following setup which reflects the principles of pedagogical workflow introduced in the article on the design of smaller scenarios.

- Activities should start with some sort of conditioning that will generate curiosity, interest, motivation and also show the interest of technology in our case. The initial classroom discussion and the perspective of publishing a nice glossary on the Internet should do this. In addition, entering 3 words on a Wiki is not very difficult and will make students familiar with the particularity of this tool
- Activities should give space to discovery by induction and therefore include exploration, search for information, experimentation and formalization of working hypothesis that can be confronted to the others. Activities in phase 3 of the above example partly implement this.
- Learners should be active and creative, even when they are involved in seemingly simple tasks like glossary making. They should discuss and cooperate with their pairs. Our glossary scenario has some "build-in" collaboration requirements.
- Feedback is important for each student activity. Therefore, we also suggest a formal evaluation of the final product (including a score). The teacher may also give bonus points for cooperative behavior, e.g. forum messages or helpful comments for the other's work. More details are discussed below.

Example 2 - University teaching

Computer-supported project-based courses can nicely be set up in a « blended situation », where face to face teaching is mixed with distance teaching. The methodology and techniques we are reporting here are developed and studied by Synteta (2002) as part of her PhD Thesis and have been tested within DSchneider's teaching. Variants of this model have then been carried out for 2 other classes a TECFA and for 2 distance teaching courses outside our unit. We estimate that the methodology is ready to be used, although adjustments are needed in several areas.

The course that we shall briefly describe here was about « exotic hypertexts » and taught in a mixed format by the authors in 2002. It lasted 6 weeks, with a few initial half days in classroom and a 2 hour presentation of the projects at the end of the course to 12 graduate students in educational technology, who were from many different backgrounds. The students were given a large freedom of choice of subjects within the general theme. The basic requirements were to produce a research plan, to respect task schedules, to participate in mandatory collective work (including diary writing), then to execute the research plan and produce a draft on paper that presented results.

Several pedagogical goals were set, namely (1) Learning something about a specific topic related to more exotic hypertexts (Topic Maps, MOO spaces, Wikis, RDF/RSS syndication, etc.) ; (2) Learning XML ; and (3) learning how to run exploratory projects.

Major phases of the Staf-18 course on « exotic hypertexts »

Phase	Major Activity	Date	imposed tools (products)
1	Get familiar with the subject	21-NOV-2002	links, Wiki, blog
2	project ideas, QandR	29-NOV-2002	classroom
3	Students formulate project ideas	02-DEC-2002	newsengine, blog
4	Start project definition	05-DEC-2002	ePBL, blog
5	Finish provisional research plan	06-DEC-2002	ePBL, blog
6	Finish research plan	11-DEC-2002	ePBL, blog
7	Sharing	17-DEC-2002	links, blog, annotation
8	audit	20-DEC-2002	ePBL, blog
9	audit	10-J AN-2003	ePBL, blog

10	Finish paper and product	16-JAN-2003	ePBL, blog
11	Presentation of work	16-JAN-2003	classroom

Project ideas have previously been discussed in the classroom. Then, the course starts with a « wake up » activity in which students had to fill in resources into the Links manager, and few definitions in the Wiki. The classroom activity also includes some traditional teaching, i.e. several introductory lectures plus some questions. The next step consists in formulating projects ideas as articles by the students.

Once they started working on a project, students had to use a special purpose project tool named ePBL, which stands for « Project-Based e-learning » (Synteta, 2003), they had to define particularly research plans with a specially made XML grammar. The required information did concern overall aim of the project, research goals and questions, work packages, etc. Students could upload these files to a server by the means of a « versioning » system. Since students had to work with a validating editor (of their own choice) the XML grammar reinforced the research plans according to some norms. More importantly, the grammar acts as scaffolding or thinking tool helping the students to produce and structure ideas. Contents of the uploaded project file are automatically parsed and summary information is made available in a students/teacher cockpit. Students were asked at regular intervals to update the project file (including workpackage completion information). Teachers then use the cockpit to annotate the project with comments and to register a more formal evaluation. After each audit the teacher also post a summary article in the portal. At the end of the course, students had to write a paper, using once more an XML grammar from which an electronic book containing all the work has been produced.

In addition to the above mentioned main activities, other interactions were carried out. Sometimes, articles about a course-related topic were posted (even spontaneously by students). The portal has also support forums (both technical and conceptual), it displays RSS news, and feeds summary of the news from other interesting sites. Some side blocks contain awareness tools (that is connected, that is passed by new messages in forums, etc.). A shoutbox (mini-chat) was used to reinforce the feeling of being « present » and for short messages from the teacher. Other tools include a calendar and chat rooms.Daniel K. Schneider 17:28, 3 September 2009 (UTC): A shoutbox (mini-chat) was used to reinforce the feeling of being « present » and for short messages from the teacher. Other tools include a calendar and chat rooms. Lastly, after each activity students had to make a diary entry (personal Weblog) that gave the teacher important information on encountered difficulties. The students have also used this tool and the Wiki as personal sounding board.

The main tool used by the teacher besides the ePBL project definition and monitoring application tool was the news engine. It was to be used to announce activities (at least one / week) and to provide feedback regarding activities or observations (namely major difficulties found in Weblogs or forum messages). The news engine therefore is a « heart- beat » tool that gives « pulse » to the whole process, which is considered as very important.

Results of this activity and several experiments with other teachers were very encouraging. We found that all students defined interesting projects (either some exploratory empirical studies or some technical developments) and that they came up with interesting results. The quality of the final paper in this specific course was not generally very good, but then only a draft has been required and we hardly could ask more in a period of 6 weeks. We found that by using this design, students worked harder and respected deadlines much better than others did in previous promotions. Class spirit was quite extraordinary and we shall comment on this later. It also turned out (and this is not surprising) that teacher involvement was a very critical variable. Constant pressure, but also rapid feedback and availability of both the teacher and his teaching assistant were judged to be highly positive in student interviews that we carried out.

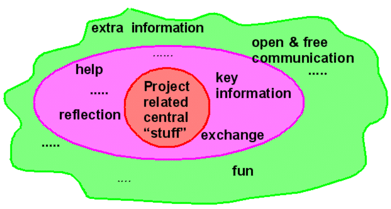
We are therefore quite happy in claiming that this quickly outlined design seems to be a good instance of the teacher as facilitator, manager and « orchestrator » paradigm. There were, of course, difficulties encountered in our Staf-18 course, in particular, working with an XML grammar at the very beginning of their studies was both a culture shock and a technical difficulty for most students. They never encountered structured text before and had big difficulties to adapt to a knowledge-tree organization of text. They also had initial difficulties to work with several tools at the same time and to participate in collective knowledge sharing and confrontation activities. However, since activities were mandatory and tools were gradually introduced they very quickly (after about 2 weeks) felt even « at home » in the portal, and really appreciated learning together.

See also the project-based learning article that addresses issues related to the general study environment.

Community, flow and creativity boosting with C3MS portals

While as we showed before, C3MS portal provide rich functionalities for pedagogical "story-boarding" they have been designed first of all as community portals and therefore are ideally suited to boost collective learning, creativity and optimal experience. As formulated by e-learning practitioner Gilroy (2001) "E-learning should be first and foremost about creating a social space that must be managed for the teaching and learning needs of the particular group of people inhabiting that space". Going one step further, on can claim that: "In order for individuals to learn how to construct knowledge, it is necessary that the process be modeled and supported in the surrounding community. This is what occurs in a learning community" (Bielaczyc & Collins 1999: 272).

While a large part of our knowledge comes indeed from formally planned learning scenarios, people learn a lot from informal exchange with fellow learners, with professors, experts, i.e. from exchange within tightly or loosely defined communities. We can define communities as networks, made up of individuals as well as public and private institutions. They share a certain amount of practices, common goals and common language. They do have a social organization including formal or informal hierarchies and some idea of "social service" (members helping each other). To support community creation we believe that learning environments should be a social "place".



Sharp focus and fuzzy edges

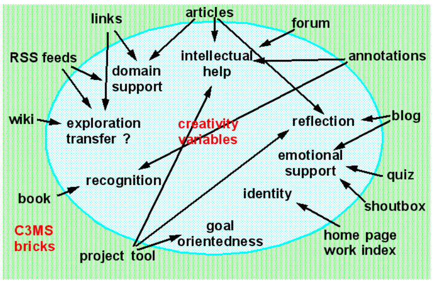
The C3MS environment summarized and revisited

First, the portal should be a rich information space for "**domain support**" and it should encourage students add their own contribution. Such a space also encourages **exploration**. Typical tools are links managers, wikis, news engines and RSS feed that keep users up-to-date about articles posted to other interesting portals or individual weblogs. **Intellectual support** is provided via forums, annotations and articles. Student productions are always accessible to all (including visitors) and therefore provide for **recognition**. One could **manage** activities by using various standard tools like articles, forums and the calendar, but it may be more appropriate to use special purpose tools.

In our experience, it has been shown that students are more like to contribute to an environment if they own an **identity**. In the student's partly automatically generated home page on the portal one can see their contributions, read public parts of their personal weblog and conversely each production in the portal is signed with a clickable link to the author.

It is very important to us that teaching generates enthusiasm, enhances concentration and favors creativity, which are very distinct but somehow interconnected phenomena. Lloyd P. Rieber (1998) convincingly argues that learning process itself - and not just the result - should be interesting, if one seeks higher motivation among learners. "Serious play" or "hard fun" are intense learning situations where learners engage large amounts of "energy" and time and that do provide equally intensive pleasure at certain moments and which have been identified as flow or "optimal experience" by Mihaly Csikszentmihalyi in 1990.

Creativity is a far more complex issue and its relation to flow is not obvious. "Optimal experience" has been described by gamers or programmers and enhances without doubt productivity, but does not necessarily entail creativity. Creativity arises as combination of (1) the social field, (2) the domain (symbol systems of knowledge) and (3) the individual traits. Education can act upon conditions, i.e. on educational tasks and the general learning environment like the "class spirit" with the help of specially designed technology that we will introduce below. By exposing students to open-ended, challenging, authentic and partly self-defined projects on one hand and by providing scaffolding and support on the other, the teacher does create situations where individual traits can be exposed and developed.



Creativity variables and enabling software

A successful teaching by projects pedagogy needs to provide strong **emotional support** and it is therefore important to encourage spontaneous, playful interaction and corner's for humor that will augment quality of on-line life and contribute to class spirit. Tools like the shoutbox or a little quotation box can do wonders. Lastly, but not least, a personal weblog (diary) can stimulate **meta-reflection**, in particular if the teacher requires that students write an entry after the completion of each activity.

Here is an executive summary of how to design such a learning environment:

LE design = landscaping & conditioning

Discussion

to be written, including some results

In the meantime:

- Such a design has high costs for the teacher. Don't do it with more than 20 students (unless you have tutors that do have domain and teaching expertise)
- Be prepared to be flexible, there is no problem to reorganize a course design. Of course you should respect some form of pedagogical contract with students, in particular regarding the kind of intermediary products they have to deliver and your evaluation scheme (Daniel K. Schneider usually grades almost every production).

Alternatives:

- You may find many more sophisticated models and environments to implement project-oriented and activity-based designs, e.g, Learning Design with LAMS or workflow designs with CeLS (once this system becomes available).

- However, this model is more failsafe and does rely on software that millions of people use. What you loose is workflow integration, but workflow often means deadlocks, in other words more sophisticated designs with sophisticated toolkits need more preparation. Once you do have a portalware or shared webtop installed, you don't need more than 1 day of preparation for a course. Guiding, scaffolding and monitoring cost of course are high or even higher. You can however profit from student productions, e.g. use them in a next round of teaching.

Real data (not just propaganda):

- 2 PhD thesis on the road, one completed ...

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C5 simulation framework

Draft

Definition

C5 (compact, connected, continuous, customizable, collective simulations) is an architecture to tightly connect four information technologies (handheld devices, desktop computers, the Web, and end-user programming) into an engaging, inquiry-based learning environment.

This article should be expanded. The concept is from the AgentSheets team. (Alexander Repenning gave a talk [1] at TECFA and these were the highlights I wrote down - DSchneider 23:30, 7 December 2006 (MET))

The Mr Vetro project

A distributed simulation of the human body. Tested in real world setting, this approach looks promising. Initial evidence of a comparative textbook teaching vs. simulation field test with 2 classes shows:

- Better scores in non-standard complex problem-solving tests ("deeper understanding")
- Same standardized test scores (which is a good result)
- Better retention (after 1 month)
- Increased motivation

Links

- Alexander Repenning and Andri IoannidouDistributed Simulations: Mr. Vetro [2]

References

- Mr. Vetro: a Collective Simulation Framework [3]

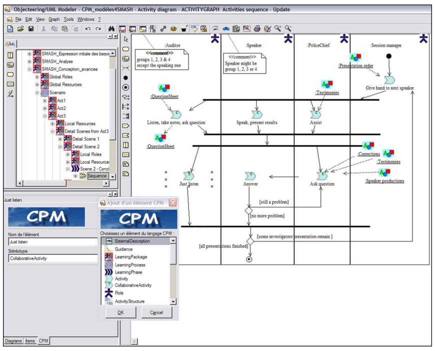
CPM

Draft

Definition

CPM was developed by Pierre Laforcade and others in the context of a PHD thesis.

“Within the industrial context of e-learning, Educational Modeling languages (EML) aim in essence to describe the content and process within "units of learning" in order to support reuse and interoperability. These languages emphasize the formal specification of models called scenarios. We present in this paper our research results about the proposition of a UML-based modeling language dedicated to Problem-Based Learning design. The CPM (Co-operative PROBLEM-BASED LEARNING Metamodel) language successes in providing a rich-graphical formalism to designers/authors of PBL. Our contribution covers the instructional design process from initial requirements step to design step upstream EMLs. Thanks to a binding mechanism provided when using dedicated tools, the CPM language finally conforms to the EML definition.” ([Laforcade, 2005: Abstract]).



Screen Capture of the CPM system. Source: http://www-lium.univ-lemans.fr/~laforcad/CPM/CPM%20-%20presentation%20v0.1.ppt

Software

CPM was a research system.

CPM is implemented a module for the free-of-charge UML CASE-tool Objecteering.

Dowload

You can download from Thierry's home page [1].

Links

- Homepage Laforcade [2] (includes publications, etc. Some online).
- PPT presentation slides [3]

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Acknowledgement: This article or part of this article has been written during a collaboration with the EducTice [7] group of INRP [8], which attributed a visiting grant to DKS in january 2009.

Campbell-Lom mentoring model

Draft

Definition

The Campbell-Lom mentoring model is a simple e-mail mechanism to enhance reflection, independence, and communication in young researchers. (Note: Our name of the model - Daniel K. Schneider, the authors call it *five questions method*).

The aim of this model is to promote higher levels of thinking necessary for successful research.

See also: Metacognition, Self-regulation, Self-directed learning, mentoring.

The model

To enhance communication, comprehension, reflection, and independence among undergraduate research students, Campbell and Lom (2006) developed a simple mechanism. On a regular basis, they ask their research students to answer these short questions via e-mail:

Question 1 - How have you spent your time?

- Stimulates students to document their progress.
- Mentor can evaluate student participation and efficiency.
- Can also help the mentor and student identify any issues with efficiency, time management, and research priorities that may arise.

Question 2 - What do you know? (what did you learn recently)

- Also stimulates students to document their progress.

- this question sets an upbeat tone and helps them document new lessons learned since their last entry.
- helps both students and mentors appreciate the intellectual gains students are making as they go through the research process.

Question 3 - What don't you know?

- Encourage students to identify gaps in their knowledge and ways to fill in those gaps (see also next question)
- By explicitly encouraging students to define the specific gaps in their knowledge, students are helped acknowledge and approach their uncertainty in a way that encourages them to communicate and problem solve.
- A first step for students learning to take charge of their own education, think independently, and develop problem-solving strategies.

Question 4 - How can you find out what you don't know?

- Encourage students to identify gaps in their knowledge and ways to fill in those gaps
- Identifies critical areas where the mentor may have inadvertently assumed knowledge that the students do not yet have, where students misunderstood important information, or where expectations may have been unclear.

Question 5 - What are your frustrations?

- Allows students to identify and share any roadblocks they encounter in their research and learning.
- Opens the door for students and mentors to address personal problems related to lab research. This is important since failures of interpersonal communication can result in situations that reduce the efficiency with which the laboratory operates

Practical issues

Cost

“ Principal investigators typically are busy people with responsibilities that extend far beyond supervising new students in their labs. Consequently, our five-question approach may sound like more busywork that will add to e-mail accounts that are already overwhelming. However, the time commitment of our approach is minimal and the payoff substantial, even time saving, for student learning and meeting our research goals.” (Campbell & Lom, 2006).

Frequency

According to the authors, “ a once-a-week e-mail works well for independent study or group investigation research courses during the academic year. For full-time summer research students, daily answers combined into one week-long document submitted Friday afternoons works very well”.

Evaluation

This 'five questions' method was piloted during the summer of 2005 with four research students. During the 2005-2006 academic year, Campbell and Lom used these questions in two group investigation courses.

“ The five-question e-mails revealed many important issues that could be addressed easily during the lab meeting such as allocation of research time, clarifying research objectives, assigning research tasks, scheduling training times, and addressing conceptual questions. Any lingering or individual questions were addressed by e-mail or in person. At the end of the semester, students commented favorably on anonymous evaluation sheets that asked if the weekly e-mail assignment helped them reflect on what they were learning and communicate with the instructor.” (Campbell & Lom, 2006).

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Carroll model of school learning

Draft

Definition

- In 1993, John Carroll proposed a model for school learning. Learning was defined as function of efforts spent in relation to efforts needed. Most of the model is time based.
- According to Huitt ([1]): School Learning = f(time spent/time needed). (DSchneider believes that this definition does not capture the full model).

The Model

According to Reeves (1997) Carroll's model include six elements with one output variable, one input variable and 4 intermediate variables.

- **Academic Achievement** is the output (as measured by various sorts standard achievement tests)
- **Aptitude** is the main explanatory variable defined as the "the amount of time a student needs to learn a given task, unit of instruction, or curriculum to an acceptable criterion of mastery under optimal conditions of instruction and student motivation" (Carroll, 1989: 26). This definition of aptitude very much reminds the principle behind mastery learning. "High aptitude is indicated when a student needs a relatively small amount of time to learn, low aptitude is indicated when a student needs much more than average time to learn" (Carrol: 1989: 26).
- **Opportunity to learn**: Amount of time available for learning both in class and within homework. Carroll (1998:26) notes that "frequently, opportunity to learn is less than required in view of the students aptitude.
- **Ability to understand instruction**: relates to learning skills, information needed to understand, and language comprehension.

- **Quality of instruction**: good instructional design, e.g. like it is usually defined in behaviorist frameworks like nine events of instruction. If quality of instruction is bad, time needed will increase.
- **Perseverance**: Amount of time a student is willing to spend on a given task or unit of instruction. This is an operational and measurable definition for motivation for learning.

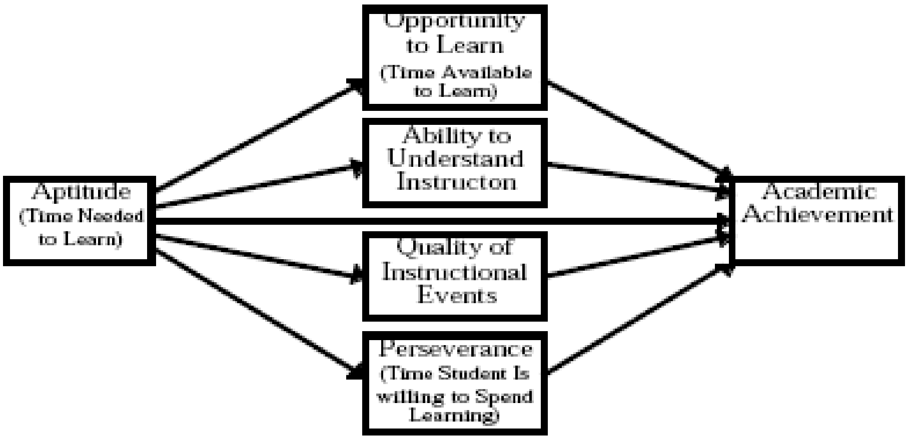

Figure 1. Carroll's (1963, 1989) Model of School Learning.
http://it.coe.uga.edu/~treeves/WebPaper.pdf

Time needed to learn and quality of instruction

The most important question the Carroll model (and numerous follow-up studies) raises is: **What is appropriate time needed to learn** (TTL) ?

" The model of school learning assumes that students differ in the amount of learning time they need. If these differences are to be adequately taken account of, considerable skill in classroom management is required of teachers" (Carroll 1989: 29).

See also the instructional time article.

Carrol's model differs from Bloom's by seeking equality of "opportunity", not necessarily equality of *attainment*. " Emphasizing equality of opportunity means not only providing appropriate opportunities to learn (*appropriate*, not necessarily *equal* for all students), but also pushing all student's potentialities as far as possible toward their upper limits." (Carroll 1989:30). According to Carroll, good planning is a key factor, but also good instructional design.

Links

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Case-based learning

Draft

Note: I started to overhaul this piece a bit and to find some more literature and web resources. So far I don't like it (too many vague bullet points, too much copy/paste from sources that are not clearly referenced. Use with care and rather follow up links.) - Daniel K. Schneider 19:35, 11 October 2007 (MEST).

What is case-based learning?

Case-based learning (CBL) is an instructional design model that is a variant of project-oriented learning. It is popular in business and law schools. CBL in a narrow sense is quite similar to to problem-based learning, but it may also be more open ended as in our definition of project-based learning. It is not close to what we called Project-methodology-based learning.

According to the Case-based Learning [1] page of the Center for Instructional Development & Distance Education , retrieved 19:35, 11 October 2007 (MEST), “Cases are factually-based, complex problems written to stimulate classroom discussion and collaborative analysis. Case teaching involves the interactive, student-centered exploration of realistic and specific situations. As students consider problems from a perspective which requires analysis, they strive to resolve questions that have no single right answer.”

Note: CBL is also a subfield of artificial intelligence. Case-based learning as technology can be found in advanced systems like Intelligent tutoring systems, e.g. to find stories to support reasoning (Jonassen & Hernandez-Serrano, 2002)

In an earlier (now unavailable) version [2], CIDDE, defines Case-based learning (CBL) as “instruction by the use of stories about individuals facing decisions or dilemmas” and was characterized as follows:

Features

- learner-centered
- Collaboration and cooperation between the participants
- discussion of specific situations, typically real-world examples.
- questions with no single right answer.

Students

- engaged with the characters and circumstances of the story.
- identify problems as they perceive it
- connect the meaning of the story to their own lives.
- bring their own background knowledge and principles.
- raise points and questions, and defend their positions.
- formulate strategies to analyze the data and generate possible solutions.
- may not agree, and sometimes a compromise is reached.

Teacher

- facilitator
- encourages exploration of the case and consideration of the characters' actions in light of their own decisions.

Cases

- factually-based
- complex problems written to stimulate classroom discussion and collaborative analysis.
- involves the interactive, student-centered exploration of realistic and specific situations.

Cases have traditionally been used to teach decision making skills in professional education. More recently, cases are being used for learning medical science in PBL. The medical school use of cases differs from that in other professional schools in that PBL focuses on medical subject matter content more so than on decision-making.

Type of Cases

According to Planning for Case-Based Learning [3] (retrieved 19:35, 11 October 2007 (MEST)), " the format of a case often influences how to use it with students. Examples of cases with commonly encountered formats are provided with a brief description and likely implementation strategies."

1. Extensive, detailed case study.
   - Frequently used in business courses,
   - Often center on a particular decision, the people who made it, the people affected by it, and the impact of that decision on all parties.
   - May run 100 pages or more. Usually the student reads the entire case individually and prepares an analysis of the decisions with recommendations for change. The case is then discussed.
2. Descriptive, narrative cases, parts of which are given successively
   - Up to 5 pages
   - 1-2 paragraphs per page
   - Designed to be used over the course of two or more class meetings.
   - Disclosed to the students one page at a time, with discussion, hypothesis generation and development of learning goals and study questions for each part of the case.
   - Objectives are given to the student toward the end of the case.
   - This style of case originated in medical settings.
3. MiniCases
   - designed to be used in a single class meeting,
   - usually tightly focused.
   - useful for helping students apply concepts, for introducing practical applications in lab settings, or as a pre-lab exercise designed to make lab work more meaningful.
4. Bullet Cases
   - Two or three sentences with a single teaching point.
   - Similar to problems commonly used on exams, however, students discuss them in small groups.
5. Directed Case Study
   - Short cases are followed immediately with highly directed questions.
6. Fixed Choice Options (Multiple Choice Cases)
   - May be a variation on bullet cases above,
   - Is a minicase with 4-5 plausible solutions. In groups students must choose and defend one solution.
   - Useful for policy, ethics, design decisions.
   - Good for short, in-class uses.
   - Multiple choice questions might convert easily to these.

Advantages of CBL

According to CIDDE [2] (2006, dead link):

- students sort out factual data, apply analytic tools, articulate issues, reflect on their relevant experiences, and draw conclusions they can relate to new situations.
- they acquire substantive knowledge and develop analytic, collaborative, and communication skills.
- Cases add meaning by providing students with the opportunity to see theory in practice.
- Students seem more engaged, interested, and involved in the class.
- CBL develops students' skills in group learning, speaking, and critical thinking.
- Since many cases are based on contemporary or realistic problems, the use of cases in the classroom makes subject matter more relevant.

Instructional Models

Clyde Freeman Herreid [4] provides eleven basic rules for CBL.

1. Tells a story.
    - It must have an interesting plot that relates to the experiences of the audience.
    - It must have a beginning, a middle, and an end.
    - The end may not exist yet; it will be what the students need to supply once the case is discussed.
2. Focuses on an interest-arousing issue.
3. Set in the past five years (increase the motivation of the students)
4. Creates empathy with the central characters.
    - to make the story line more engaging
    - because the personal attributes of the characters will influence the way a decision might be made.
5. Includes quotations.
    - add life and drama to any case.
    - provide realism.
6. Relevant to the reader.
    - This improves the empathy factor and makes the case clearly something worth studying.
7. Must have pedagogic utility.
8. Conflict provoking.
9. Decision forcing.
    - In dilemma or decision cases, students can not duck the issue, they must face problems head on.
10. Has generality.
    - Cases must be of more use than a minor or local problem; they must have general applicability.
11. Is short.
    - must be long enough to introduce the facts of the case but not so long as to bore the reader or to make the analysis tedious.

Course Structure

CBL course structure can be planning in various ways. Regarding questions like: When does the course meet? How often? How long? For what purposes? When would you fit in cases?, Fitting Investigative Case Study Approaches into Courses [5], retrieved 19:35, 11 October 2007 (MEST) suggest the following "prototypical weeks":

```
Traditional       3 hours of lecture, 2-3 hours in lab
Option A       Two blocks per week "workshop" style with some time for case work
Option B       Combine lecture and case work, sandwiching lab
Option C       Start case on Fri., work on in lab, finish next Fri.
Other options       Create your own
```

How to do CBL - take two

How can CBL be used in the classroom?

source: http://www.pitt.edu/~ciddeweb/faculty-development/FDS/casebase.html

- Cases can be used as the catalyst for class discussions and lectures.
- A student-centered discussion can be a main classroom activity as students collaborate to analyze the full dilemma and the data provided and decide upon a course of action.
- Case-based studies can be used in small or large classes.

In very large classes

- cases could be short introductory experiences that lead into additional learning experiences in lab or recitation time.
- Some part of the lecture time is used to provide the case background, perhaps in a short video segment.
- Directed cases with a defined problem space are used within large lecture settings by selecting class members to respond individually.
- Often individuals are chosen to report on the progress of short periods of work accomplished within proximity groups of students.
- There are many solutions to having students in larger classes do meaningful work in smaller groups. Additional support for case based teaching can be provided by faculty working in teams, graduate students (if available) and advanced undergraduate teaching assistants.
- It is possible to break up large classes into smaller groups, but you do need a high tolerance for noise while a couple of hundred students, working in near-neighbor groups, discusses a case.
- Peer interactions are enriched by the prior knowledge, experience and interests the larger number of students bring to the process.

In smaller classes

- real advantage for students learning how to work together on cases.
- Groups can be smaller and more easily interacted with.
- Investigative CBL works well in this setting.
- Further research options might include modeling and simulation, data mining, or data visualization.

In virtual classes

- cases are introduced electronically with student groups working together on-line.
- also works well to extend opportunities for community college students who may be older and working. There are faculty whose case materials and advice are made available on line.

How to prepare students to use case study approaches

Most college students are ill-prepared for collaborative group work. Nonetheless, at present, college faculty need to recognize that they will have to teach students how to work together. They will also have to teach them how to use case study approaches.

Address student concerns by providing access to specific information on what to expect with CBL such as: Notes for Students on Investigative CBL At Harvard Medical School, incoming classes of medical students are introduced to CBL in 3 ways.

1. in orientation, they do a case about plumbing (which few know about and it isn't medical, so the pressure is off).
2. also during orientation, they sit as a group of 160 in a lecture hall and watch a small group tutorial take place live in front of them (run by second year students).
3. in their first real course, time is allotted for discussing group dynamics and case processes.

You will likely want to make a low-pressure situation for your students the first time they do a case. Make it small, fun and easy, so they can learn how to brainstorm the issues and questions of the case. Don't be afraid to give explicit directions, such as:

- "We begin by having one person read the case out loud. Who would like to do this?"
- "Are there any words you don't know?" Or "what do you think this case is about?"
- "It will help you later if one ofyou acts as scribe and writes down the ideas (on the chalkboard). You might want to keep track of facts, questions, issues, and proposed answers to the problem."
- "We have 10 minutes left and you need to plan for next meeting. What do you see as key issues you'd like to work on?"

Students also need guidelines for how to act during discussions. Having printed guidelines can help, such as

- "Don't interrupt one another" ... "Don't attack people personally, focus on ideas"... "Each person must contribute to the group. There are many ways to do this."

How evaluate a case

Before writing your own case, ask yourself these questions:

- What is the case about?
- What are some of the potential learning issues?
- Are these central enough to the case for me to use this case?
- Can I modify the case?
- How difficult or obscure are the issues in the case?
- Will there be issues my students will care about?
- Is the case open-ended enough for students to go beyond fact finding?
- What do I see as possible areas for investigation?
- What product might I ask students to produce?
- Is the case too short or too long for the time I have available?
- What sorts of learning resources might be needed for this case? Are they accessible?
- If I use this case, what lectures/labs/discussions might I want to change, add or eliminate?

How to write a case

If no case is perfectly made for your course, you can write your own case. The work required varies enormously depending upon the materials you decide to provide the students. You can use for example:

- a 100-word paragraph from a journal
- an elaborate preparation requiring dozens of pages of text and extensive research.
- a business cases may require over a year of information gathering and interviews along with thousands of dollars of investment to develop a case that may extend over several class sessions.

Pre-existing Materials

- can be found prepackaged almost anywhere (newspapers, magazines, novels, cartoons, videos, and television dramas). For example, the movie "Jurassic Park" is an ideal story to consider questions about scientific responsibility as well as DNA technology.
- Another technique is to simply collect a series of articles focused around a single topic. If accompanied by a short series of questions to guide student's reading, an outstanding case can be developed.
- In summary, pre-existing materials are cheap and easy to find. They come from familiar sources and are recognizable as authentic parts of the student's world. There is an immediacy in their use; one can see an article in the press in the evening and be using it in the classroom the next day.

Writing Cases

- Many cases are best developed from scratch (most business cases and although it requires considerable time, it has the advantage that only essential material is included in the writing).
- May be customized exactly to meet the teacher's goals.
- Reynolds (1980) has classified cases into three basic types:
  1. Decision or dilemma cases present problems or decisions that need to be made by a central character in a drama.
     - usually consists of a short introductory paragraph setting up the problem to be considered and may introduce the decision-maker at the moment of crisis.
     - A background section fills in the historical information necessary to understand the situation.
     - A narrative section then presents the recent developments leading up to the crisis that our protagonist faces.
     - Appendices follow including tables, graphs, letters, or documents that help lay the foundation for a possible solution to the problem.
  2. Appraisal cases ("issue cases") are used to teach students the skills of analysis. #* The material is focused around answering questions like "What is going on here?"
     - This type of case frequently lacks a central character in the drama and generally stops short of demanding that the students make a decision.
  3. Case histories are largely finished stories
     - generally less exciting than decision or appraisal cases.
     - can serve as illustrative models of science in action and they provide plenty of opportunities for Monday-morning quarterbacking.
     - Science is replete with cases of this type (e.g. the Copernican revolution, cold fusion, ...)

How to teach a case

In almost all methods there is a common approach. The instructor must have his objectives clearly in mind, must structure the presentation to develop the analytical skills of the students, and must be sure that student participation is maximized.

Discussion Format

- classically used by business and law schools to deal with cases.
- Students are usually presented with decision or appraisal cases.
- The instructor's job is to identify, with the student's help, the various issues and problems, possible solutions, and consequences of action.
- simple method : the instructor asks probing questions and the students analyze the problem depicted in the story with clarity and brilliance.

Case discussion instructors vary enormously in their classroom manner:

- strong intimidating approach.
  - The "all-knowing" instructor (acting as inquisitor, judge, and jury) tries to extract wisdom from his student victim.
  - In its worst form, the questioning can be a version of "I've got a secret, and you have to guess it."
  - In its best form, it can bring about an intellectual awakening as insights emerge from a complex case.
- almost nondirective class discussion.
  - The instructor can practically stay on the sidelines while the students take over the analysis.
  - The instructor may start the discussion with a minimum of fuss saying, "Well, what do you think about the case?"
  - From that moment on, the instructor may merely act as a facilitator, being sure that some semblance of order is kept and students get to voice their views.
  - Finally, the class may end without any resolution of the issue or summation.

Most practitioners of the discussion method prefer a middle ground. William Welty (1989) argues for such an approach with proper introduction, directive but not dominating questioning, good blackboard work to highlight the essential issues, and an appropriate summary.

Debate Format

- well suited for many types of cases where two diametrically opposed views are evident.

Public Hearing Format

- ideal format to allow a variety of people to speak and different views to be expressed.
- Their use in case studies has similar strengths and has the added virtue of mimicking real-world events.
- Public hearings are structured so that a student panel, role-playing as a hearing board, listens to presentations by different student groups.

Trial Format

- have inherent fascination because of their tension and drama.
- two opposing sides each represented by an attorney, with witnesses and cross-examination.

Problem Based Learning Format

- Medical schools have used the case method of instruction for years.
- PBL is faculty-intensive, for it uses one tutor for every four or five students. They stay together for the entire term, working through a series of cases.
- The cases are typically linked by some common area of study or progressive shift in complexity.

A typical case passes through several stages. In their first meeting, the instructor presents a short written account of the patient with some symptoms and background. The faculty and students together try to identify the points they think they understand and determine those terms, tests, procedures, symptoms, etc., for which they need more information. At the end of this meeting, students agree on how each will divide up the responsibilities to search for the needed information in the libraries.

In the second meeting, students discuss their findings and share opinions. Their search for the correct diagnosis narrows down. By the end of the class meeting, the students have determined what new information they need to uncover and go their separate ways to find it.

At the third meeting, students share their thoughts, data, and understanding. They try to reach closure on the diagnosis and treatment. This is the last step in the process and generally students will not find out the "real" answer to the problem. The knowledge and understanding of the case comes from the search for answers, not from "the answer" to a particular case. The power of this method is its interactive approach between thinking, discussion, and searching for more information. Consequently, it mimics the approach we usually use in real life.

Scientific Research Team Format

- The essence of most scientific research is the case method.
- scientists are constantly confronted by problems, questions, or dilemmas
- they usually have a large background of information, which they can use to "solve the problem."

they use some version of the hypothetico-deductive method where we ask questions, make hypotheses, make predictions, test predictions by observation and experiment as they collect data, compare the results with their predictions, and make evaluations and draw conclusions.

Here is an example of student-research projects which involves the simple collecting of rain samples in different regions of the campus or city and measuring pH. The data collected over a semester will yield lots of tables and graphs for comparison with other regions of the country and lead to discussions of acid rain and its effect upon the ecosystem. Mundane though this project seems it instills in students a great sense of many steps in the collection and analysis of data.

See also: cognitive flexibility theory

Tools

Virtu@l Consult@tion

The medical curriculum has changed with the adoption of the student-centered and case-based learning paradigm. Clinical Reasoning Learning (CRL) is a pedagogical method used in order to develop and improve student's clinical reasoning and problem-solving skills.

Virtu@l Consult@tion:

- Computer-Supported Collaborative Learning (CSCL) environment for Remote Clinical Reasoning Learning (CRL) sessions in Cardiology .
- composed of a set of cooperative platform-independent tools which allow to the CRL group to communicate and to share information during the sessions.
- allows teachers and students to simulate medical tele-consultations.
- use of multimedia data making this simulation more realistic than a face-to-face CRL session.
- the multimedia resources are close to formats that students will find in their professional life.
- can be used for undergraduate, internships, residency or continuing medical education at distance.
- useful to prepare physicians to telemedicine technologies.

source:http://www.ea3888.univ-rennes1.fr/cgi-bin/ea3888/ea3888.pl?action=page_perso&pers=208477

CaseMaster

an Interactive Tool for Case-Based Learning over the Network

- Web-based platform supporting presentation of and work with cases as well as other learning scenarios over the Web.
- CaseMaster allows creating cases (course content) as a non-linear structure like a story with one start, but with many possible different endings.
- advocates human interaction and gives possibility for solving problems together.
- encourages blended learning with human meetings and discussions.
- successfully used in the PharmaPaC project for learning pharmacology
- successfully used in the SwedKid project for learning more about i.e. treatment of minorities, the position of recent refugees and immigrants.
- url : http://www.casemaster.co.uk/
- demo: http://www.casemaster.co.uk/flash/flashdemo.html

source: http://www.educ.umu.se/~ojje/om_mig/CaseMaster_Orjan_Johan.pdf

CAMPUS

Training System in Medicine

- Case-based and Web-based training shell system
- to develop, organise and (re-)use flexible,simulative medical multimedia cases
- can be used by different users (medical students and physicians at different levels) in different learning scenarios.
- improvement of the own problem- or case-solving competence
- can be used over the Web and locally
- http://www.medicase.de

source: http://www.coe.missouri.edu/vrcbd/pdf/WorldConfEdMedia2001.pdf

Links

- Case-Based & Problem-Based Teaching & Learning [6], CET, USC. This website also includes good links to articles and guidelines. Best overall site.
- Pyatt, Elizabeth, Home: About Case Studies [7], Teaching and Learning with Technology, Penn State University, , retrieved 19:35, 11 October 2007 (MEST). Includes guidelines, links and example cases and links to case repositories.
- Planning for Case-Based Learning [3]
- The Case Method of Teaching Science [8], Articles by Clyde Freeman Herreid and pointers to other online publications.
- What Is Case-Based Learning? [9]. Short summary of C.F Herreid's eleven rules.
- http://www.pitt.edu/~ciddeweb/faculty-development/FDS/casebase.html
- http://www.bioquest.org/usernote.html

Case repositories

- World history sources [10], Center for history and new media, George Mason University
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Case-based reasoning

Draft

Case-based reasoning defines the rationale applied when cases, stories, or narratives are used in learning contexts (case-based learning). In its simplest form it represents the learning cycle undergone as lessons learned from them are applied to present situations.

CeLS

Draft

Definition

CeLS (Collaborative e-Learning Structures) is a web-based environment for creating and conducting *structured asynchronous collaborative activities* and incorporating them in the existing instructional setting for all subjects and levels. CeLS is a web-based system designed to create and reuse activity structures; runable formats reflecting various collaborative instructional strategies e.g., creating and analyzing a common database, reaching an agreement, peer-product evaluation, contest, creating a group product.

- See also: The LAMS and DialogPlus Toolkit system, Educational modeling language and IMS Learning Design

Note: Contents of this entry are excerpts from Miky Ronen, Dan Kohen-Vacs and Nohar Raz-Fogel (2006) and a PPT presentation, permission to reuse contents by Miky Ronen (Jan 2007).

Goals and main features of the CeLS project

Design goals

- Encourage & support teachers to create and conduct structured collaborative activities in the actual educational setting
- Support a wide range of situations, e.g. elementary school to Higher Education, dedicated to busy teachers, small to large groups
- Focus on courses supported by web-based (asynchronous) components
- Encourage sharable online pedagogies through reusable components (as such the system does address change management issues)
- Modelling of groups (and roles), artefacts , dynamic features, work and control flow between activities, varied forms of social interaction

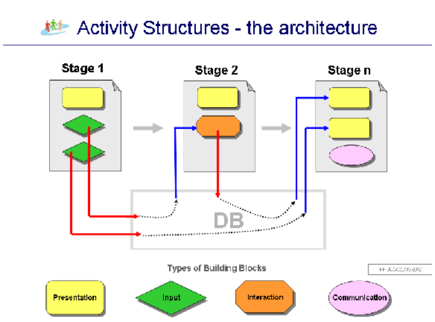
Architecture

- CeLS is an executable XML-based model for collaborative Activity Structures, consisting of stages that are interconnected and based on each other.

Architecture of the CeLS system

CeLS is a web-based system consisting of a server-side run-time engine and a client side Activity Editor. An additional server module is responsible for administrative aspects. An Activity Structure (AS) may include any number of stages of interaction between a learner and the system. Each stage comprises of any combination of distinct objects of *four different types*

- **Presentation** objects are passive elements used to present information of any kind (text, hyperlink, media). This information can be provided by the teacher or consist of learners' *products* from previous stages. A product can be an organized collection of distinct items contributed by different participants (identified or anonymous) or a single item that results from the combined action of a group.
- **Input** objects are interfaces that allow the participant to submit *new data* to the system (text, hyperlinks, media or any kind of attached electronic file or as voting on various scales).
- **Interaction** objects are interfaces that allow participants to *interact with products* created in previous stages, in various ways: by grading, ranking, categorizing and editing or responding to these products via text or graphic manipulations.
- **Communication** objects are interfaces that allow participants to freely communicate with each other or with the teacher.



The architecture of the CeLS activity structures

Each object has properties that can be adjusted by the author. Some properties are generic, for instance, if the completion of an object is mandatory or not, and others are particular to the object or to its type, for instance, maximum or minimum text length or the vocabulary used for Text Input object.

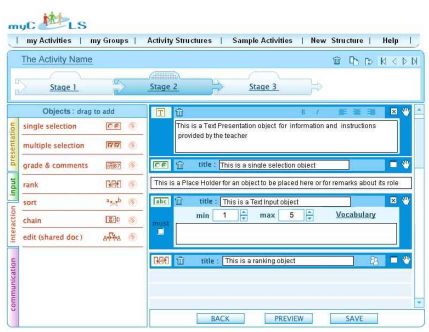
These basic building blocks are merely technological and do not carry any pedagogical meaning. It is only their *combination* as an Activity Stage and or Activity Structure that creates such meaning.

An activity stage can consist of *any combination* of objects of various types. The functionality is determined by attributing properties related to groups to the stage or to specific objects, so that different participants may encounter different information and perform actions on different data items during the same activity stage. As a result, the process represented by the whole activity is not actually linear, though it may seem linear to each of the participants. A stage may be assigned "start" and "end" times, advance upon completion or according to other conditions defined by the author of the activity.

The CeLS master group is a class. Groups can be merged to form 'communities' or divided to *families* of subgroups representing subjects assigned to the subgroups or roles played by the subgroups. A family of subgroups has specific properties such as max and min members in a subgroup, number of subgroups, their generic or particular names. An Activity Structure may *use different families of subgroups* in its stages.

Authoring with CeLS

The figure below gives a glance at the CeLS authoring capabilities. *My Activities* allows teachers to access their own activities (preview or participate), to manipulate them (edit or duplicate), or to view students' contributions and follow their actions without interfering. Groups and subgroups creation is handled by the *my Groups*options. The definitions of an activity can be edited after the activity has started, enabling the teacher to introduce modifications and adjustments 'on the fly', by adding or changing objects in a stage or adding stages. *Activity Structures* present the teacher with a collection of pre-defined generic structures. These Structures are content-free skeletons and include recommendations for their customization to various needs and settings. The *Sample Activities* option provides a searchable domain of all the activities that were *implemented* with students by the system users, in all institutions, contents and levels. Teachers can view and explore these examples, adopt them for personal use by duplicating them, then adapt their structure and content to their specific needs. If none of the existing resources seems suitable, the teacher can create a *New Structure* using the basic building blocks.



The architecture of the CeLS activity structures

Sample activities

Here is a short list of sample activities that have been implemented with CeLS:

- Creating a common database (simple/complex, open/p.b.v.)
- Responding to peers' items (grading, ranking, categorizing …)
- Pros & Cons (open/p.b.v.)
- Reaching an agreement
- Creating a group product (parallel/ sequential)
- Peer/self evaluation (rubrics)
- Peer product assessment (online/offline, group/personal)
- Competition
- Group Inquiry / Problem solving (Jigsaw…)
- E-Games, Role play …

Discussion

Daniel K. Schneider believes that CeLS is currently the most interesting system to implement activity-based pedagogical scenarios. The CeLS project follows a design-based research methodology and is open to various avenues.

Scenarization power

- Compared to LAMS, the advantage of the CeLS design is its ability to use learners' products from previous stages and to conduct complex, multi-stage, structured activities. CeLS provides a sample of content-free Activity Structures and a searchable domain of all the activities that were implemented with students. Teachers can explore these examples, adopt them for personal use and adapt their structure and content to suit their specific needs. If none of the existing pre-designed resources seems to suit the needs, they can create new structures using basic building blocks.

Implementation

- CeLS is implemented with MS .Net server-side technology and Flash / DHTML on the client side. For the moment CeLS runs on a single server and needs an IE6 webclient. The system is in Beta stage but has been tested by 30 teachers, 50 courses, 3000 students (2004-2006).

Suggestions for further development

(By Daniel K. Schneider 15:28, 30 January 2007 (MET))

Technical

- Implement a replication architecture so that several distributed CeLS servers could be run. This is necessary because scenario sharing between teachers is integrated *in* the system.
- Make it Firefox/Opera compatible (Since IE7 still doesn't implement CSS2 correctly, still doesn't provide XHTML/SVG/MathML support, Daniel K. Schneider doesn't endorse this software).

Conceptual

- Make explicit a modeling language (while IMS Learning Design is currently the *hot* format, it will not necessarily be accepted by everyone and explicit alternatives would be welcome

Documentation

- Write a teacher's manual (this is under progress).

Links

- Prof. Miky Ronen [1] Homepage
- Instructional Systems Technologies [2], Holon Institute of Technology.

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Cognitive flexibility hypertext

Draft

Definition

Cognitive flexibility hypertext is a learning environment designed according to cognitive flexibility theory.

> *This text presents essentially the foundations for cognitive flexibility hypertexts, a clear design model is yet missing*

Foundations of the model

The Spiro et al. ground their model on 2 issues: Firstly a lot of knowledge to be taught is both complex and ill-structured and and second that such teaching remains a challenge. " Cognitive and instructional neglect of problems related to content complexity and irregularity in patterns of knowledge use leads to learning failures that take common, predictable forms. These forms are characterized by conceptual oversimplification and the inability to apply knowledge to new cases (failures of transfer). For learners to develop cognitively flexible processing skills and to acquire contentive knowledge structures which can support flexible cognitive processing, flexible learning environments are required which permit the same items of knowledge to be presented and learned in a variety of different ways and for a variety of different purposes (commensurate with their complex and irregular nature)." (Spiro, 1996)

Any effective approach to instruction must simultaneously consider several highly intertwined topics, such as:

1. the constructive nature of understanding;
2. the complex and ill-structured features of many, if not most, knowledge domains;
3. patterns of learning failure;
4. a theory of learning that addresses known patterns of learning failure.

(Spiro, 1996)

In particular, Spiro et al. a are concerned by *oversimplification* for which they identify several forms, e.g. the *additivity bias* (learners think that parts integrated into a whole retain the same characteristics), the *discreteness bias* (continuous processes are segmented into discrete steps), and the *compartimentalization bias* (highly interdependent conceptual elements are treated in isolation with taking into account interaction effects).

" The remedy for learning deficiencies related to domain complexity and irregularity requires the inculcation of learning processes that afford greater cognitive flexibility: this includes the ability to represent knowledge from different conceptual and case perspectives and then, when the knowledge must later be used, the ability to construct from those different conceptual and case representations a knowledge ensemble tailored to the needs of the understanding or problem-solving situation at hand." (Spiro, 1996)

Rephrased by Godshalk et al (2004:211) Cognitive flexibility theory

as conceived by Spiro et al. (1987) suggests the following:

- Using multiple case studies to insure that a variety of possible situations are presented.
- Focusing on cross-case differences in how concepts and principles are applied.
- Consideration of multiple perspectives (individual points of view) as an aid to understanding the connected nature of the domain concepts and promoting flexible knowledge building.

According to Spiro and Jehng (1990), this crisscrossing connection of concepts and cases is most readily accomplished using the ability of hypertext systems (such as the WWW) to explicitly link information. The key to deciding how to link concepts is to provide themes and perspectives that may be considered across the cases.

“ In summary: Ill-structured aspects of knowledge pose problems for advanced knowledge acquisition that are remedied by the principles of Cognitive Flexibility Theory. This cognitive theory of learning is systematically applied to an instructional theory, Random Access Instruction, which in turn guides the design of nonlinear computer learning environments we refer to as Cognitive Flexibility Hypertexts.” (Spiro, 1996)

The architecture of a cognitive flexibility hypertext

Spiro et al. (1996) claim that good strategies for advanced teaching and learning in ill-structured domains are in many ways the opposite of what works best for introductory learning and in more well-structured domains as for example in the direct instruction model.

A few contrasts of design features:

	introductory learning and well-structured domains	**advance learning and ill-structured domains**
knowledge organization	compartmentalization	knowledge interconnectedness
generalization	general principles with wide scope of application	across-case variability and case-sensitive interaction of principles
representation	single unifying representational basis	multiple representations

Since it is impossible to teach each occurrence of ill-structured knowledge, Spiro et al. (1996) argue that “ emphasis must be shifted from the retrieval of intact knowledge structures to support the construction of new understandings, to the novel and situation-specific assembly of prior knowledge drawn from diverse organizational loci in preexisting mental representations.”

Jacobson & Spiro (1993, 1995) derive five instructional principles from cognitive flexibility theory. These are:

- Use multiple conceptual representations of knowledge (e.g. multiple themes, multiple analogies, multiple intellectual points of view).
- Link and tailor abstract concepts to different case examples (illustration of concepts to demonstrate nuances of abstract conceptual variability).
- Introduce domain complexity early (but still in a cognitively manageable manner)
- Stress the interrelated and web-like nature of knowledge (variable thematic links across cases).
- Encourage knowledge assembly (from different conceptual/thematic and case sources)
- Promote active learning (provisions for learner control of navigation paths).

These theory principles then can be mapped to hypertext features as described in the experimental setup of Jacobson & Spiro (1995:307). There were 3 experimental groups. Both groups were exposed to the same "reading stage" (see below). After that one group was exposed to criss-crossing activities (the study stage below) whereas two others groups were exposed to drill and practise over facts and concepts taken from phase 1.

Theory principles	**Hypertext features**
The reading stage (i.e. a minimal "treatment")	
Use multiple conceptual representations of knowledge	Multiple cases and multiple dimensions of a complex concept
Link and tailor abstract concepts to different case examples	Theme list and theme commentaries that accompany case presentations
Introduce domain complexity early (but in a cognitively manageable manner)	Minicase organizational structure
The study stage (i.e. an experimental treatment or an instructional task)	
Stress the interrelated and web-like nature of knowledge	Have students reread minicases exemplifying different combinations of themes
Encourage knowledge assembly (explicit demonstration of abstract and case-specific knowledge components)	Knowledge assembly from different conceptual and case source

Results of this study showed that the minimal hypertext/drill group had higher scores on factual knowledge but the transfer group was better in using/transferring the knowledge, which corroborates the hypothesis that simple instruction tends to create rigid knowledge representations and inert knowledge. We therefore can assume that the above table represents the core of a defendable instructional design model.

More precisely, DSchneider has the impression (but is not sure) that cognitive flexibility hypertexts should feature:

- Links from concepts (complex themes) to full cases (e.g. a movie)
- Links from concepts to sub-units of cases, i.e. mini-cases (e.g. a short movie sequence).
- Optional links from sub-units to situated definitions (extra information / perspectives)
- Optional links from concepts and extra information to related concepts (since each concept is ill-structured, understanding of a situation depends on more than one concept)
- Rearranged instructional sequences, i.e. the system could adapt to the user
- Concepts can be explored in multiple ways, i.e. there isn't necessarily a recommended navigation path.

“ Implementing Cognitive Flexibility Theory is not a simple matter of just using the power of the computer to "connect everything with everything else."” (Spiro et al. 1996). E.g. the learner should not become lost in a confusing labyrinth of incidental or ad hoc connections. Therefore *this* wiki while it could be used as a basis for flexibility hypertext to teach educational technology is *not* yet a cognitive flexibility hypertext.

Hypertext design must not just reflect ill-structuredness of a domain but aim to train construction of new understandings in new situations. It's aims at a competence to build dynamically situated knowledge (situation-sensitive knowledge assembly).

On method to insure that instructional goal is described as "conceptual structure search".

Conceptual structure search

Content is automatically re-edited to produce a particular kind of "criss-crossing" of the conceptual landscape that visits a large set of case examples of a given conceptual structure in use. The learner then has the option of viewing different example cases in the application of a concept he or she chooses to explore. That is, the instructional content is re-edited upon demand to present just those cases and parts of cases that illustrate a focal conceptual structure (or set of conceptual structures). Rather than having to rely on sporadic encounters with real cases that instantiate different uses of the concept, the learner sees a range of conceptual applications close together, so conceptual variability can easily be examined. Learning a complex concept from erratic exposures to complex instances, with long periods of time separating each encounter, as in natural learning from experience, is not very efficient. When ill-structuredness prevents telling in the abstract how a concept should be used in general, it becomes much more important to show together the many concrete examples of uses.

E.g. in the KANE hypertext (Knowledge Acquisition in Nonlinear Environments) which explores thematic structure in Citizen Kane, the learner could see film scenes in a row, that illustrate different varieties or "flavors" of the "Wealth Corrupts" theme. Each of these scenes constitutes a **case** that illustrates this theme. Furthermore the learner then can consult **case-specific particularized background informations** (definitions). Furthermore, there are **cross-references** to other instances of the conceptual structure or even **other conceptual themes** that are related to the "wealth corrupts" topic and that can also explain the behavior of Citizen Kane. “ Thus there is a double particularization in Cognitive Flexibility Hypertexts: the generic conceptual structure is particularized not only to the context of a specific case, but also to the other concepts simultaneously applicable for analyzing that case. That is, each case or example is shown to be a complex entity requiring for its understanding multiple conceptual representations, with the role of non-additive conceptual interdependencies highlighted.” (Spiro et al., 1996).

A light-weight version ?

DSchneider thinks that it may be possible to reuse a wiki like the present one to implement at least some features of the original concept:

- There should be a short introductory articles for a given topic (e.g. "instructional design model".)
- Such an article should point to small examples, both abstract and concrete (cases). E.g. to illustrate what we mean by instructional design model we should point to various different models, but also show concrete designs.
- Each model and each design case should point to various learning and instructional theory that intervene.
- Each example should have links to related examples.

Such a design is probably not effective for most learners, since a typical learner lacks to initiative to dig around until he manages to build up sufficient applicable knowledge. Therefore, we suggest to combine such an architecture with some project-oriented learning (e.g. design a course) or problem-based learning (e.g. design a course for a given topic and public) design or at least writing-to-learn (e.g. contrast design X with design Y) activity.

Conclusion

It is again important to point out that “ Cognitive Flexibility Hypertexts Provide Building Blocks For Flexible, Situation-Sensitive Knowledge Assembly, Not Final Products Of Knowledge” as one of the afterword subtitles in the on-line version of Spiro et al., 1996) points out. In this sense, cognitive flexibility hypertexts are exploratory environments that will enhance constructivist thinking, i.e. it provides building blocks for knowledge for knowledge construction. Single cases (or their features) can not be transferred as such to new situations, but require selective assembly of subsets of representational perspectives met in particular situation.

That stance lets the author conclude that “ the extent of knowledge prespecification found in CFHs is limited to rough guideposts or starting points for thinking about the domain, with an emphasis on their flexibility rather than rigidity of structuration and use.” or by referring to Wittgenstein “ meaning is partially determined by rough patterns of family resemblance and then filled out by interactions of those patterns with details of their specific contexts of use (Wittgenstein, 1953). It is for the learner to construct understandings that grasp these patterns of family resemblance and context-dependency; CFHs assist in this learner-based constructive activity.”

This approach is "middle road" between rigid rigid prestructuration and rigid prescription of routines for knowledge use, and discovery learning in a totally unstructured environment at the other extreme. In addition, as in most modern instructional designs, teacher/systems control is meant to fade out as the learner progresses.

A very general statement that DSchneider likes in the Spiro et al. (1996) paper is that “ instruction must be as complicated as is necessary to achieve the established goals of learning, given the constraints imposed by the features of the knowledge domain that is the subject of learning.”. In support of this statement the authors cite previous research showing that initial simplifications of complex subject areas can impede the later acquisition of more complex understandings (Feltovich, Spiro, & Coulson, 1989; Spiro et al., 1989).

Links

General links

- Web-Based Learning Framework on Mapping Instructional Strategies to Web Features [1] by Nada Dabbagh.
- Cognitive Flexibility Theory: Implications for Teaching and Teacher Education [2] by Stephanie R. Boger-Mehall

Examples

(more are needed)

- Graddy, Duane B. Cognitive Flexibility Theory as a Pedagogy for Web-Based Course Design, Teaching Online in Higher Education Online Conference 2001, HTML [3]

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Cognitive flexibility theory

Draft

Definition

- “ Spiro, et al. (1992) offer a constructivist theory of learning and instruction that emphasizes the need to treat complex, ill-structured knowledge domains differently from simple, well-structured domains. Examples of ill-structured domains such as history, medicine, law, literary interpretation, and teacher education are prime targets for flexible instruction, in part because learners must apply what they have learned to novel and unique situations.” (quoted from Boger-Mehall)
- “ Cognitive flexibility theory suggests that learners grasp the nature of complexity more readily by being presented with multiple representations of the same information in different contexts. By seeing multiple representations of the same phenomenon learners develop the mental scaffolding necessary for considering novel applications within the knowledge domain. [....] Cognitive flexibility hypertext fosters the development of knowledge-transfer skills by confronting the learner with multiple representations of case-events. Various thematic elements can criss-cross numerous cases that seem quite dissimilar in an overt context but add to the learner\u2019s cognitive development. ” (Graddy [3] retrieved 19:20, 16 June 2006 (MEST))

Cognitive Flexibility theory and education

According to Godshalk et al (2004: 510), Cognitive Flexibility Theory “ maintains that instruction in complex, ill-structured domains must allow the learner to "crisscross" the domain knowledge by comparing and contrasting information gained from different perspectives and themes pertinent to the domain. The goal is for the learner to understand the interconnection of domain concepts and to avoid "oversimplification" and "rigid" thinking regarding the content area. In other words, learners must be flexible in their understanding of a topic to apply important concepts.”

According to Spiro (1992): Any effective approach to instruction must simultaneously consider several highly intertwined topics, such as:

- the constructive nature of understanding;
- the complex and ill-structured features of many, if not most, knowledge domains;
- patterns of learning failure;

- a theory of learning that addresses known patterns of learning failure.

Cognitive Flexibility Theory and Educational Technology

- One answer is Hypertext, because "The remedy for learning deficiencies related to domain complexity and irregularity requires the inculcation of learning processes that afford greater cognitive flexibility: this includes the ability to represent knowledge from different conceptual and case perspectives and then, when the knowledge must later be used, the ability to construct from those different conceptual and case representations a knowledge ensemble tailored to the needs of the understanding or problem-solving situation at hand." (Spiro 1992)
- Further down Spiro (1992) argue that "The computer is ideally suited, by virtue of the flexibility it can provide, for fostering cognitive flexibility. In particular, multidimensional and nonlinear hypertext systems, if appropriately designed to take into account all of the considerations discussed above, have the power to convey ill-structured aspects of knowledge domains and to promote features of cognitive flexibility in ways that traditional learning environments (textbooks, lectures, computer-based drill) could not (although such traditional media can be very successful in other contexts or for other purposes). We refer to the principled use of flexible features inherent in computers to produce nonlinear learning environments as Random Access Instruction (Spiro & Jehng, 1990)."
- “ In summary: Ill-structured aspects of knowledge pose problems for advanced knowledge acquisition that are remedied by the principles of Cognitive Flexibility Theory. This cognitive theory of learning is systematically applied to an instructional theory, Random Access Instruction, which in turn guides the design of nonlinear computer learning environments we refer to as Cognitive flexibility hypertexts.” (Spiro, 1992)

Therefore: see Cognitive flexibility hypertexts but also case-based learning.

Links

- http://tip.psychology.org/spiro.html

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Cognitive load

Draft

Definition

Cognitive load theory (CLT) is both theory of cognition and learning and a instructional design model. It's main contributor is J. Sweller.

- “ Cognitive load theory describes how the architecture of cognition has specific implications for the design of instruction. The theory has broad applications in the design of instructional materials, providing a general framework and conceptual toolkit for instructional designers to minimize and control the conditions that create unwanted cognitive load in learning materials. ” (Wikipedia [1])
- “ CLT is concerned with the design of instructional methods that efficiently use people's limited cognitive processing capacity to apply acquired knowledge and skills to new situations (i.e., transfer). CLT is based on a cognitive architecture that consists of a limited working memory with partly independent processing units for visual and auditory information, which interacts with an unlimited long-term memory.” Pass et al. 2003: Abstract.
- “ Cognitive load theory can inform the design of web-based instruction. The basic premise of cognitive load theory is that the focus of an instructional module must be the instruction itself. Information that is adjunct to the instruction must be designed to minimize cognitive load and enhance working memory. Because the mental resources of working memory can be overloaded, any information that ignores cognitive load may interfere with the process of acquiring knowledge and skills. Instruction that effectively presents the learning to our working memory has an impact on our ability to store knowledge and skills in our long-term memory. Everything that we "know" is held in our long-term memory ” (Feinberg & Murphy 2000:Abstract).

Graham Cooper, one of Swellers co-workers, present CLT as follows:

In recent years there has been an increased focus on the role of education and training, and on the effectiveness and efficiency of various instructional design strategies. Some of the most important breakthroughs in this regard have come from the discipline of Cognitive Science, which deals with the mental processes of learning, memory and problem solving. [Editor Note: Cognitive Psychology. Cognitive Science is usually defined a "the interdisciplinary study of mind and intelligence, embracing philosophy, psychology, artificial intelligence, neuroscience, linguistics, and anthropology" Stanford Encyclopedia of Philosophy [2]]

Cognitive load theory (e.g. Sweller, 1988; 1994) is an instructional theory generated by this field of research. It describes learning structures in terms of an information processing system involving long term memory, which effectively stores all of our knowledge and skills on a more-or-less permanent basis and working memory, which performs the intellectual tasks associated with consciousness. Information may only be stored in long term memory after first being attended to, and processed by, working memory. Working memory, however, is extremely limited in both capacity and duration. These limitations will, under some conditions, impede learning

The fundamental tenet of cognitive load theory is that the quality of instructional design will be raised if greater consideration is given to the role and limitations, of working memory.

(Cooper, 1998; Source [3])

John Sweller's work is based on an information processing model of cognition, and in particular the limitations of working memory. In addition,“ key learning activities are schema acquisition and automation of their usage. After enough training, acquired schemata are stored in long-term memory. They allow high cognitive performance with a very limited working memory” (Heeb 2001: 3). Now when learning concerns multiple interacting elements of information, they have to be learned at the same time and that is a challenge for educators !

Sweller differentiates between intrinsic, germane, and extraneous cognitive load.

- **Intrinsic load** is related to the difficulty of concepts, i.e. integral complexity of an idea or set of concepts (learning contents). For example, in programming, learning to program "Hello" with PhP is much easier than doing it with Java.
- **Extraneous load** (irrelevant) is due to the design of the instructional materials. In inefficient instructional designs it adds unnecessary load. For example, an audio-visual presentation format usually has lower extraneous load than a visual plus text format, because in the former case, working memory has less information to process.
- **Germane load** (relevant) relates to the degree of effort involved in the processing, construction and automation of schemas. Germane load is sometimes associated with motivation and interest. Intrinsic load is unchangeable, whereas the instructional designer can manipulate extraneous and germane load.

Sweller's principles and guidelines for instructional designers

Cognitive load theory suggests preventing students from using a means-ends strategy and encouraging them to attend to problem states and their associated moves should reduce extraneous cognitive load and so facilitate schema acquisition. In general, instructional techniques should attempt to reduce extraneous cognitive load associated with constructing a representation because this facilitates learning.

According to Rebetez (2006:12-13) Sweller, based on his cognitive load theory, describes a series of effects and guidelines to create learning materials:

1. **Goal free effect**: novice learners with a specific learning goal (like a precise question to answer) focus on the goal and pay no attention to other information. This is detrimental to learning.
2. **Worked examples effect**: using known and resolved examples diminish cognitive load and improves comprehension.
3. **Problem completion effect**: the worked out example should be followed by a similar but unresolved problem to maximize motivation.
4. **Modality effect**: two messages on similar elements should be provided through different sensory modalities. Research suggest that more memory capacity is available when dual modalities were used, however it may lead to a split-attention effect and excessive animated multimedia may lead to a general overload.
5. **Split-attention effect**: occurs when learners have to process and integrate multiple and separated sources of information. For instance, a geometrical sketch is better understood when textual information is spatially integrated rather than separated . This effect is very similar to Mayer spatial and temporal contiguity principles (see multimedia presentation
6. **Redundancy effect**: when the same information is presented more than once the multiple processing is negative for comprehension since it increases external cognitive load. If novices can benefit from partially redundant information (integrated text and picture for example), expert's performances can be impaired . These six first effects try to minimize extraneous cognitive load (to reduce the number of cognitive processes involved that are unnecessary for learning).
7. **Element interactivity effect**: interactivity with the material increases negative effects such as split-attention and redundancy effects.
8. **Isolated interacting elements effect**: with complex models containing multiple interacting elements it is advisable to begin with presenting every element separately.
9. **Imagination effect**: mentally simulating the functioning and interaction of elements allow experts to obtain better results.
10. **Expertise reversal effect**: with experts, several effects are inversed. In this case, classical design rules are advisable instead of those based on cognitive load.
11. **Guidance fading effect**: as expertise is obtained, learners should be less guided in their exercises.

Limitations of the Cognitive Load Theory

- Many of these ideas are mostly inspired by theories of cognitive processes published in the 70s or 80s. Miller's finding of a limit to the amount of information that can be maintained in short-term memory in 1956 (Short Term Memory @ Wikipedia [4]), Baddeley and Hitch early model of working memory in 1974 (Baddeley's model of working memory @ wikipedia [5]) and Paivio's ideas of a dual-coding storage hypothesis in the early 1970s (Dual-coding theory @ wikipedia [6]), models of attention by Deutsc, & Deutsch (1963) or Kahneman (1974) (Attention @ wikipedia [7]).
- More modern views or more recent findings on working memory and attention are not always taken into account in the most recent versions of the Cognitive Load Theory.
- The recommendations are given in the form of guideline and strong empirical evidence is not always provided.
- This theory has constraints about how memory works at his chore. But the defenders of this theory sometime make very naive or ill-informed statements about what has been learned about memory in the field of Cognitive Psychology. For instance, Dr Cooper states that "Working memory is the part of our mind that provides our consciousness" well, this is a quite original proposal.

Other Strategies to diminish cognitive load

Cognitive tools

- Computer-supported authoring tool could scaffold and facilitate cognitive processes by alleviating the cognitive load.

Collaborative learning

- In collaboration the persons can share cognitive load by dividing it up into smaller portions. Each of them will be mainly treated by one of the persons.

Metacognitive tools

- Appropriate selection of processing strategies can diminish cognitive load.

On the other hand, the difficulty with metacognitive processes is that they enter into competition with lower cognitive process for resources (especially working memory). Metacognition involves an increased cognitive load. Supporting cognitive and metacognitive processes with tools may benefit the metacognitive layer (which often comes after other attention mechanisms).

These strategies go somewhat beyound the debate on cognitive load in the sense that some instructional design models do not try to minimize intrinsic and germane cognitive load. E.g. some project-oriented learning designs even require that learners are exposed to authentic cognitive load situations and that they learn how to handle this by acquiring appropriate learning strategies. This being said, a designer always should take into account cognitive load and make sure that it is not unnecessarily high.

Tools

- The NASA-TLX measures task load (Hart & Staveland, 1988)

Links

- Cognitive Load Theory (J. Sweller) [8]
- Improving Traditional Instruction [9]. (This is a short, very good introduction).
- Research into Cognitive Load Theory and Instructional at UNSW [10] by G. Cooper (Good Introduction)

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Collaborative Face to Face Educational Environment

Draft

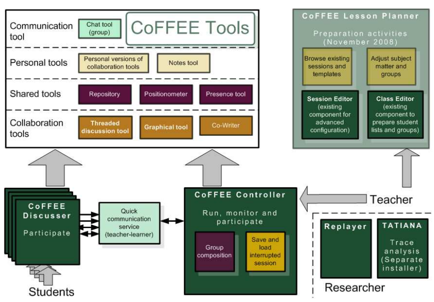
“CoFFEE is a suite of applications to support collaborative problem-solving discussions in the **classroom**. Its main components are a series of tools for collaboration, shared work, individual work and communication. Around these core tools, several other components make it possible to plan, run or participate in a CoFFEE lesson (or session).” (Coffee-soft.org [1], retrieved 11:22, 12 January 2009 (UTC).)

CoFFEE is the main technology produced in the EU LEAD [2] project. The software itself is {{citation|complemented by pedagogical scenarii - customisable lesson plans that are written by the projects researchers. These scenarii offer a good starting point for teachers who want to start using CoFFEE. They include both files that teachers can plug into CoFFEE to run a lesson plan, as well as a written step-by-step lesson plan instructing the teacher on all the relevant aspects of running a CoFFEE supported classroom activity. ([3], retrieved 11:22, 12 January 2009 (UTC))

See also: the french version (better for now).

Architecture of the CoFFEE system

CoFFEE lessons are called Sessions. A session can be a short part of a whole lesson or span several lessons over a period of several weeks. Such a session is composed of a number of distinct Steps, each with different tools or tool combinations. During the lesson, the teacher can navigate from step to step. A Step may contain a single CoFFEE tool, or a combination of up to 5 different tools.



Coffee system diagram, reproduced from coffee-soft.org [1] without special permission

Learner Tools

From the "Coffee discusser" tool the learner can access the various learning tools:

- Threaded discussion tool with several extra features, e.g. manage several topics at the same time
- Graphical discussion tool (with grid and time organisation)
- Co-Writer tool
- Positionometer
- Presence and learner groups tool
- Repository
- Chat tool
- Quick messaging tool
- Private note tool. Each other tool also can be configured for private use only.

Additional tools are available as plugins, e.g.

- Streaming tool
- IE Explorer tool
- Document browser tool

Teacher Controller tool

The **Controller tool** (Session Player):

- can manage steps and monitor what students do (except private tools)
- organise sessions and group formation

Lesson planner/editor/designer tools

Notice: Depending on the publication and version, these tools maybe arranged differently

- The **Lesson Planner** can import templates for reuse without changing its structure, e.g. the teacher can adjuste subject matter and groups..
- The **Session Editor** allows for advanced configuration of components and to create templates
- The **Class editor**: Define students and passwords, can also assign students to groups

The replayer tool

The Replayer (available as "Tatiana") can replay all the details of a sessions. It's both an evaluation and a research tool.

Modelling and Formats

Scenarios

A pedagogical scenario in CoFFEE is defined as a **session** that includes set of **steps** (phases). Each step is defined by an activity - either a classroom activity or a (several) groups activity - usually involving several interactions and supporting tools. Therefore a scenario is **sequence of activities** that engage learners in tasks using tools.

In "groups" mode, it is possible to assign different tasks and tools to various groups. Products are only available to group members until the activity ends. After that, the artifacts of all groups are revealed to everybody.

A session can be part of a lesson or extend over a longer period. The activities sequence is assembled, beforehand, as a Session defined as a sequence of steps, through the **Session Editor/Designer** component.

Sessions can be extended during runtime and latecomer users also can be managed.

Templates

A template is a combination of tools and steps that are designed to support an activity type (e.g brainstorming, planning or problem solving) within a particular setting (small groups, whole-class, a particular age-group). Technically, a template consists of a session file, a description file (in rtf format) and a template information file (xml), which can all be created in the Lesson Planner's Session Editor.

Tailorability

CoFFEE allows a teacher to (1) use an existing Session, (2) modify an existing Session, (3) create a Session from an existing template, (4) or finally create a Session from scratch. See tailorability

Software

- CoFFEE is freely available under an Eclipse licence [4].
- Coffee-soft.org [5] (downloads for Win/Mac/Unix)
- It has been implemented as Eclipse extension.

Links

- Lead2Learning [6] Research web site
- Coffee-soft.org [5] Product web site (downloads and support)
  - Resources [7]

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Community of inquiry model

Draft

Definition

The **community of inquiry model** is an instructional design model for e-learning developed by Randy Garrison, Terry Anderson et al (University of Calgary). Its purpose is to provide a framework for the use of CMC in supporting an educational experience.

See also: social presence, community of practice, knowledge-building community model, community of learning, virtual community, social software

The model

“ "A critical community of learners, from an educational perspective, is composed of teachers and students transacting with the specific purposes of facilitating, constructing, and validating understanding, and of developing capabilities that will lead to further learning. Such a community encourages cognitive independence and social interdependence simultaneously."” (Garrison & Anderson, 2003:23)

The community of inquiry model defines a good e-learning environment through three major components. On the communities of inquiry web site [1] (retrieved 15:45, 6 July 2006 (MEST)) these are defined as follows:

1. **Cognitive presence** is the extent to which the participants in any particular configuration of a community of inquiry are able to construct meaning through sustained communication. (COI/Cognitive Presence [2])
2. **Social presence** is the ability of learners to project their personal characteristics into the community of inquiry, thereby presenting themselves as 'real people.' (COI/Social presence [3])
3. **Teaching presence** is defined as the design, facilitation, and direction of cognitive and social processes for the purpose of realizing personally meaningful and educational worthwhile learning outcomes. (COI/Teaching presence) [4])

The relationship and function of these components is explained in this picture

The community of Inquiry model. Copyright 2007 R. Garrison, T. Anderson, W. Archer and L. Rourke et al., University of Calgary, reprinted with permission by Terry Anderson

Note the pivotal role of social presence in not only setting the educational climate but also in supporting discourse and creating the educational experience. We defined social presence as "the ability of learners to project themselves socially and affectively into a community of inquiry" (Rourke, Anderson, Archer, & Garrison, 1999). We spent some time developing tools to measure social presence in asynchronous text conferencing systems and validating these tools via interviews and surveys (Rourke & Anderson, 2002). This work has been extended and quantified by a number of researchers (Tu, 2002; Stacey, 2002) demonstrating amongst other findings that social presence is correlated with student satisfaction and higher scores on learning outcomes (Richardson & Swan, 2003). - Anderson, (2005:2) [5], retrieved october 25 2007.

Stephen Downes made a suggestion to extend "presence" by "network". “ The COI exists within the larger context of the educational semantic web. I also envisioned the larger Net with all of its social, teaching and cognitive stimulation and support as being outside - but directly linking in to the three presences. Visualized as the whole the model immersed in the flow of the Net. Stephen's additions make that more clear and explicitly site the encompassing effect of the Net on learning and living these days.” (Virtual Canuck [6], retrieved 15:45, 6 July 2006 (MEST).)

Software

- Portalware that is read/write
  - Not Learning management systems, but for example C3MS, Wikis, Mashups like syndicated Personal learning environments or platforms like ELGG.

Links

- Communities of inquiry [1] This site documents the work completed during a Canadian Social Sciences and Humanities research funded project entitled "A Study of the Characteristics and Qualities of Text-Based Computer Conferencing for Educational Purposes.

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Component display theory

Draft

Definition

Component display theory (CDT) addresses the issue of learner control and the separation of instructional strategy from instructional content.

“ Component Display Theory was an attempt to identify the components from which instructional strategies could be constructed. CDT describes instructional strategy in terms of strategy components: primary presentation forms (PPFs), secondary presentation forms (SPFs), and interdisplay relationships (IDRs). CDT identifies strategy prescriptions for different kinds of learning outcomes. Each of these prescriptions identified a best case combination of PPFs, SPFs, and IDRs for a particular kind of learning outcome. CDT was analysis oriented, emphasizing the components of instructional strategies for different kinds of instructional goals.” (Merril)

History

This instructional design model was developped through the Time-shared Interactive Computer Controlled Information Telelvision (TICCIT) project in the seventies.

CDT had strong influence on other instructional theories, such as Reigeluth's elaboration theory and Merril's later Instructional transaction theory (ITT)

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Computer simulation

Draft

Definition

“Computer simulation is defined as having the following two key features: There is a computer model of a real or theoretical system that contains information on how the system behaves. Experimentation can take place, i.e. changing the input to the model affects the output. As a numerical model of a system, presented for a learner to manipulate and explore, simulations can provide a rich learning experience for the student. They can be a powerful resource for teaching: providing access to environments which may otherwise be too dangerous, or impractical due to size or time constraints; and facilitating visualisation of dynamic or complex behaviour.” (Thomas and Milligan, 2004 [1])

See also simulation (list of other types)

Simulation in education

Simulations can be considered a variant of cognitive tools, i.e. they allow students to test hypothesis and more generally "what-if" scenarios. In addition, they can enable learners to ground cognitive understanding of their action in a situation. (Thomas and Milligan, 2004; Laurillard, 1993). In that respect simulations are compatible with a constructivist view of education.

Most authors seem to agree that use of simulations needs to be pedagogically scaffolded. “Research shows that the educational benefits of simulations are not automatically gained and that care must be taken in many aspects of simulation design and presentation. It is not sufficient to provide learners with simulations and expect them to engage with the subject matter and build their own understanding by exploring, devising and testing hypotheses.” (Thomas and Milligan, 2004: 2). The principal caveat of simulations is that students rather engage with the interface than with the underlying model (Davis, 2002). This is also called video gaming effect.

Various methods can be used, e.g.:

- the simulation itself can provide feedback and guidance in the form of hints
- Human experts (teachers, coaches, guides), peers or electronic help can provide assistance using the system.
- Simulation activities can be strongly scaffolded, e.g. by providing built-in mechanisms for hypothesis formulation (e.g. as in guided discovery learning simulation)
- Simulation activities can be coached by humans

The inquiry learning perspective

“Inquiry learning is defined as "an approach to learning that involves a process of exploring the natural or material world, and that leads to asking questions, making discoveries, and rigorously testing those discoveries in the search for new understanding" (National Science Foundation, 2000). This means that students adopt a scientific approach and make their own discoveries; they generate knowledge by activating and restructuring knowledge schemata (Mayer, 2004)). Inquiry learning environments also ask students to take initiative in the learning process and can be offered in a naturally collaborative setting with realistic material.” (De Jong, 2006).

According to the What do we know about computer simulations [2], common characteristics of educational computer simulations are:

- **Model Based**: Simulations are based on a model. This means that the calculations and rules operating the simulation are programmed. These calculations and rules are collectively called "the model", and it determines the behavior of the simulation depending on user actions.

- **Interactive**: Learners work interactively with a simulation's model to input information and then observe how the variables in the simulation change, based on this output.
- **Interface driven**: The value changes to the influenced variables and the observed value changes in the output are found in the simulation's interface.
- **Scaffolded**: Simulations designed for education should have supports or scaffolds to assist students in making the learning experience effective. Step by step directions, or small assignments which break the task down to help students, while they work with a simulation, are examples.

Software

- SimQuest (Note there is also a commercial SimQuest [3] system for BioMedical Simulation)
- JeLSIM [4] - Java eLearning SIMulations.Jelsim Builder is a tool for the rapid production of interactive simulations (Jelsims).
- NetLogo and AgentSheets are programmable micorworlds allowing all sorts of agent/cells simulations
- some multi-purpose cognitive/classroom tools like Freestyler may have embedded simulations tools.

Links

(needs additions !)

Introductions and Overviews

- Computer simulation [5] (Wikipedia)

Indexes

- ???

Associations

- The Society For Modeling and Simulation International [6]
  - Simulation Resources [7]
- EUROSIM, the Federation of European Simulation Societies [8]
- The ACM Special Interest Group on Simulation [9]
- Simulation Interoperability Standards Organization [10]
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Constructivist emotionally-oriented model

Draft

Definition

- The **Constructivist emotionally-oriented** model (CEO) is a "model of web-based learning which emphasizes safety, challenge, and new thinking, and offers several strategies to enhance the emotional experience of learners."
- The CEO instructional design model of web-based education emphasizes safety, challenge and new thinking and includes several strategies to enhance the emotional experience of learners.
- Emotions have been neglected in education and online education, in favor of a heavy emphasis on cognition and rationality. (MacFadden, 2005: Abstract).

See also: Astleitner's FEASP model and the emotion article.

The Model

The table below, summarizing the CEO model is **copyright by Robert MacFadden, Marilyn A. Herie, Sarah Maiter and Gary Dumbrill (2003) and reproduced here with permission by Robert MacFadden**. (Retrieved 19:27, 1 June 2006 (MEST) from Past & Present Workshops [1]).

Stage	Purpose	Activity	Potential Feelings of Learners
Safety	To create a safe learning environment that facilitates risk taking and examining ones ways of thinking	Construct rules to foster free communication and ensure safety. Monitoring of communication to ensure compliance and safety	Safety, support & acceptance
Challenge	To provide the opportunity for participants to critically examine their knowledge and world views	Introduce exercises and processes that allow participants to step outside their existing ways of thinking	Disequilibrium, confusion, anxiety, frustration in a context of safety support & acceptance
New thinking	To create opportunities for engaging with new knowledge and gaining new ways of viewing the world	Introduce alternative knowledge and ways of viewing the world	"Ah ha!" moments leading to a new equilibrium, satisfaction, exhilaration

Links

- Thinking and Feeling: Building a Constructivist, Emotionally-Oriented Model for Online Education [2]
- Robert MAcFadden's Home page [3]

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Cybergogy

Cybergogy is an instructional design model created by Wang et al.

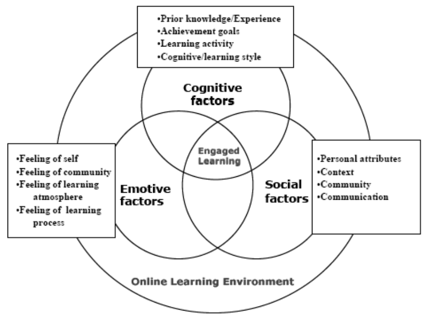
Minjuan Wang revised this entry thoroughly on Nov. 30, 2009

Summary

The application of educational technology has created a new teaching and learning concept – Cybergogy. One of the central elements of cybergogy is the intent to combine fundamentals of both pedagogy and andragogy to arrive at a new approach to learning (Carrier & Moulds, 2003). Cybergogy focuses on helping adults and young people to learn by facilitating and technologically enabling learner-centered autonomous and collaborative learning in a virtual environment. At the core of cybergogy is awareness that strategies used for face-to-face learning may not be the same used in the virtual environment.

Facilitators need to be mindful of Cybergogy. As many studies reveal, learner’s active engagement in the learning process affects their learning outcomes. In any learning environment, truly engaged learners are behaviorally, intellectually, and emotionally involved in their learning tasks (Wang & Kang, 2006; Wang, 2007). Cybergogy for Engaged Learning Model is created by Dr. Minjuan Wang (Educational Technology, San Diego State University), and Dr. Myunghee Kang(Educational Technology, Ewha Womans University, South Korea). This model is a synthesis of current thinking, concepts, and theoretical frameworks on the extent and nature of the domains in learner online engagement. The Cybergogy model is published as a book chapter (Wang & Kang, 2006), a peer-reviewed journal article (Wang, 2008), and also recognized as an innovative model for instructional design (Wang, 2008).

The Cybergogy for Engaged Learning model, as Wang and Kang (2006) present, has three overlapping/intersecting domains: cognitive, emotive, and social (see the figure). The authors argue that engaged learning will occur when the critical factors in each domain are well attended, so as to encourage learners’ cognitive, emotive, and social presence. This model is created particularly for online settings that involve more generative and constructive learning activities. For the online learning experience to be successful, students must be furnished with prior knowledge, motivated to learn, and positively engaged in the learning process. In addition, Wang and Kang suggest, students must also be comfortable with the learning environment and feel a strong sense of community and social commitment. The Cybergogy for Engaged Learning model could be used to conduct needs assessment and to lay out course design and facilitation techniques. Instructors could use this model to profile each student's cognitive, emotive and social attributes and then effectively engage learners by addressing individual's learning needs and attributes (Wang & Kang, 2006). The authors identify methods that instructors can use to detect learners' emotional cues and cultivate their positive feelings; to increase learners' self-confidence and arouse their curiosity through course design and e-facilitation; to conduct online communication and build a supportive learning environment. Therefore, the term "Cybergogy" becomes a descriptive label for the strategies for creating engaged learning online.



Cybergogy for engaged learning (Wang et al.)

The Cybergogy model values affective learning as highly as cognitive learning, and sees the two as interwoven. The authors (2006) argue that current educational systems must value the learner over the curriculum, and must tolerate learning outcomes that may be less predictable but highly worthwhile.

The Cybergogy for Engaged Learning model also provides a framework for generating meaningful and engaging learning experiences for distance students with diverse cultural and linguistic backgrounds. Engagement is positively correlated with motivation, which may be prompted in different ways for culturally different students. There are four motivational conditions that the instructor and the learners collaboratively create. First, cultivating learners' competence about being effective in learning valuable things; second, creating a respectful and connected learning atmosphere; third, helping learners develop favorable attitudes toward the learning experience through personal relevance and choice; and fourth, creating challenging and thoughtful learning experiences that are consistent with learners' perspectives and values.

Cybergogy Model for Engaged Learning reflects the systemic approach to online learning. The key features of this systemic view include: a) putting the right people, elements and resources in place to succeed; b) evaluating results through learning outcomes; and c) providing feedback and taking action to maintain alignment with established educational and societal goals. Factors in the cognitive, emotive, and social domains are identified as critical elements in a learning environment when used as input in the system described. These input elements together transform the learning system into cognitive, emotive, and social presence, and they finally generate engaged learning as a whole. As a consequence, learners will not only have the opportunity to accomplish their learning goals, but also will be actively involved in the learning process.

Since its creation, this model has been validated and tested in a handful of systematic studies (e.g., Kang et al., 2009; Wang, Shen, & Novak, 2008; Shen, Wang, & Pan, 2008; Wang, Novak, & Pacino, 2009; Shen et al., 2009; Scopes, 2009; Cronin, McMahon & Waldron, 2009).

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DialogPlus Toolkit

Draft

Definition

The DialogPLUS Toolkit was a tool made for guiding and supporting teachers as they create, modify, and share learning activities and resources. DialogPLUS is an online browser-based application (as of 2010 it is still open) and was sponsored by the British JISC/NSF funded DialogPlus project. See also the Learning activity reference model, a larger related JISC project from this period.

DialogPLUS has been superceded by other projects, in particular the Open University Learning Design Initiative [1]. One of the products under active development is the CompendiumLD learning design software and the Cloudworks [2], “a place to share, find and discuss learning and teaching ideas and experiences.”

See also: Conole and Fill learning taxonomy (a visualization of ingredients)

Purpose

This tool is partly inspired by IMS Learning Design and somewhat related toolkits like LAMS and MOT.

According to Conole and Fill (2005: 1), “ despite the plethora of Information and Communication Technologies (ICT) tools and resources available, practitioners are still not making effective use of e-learning to enrich the student experience”. The DialogPLUS learning design toolkit should guide practitioners through the process of creating pedagogically informed learning activities which make effective use of appropriate tools and resources.

The learning design toolkit described can be used for three main purposes:

1. As step-by-step guidance to help practitioners make theoretically informed decisions about the development of learning activities and choice of appropriate tools and resources to undertake them.
2. As a database of existing learning activities and examples of good practice which can then be adapted and reused for different purposes.
3. As a mechanism for abstracting good practice and metamodels for e-learning

Conole and Fill (2005: 7-8)

The tool

We firstly will describe a few concepts used in the modelling framework and then shortly describe the system.

Concepts

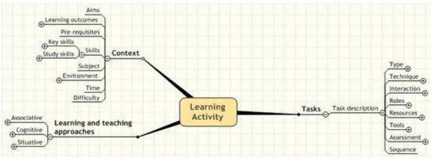
At the heart of this instructional design method are **nuggets**, i.e. learning activities or pedagogical scenarios. Nuggets embody both learning activities and resources. Nuggets are activity-based learning objects. “ Nuggets range in size (from a single file, to a mini-website), formats (word documents, powerpoint slides, html, flash etc), media (text, images, animations) and educational styles (learning material, assessments, activities, resources).” ([3]), retrieved 11:37, 23 November 2006 (MET)).

The software uses a **nugget taxonomy** as a language to to specify the nugget and its components. Below we reproduce some concept maps produced by the authors that illustrate a few selections a teacher/designer has to make when he designs a "nugget". These concept maps probably do not reflect the current state of the system, but they give an idea of the kind of design decisions that are being modeled. Also, please note that we don't show all expanded "nodes" of the model.

The learning activity

The notion of a learning activity (LA) is at the heart of the "nugget" and the tool and it is composed of three elements:

- The **context** of the activity: e.g. subject, level of difficulty, intended learning outcomes and the environment within which the activity takes place.
- The **learning and teaching approaches**: including theories and models.
- The **learning tasks**: This includes type of task, techniques used, associated tools and resources, interaction and roles of those involved and learner assessment.



Learning Activity - Top Level, copyright Conole and Fill (2005), reproduced with permission by K.Fill and G.Conole

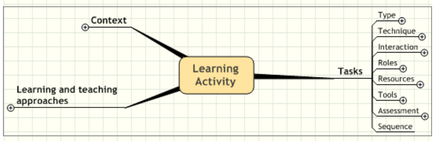
Learning and teaching approaches

The tool supports a variety of instructional design models. DSchneider thinks that it definitely fits a modern activity-based instructional design perspective, e.g. as an alternative to more traditional lesson planners and more in the spirit of more powerful tools like MOT+, but being much easier to learn.

With the tool, the teacher can explicitly state a given pedagogical approach, but the design itself is then defined through tasks.

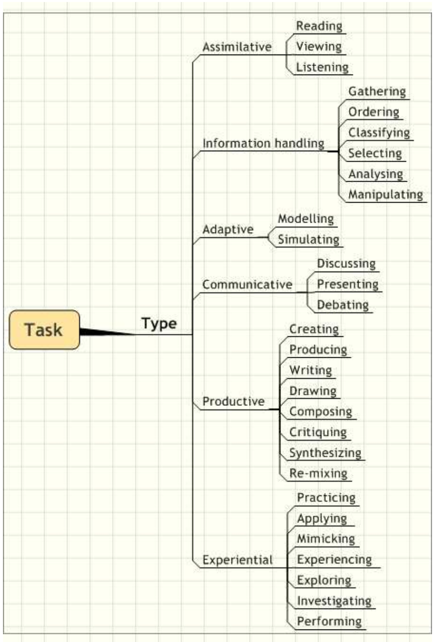
Tasks

A task is firstly defined by a description, a length, a type, a technique and interaction. A task then assigns roles and includes resources, tools and assessment.



Tasks in DialogPLUS, copyright Fill et al. (2004) [4], reproduced with permission by K.Fill and G.Conole

Task types



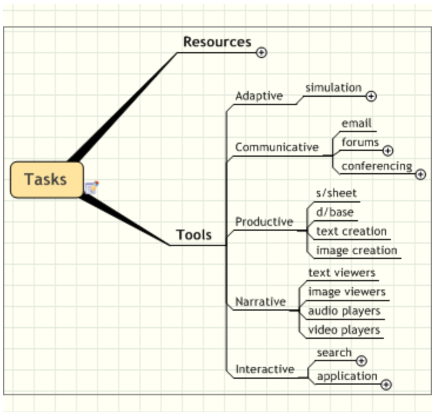
Task types in DialogPLUS, copyright Fill et al. (2004) [4], reproduced with permission by K.Fill and G.Conole

Task techniques

Task techniques include brainstorming, exercise, field work, role play, reflection and syndicates. The authors " identified almost thirty techniques to be stored in the toolkit such that advice can be offered to practitioners. Interactions required are likely to be individual, one to many, student to student, student to tutor, group or class base".

Task resources

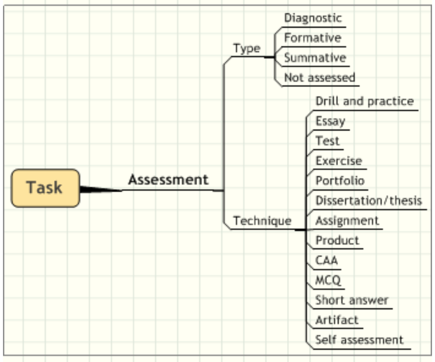
Available resources and tools are based on the Laurillard conversational framework five principal media forms (Narrative, Communicative, Adaptive, Productive, and Interactive) (Laurillard, 2002, p.90).



Tasks in DialogPLUS, copyright Fill et al. (2004) [4], reproduced with permission by K.Fill and G.Conole

Assessment types

Not surprisingly, there is a large palette of assessment types and techniques.



Tasks in DialogPLUS, copyright Fill et al. (2004) [4], reproduced with permission by K.Fill and G.Conole

The learning taxonomy in one table

One major outcome of this project and **that will stay** is just the taxonomy itself. It can be used for various purposes, e.g. in teacher training or as a tool that allows a designer/teacher to think about pedagogical approaches, tasks, tools, resources, support and outcomes in a learning design perspective.

The table below was presented by Conole (2010:Appendix) in a *draft for discussion version* of a State of the Art report on training teachers, blended learning and elearning [5]

Context	Learning outcome, subject, discipline, level, learner characteristics, pre-requisites, time to complete					
Pedagogy		**Tasks and supporting assets and outputs**				
Approaches	**Techniques**	**Tasks**	**Tools**	**Resources**	**Support**	**Outputs**

Action research	Buzz words	Analyse	List	Bibliographic software	Annotated bibliography	Buddying	Artefact
Active learning	Crosswords	Apply	Listen	Blogs	Content in blogs	Coach	Assignment
Case study	Drill and practice	Argue	Manipulate	CAA tools	Content in wikis	Diagnostic test	Book report
Collaborative	Exercise	Brainstorm	Model	CD/DVD	Course information	Explanation	Concept map
Conceptual	Experiment	Calculate	Negotiate	Chat	Course reading materials	Facilitation	Dissertation
Constructivist	Fishbowl	Classify	Observe	Concordancer	Discussion forum content	Formative Feedback	Essay
Dialogic	Game	Compare	Order	Database	FAQs	Induction	Paper
Enquiry-led	Ice breaker	Create	Organise	Digital audio	Interactive CD ROM	Instructions	Performance
Experiment	Journaling	Criticise	Practice	Digital video	MCQ	Intervention	Portfolio
Field trip	Pair dialogues	Critique	Predict	Discussion board	Previous cohort resources	Monitoring	Presentation
Goal-based scenario	Panel discussion	Debate	Prepare	Electronic library	Schedule/course calendar	Orientation session	Product
Problem-based	Peer exchange	Decide	Present	Email	Peer-generated resource	Peer collaboration	Report
Procedural	Puzzles	Define	Produce	Graphic package	Peer-recommended sites	Peer reflection	Review
Project-based	Question/answer	Demonstrate	Question	Instant messaging	Subject-based web sites	Scaffolding	
Reflective practitioner	Rounds	Describe	React	iPOD/MP3 player	Template	Set up	
Resource-based	Scavenger hunt	Design	Read	Image software	Research journal articles	Surgery	
Role play	Snowball	Differentiate	Recite	Memory stick	Grey literature		
Vicarious learning	Structured debate	Discover	Refine	Mind map			
	Tutorial	Discuss	Reflect	Modelling NVIVO			
	Web search	Draw	Report	Online assessment			
		Evaluate	Research	Podcast			
		Experience	Resolve	Project manager			
		Explain	Review	Search engine			
		Explore	Search	Simulation software			
		Gather	Select	Spreadsheet			
		Generalise	Simulate	Statistical software			
		Hypothesize	Solve	Text image audio or video viewer			
		Identify	Specify	Video conferencing			
		Illustrate	State	VLE/LMS			
		Infer	Summarise	Virtual worlds			
		Interpret	Synthesise	Voice over IP			
		Interview	Test	Voting system			
		Investigate	Translate	Wikis			
		Judge	View	Word processor			
		Justify	Vote				
			Write				

The tool

The tool is available as on-line Web application [6]. External users may create an account (checked on 20:24, 22 November 2006 (MET)).

(*needs some description here* - DSchneider)

DialogPlus can export to IMS Learning Design

DialogPlus is also integrated with ConceptVISTA [7], a ontology creation and visualization tool that stores ontologies in the Web Ontology Language (OWL)

Current status

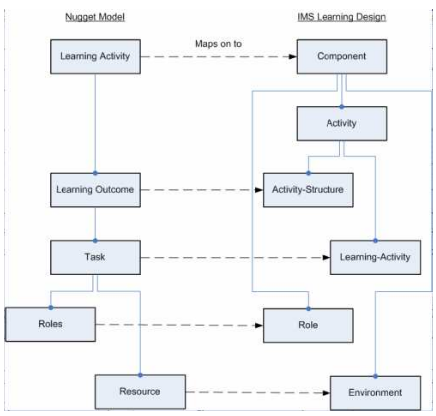
As of Nov 2006, the DialogPlus toolkit is being further evaluated, together with LAMS, as tools for teacher development as learning activity designers in the JISC funded EDIT4L [8] project, part of the Design for Learning programme.

As of April 2010, the project is mostly dead, although the web site is still up and running. Replacement can be found through the Open University Learning Design Initiative [9] (OULDI). E.g. you may have a look at CompendiumLD (if your read french, see also our Tutoriel CompendiumLD. The OULDI approach is much less "molecular", i.e. focuses on community building and exchange of ideas and patterns through the Cloudworks [2] website (a kind of multi-user blog). "Clouds" are entries (posts of various natures + comments" and "Cloudscapes" are categories. In principle, people should contribute CompendiumLD designs there. Since a first stable version only came out on May 2010, there are only very few so far.

DialogPlus vs. IMS Learning Design

Bailey et al. (2006). Panning for Gold [10] explains that there are many structurals similarities between DialogPlus and IMS Learning Design and this is why DialogPlus can export to IMS LD.

Here is a figure (reproduced without permission for the moment) from this paper that summarizes the situation:



Bailey et al. comparison between DialogPlus and IMS LD

Discussion

Comments by DSchneider / 2006

General

- Given the complex scenario descriptions the tool can handle, it's fairly easy to understand how to use it (globally speaking). Overally speaking, I have a good impression and this tool certainly could be used in teacher education.

The nugget definition

- Nugget aims can not be re-edited
- The generic nugget module window provides a useful overview, but it doesn't make sense to use a separate column to display various nugget categories. Even with my 3500 px two 20 + *24* screens...

Task definitions

- The task can't be described. Not sure that it is enough to describe with various taxonomy elements.
- It is not practical to have to enter the same resource or tool several times. One ought to be able to link various tasks to one single resource or tool. E.g. a same wiki can be use to look up definitions, to find further readings, to compose a project page, to add/modify definitions, to discuss. A similar remark concerns function. One tool can have more than one function. Of course media have affordances, but a tool is instrument because of way it is being used.
- Resources and tools can not be edited.

IMS LD export

- Export to IMS LD works, but the result can't be loaded into the Reload LD Player (there is a missing identifier attribute in the manifest, learnobjectid is defined twice, ...). I will try to fix the manifest by hand later.

ConceptVISTA

- I didn't understand really how the 2 are integrated (but didn't really try so far)

Comments by DSchneider / 2010

I finally never used this website for myself and also think that it's not suitable for normal teachers, since they don't like to plan in top down fashion. However, I still feel that DialogPlus would be a really valuable tool for teacher education. Also, in that respect, the Interface could be made "web 2.0" kind of easy-to-use, but this would need some funding. As I also said above, the learning taxonomy itself is a great output of this project and will stay around.

According to Conole (2010), State of the Art report on training teachers, blended learning and elearning [5] (draft for discussion version), “the linear nature of the design of the toolkit does not align with real teacher-design practice, which is messy, iterative and intuitive.”. In a message posted to cloudworks [11], Graínne Conole explains that “Visualusation has become central to my thinking both in terms of how adapted mindmapping tools like the CompendiumLD tool we have created can be used, but also conceptual 'views' to help thinking about design from differnt perspectives”.

Update 2014

As of March 2014, most links seem to be dead, including the DialogPlus web site. A fairly typical situation in Educational Technology:

- Funding allow to create a prototype
- After funding, researchers try to maintain or even improve
- After some years, there are other priorities, the site often will be hacked and/or spammed and then killed ....

Links

DialogPLUS On-line Application

- DialogPlus Nugget Developer Guidance Toolkit [6] (dead link)
- The DialogPLUS Toolkit (DPT) User Guide [12] (dead link)

Project websites and related

- DialogPlus Home Page [13] (dead link) (http://www.dialogplus.org/dead link)
- EDIT4L [8], Evaluation of Design and Implementation Tools for Learning (dead link)
- JISC Design for learning [14]. A larger British project (2006 - 2088) for projects in developing, implementing and evaluating tools and systems that support design for learning.
- ConceptVISTA [15]

Other

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Direct instruction

Draft

Definition

Direct instruction (DI) is a popular instructional design model for classroom teaching initially developped in the 60's by Siegfried Engelmann. It grew out of the work of Siegfried Englemann and Carl Bereiter with disadvantaged children (Bereiter & Engelmann, 1966)

This method is somewhat related to mastery learning, but it is more explicit regarding curriculum design and effective planned instructional delivery (lesson planning). Some call this method "teacher proof" under the condition that he really is willing to learn a teaching script developped by professional instructional designers. Direct instruction is available as commercial instructional programs that includes materials and teacher training / in-classroom coaching.

Features

We identified the following salient features of direct instruction:

- Scripted Lesson Plans. Such lesson plans relieve the teacher from time-consuming preparation tasks. These are explicitly tested examples and sequences made by professional instructional designers.
- Signal-based teachers. Teachers send frequently signals to learners to which they should respond.
- Skill focused: Skills are taught in sequence until students have them automated.
- Appropriate pacing: teacher-directed instruction followed by small collective or individual learning/repeating activities. Pacing of different teaching methods is rather fast, but children must have space to respond.
- Frequent probing/testing and assessments with a appropriate corrective feedback / differential praise.
- Direct instruction is not just drill & practise. Learners can engage in more complex tasks during certain activities.

Kenny (1980) lists the following features:

1. goals are clear to the students
2. time allocated for instruction is sufficient and continuous
3. content covered is extensive
4. students' performance is monitored
5. questions are at a low cognitive level produce many correct #sponses
6. feedback to students is immediate and academically orientated
7. the teacher controls the instructional goals
8. the teacher chooses material appropriate for the student's #vel
9. the teacher paces the teaching
10. interaction is structured but not authoritarian

Instructional design models

There are many descriptions of *direct instruction*:

According to Huitt (1996), direct instruction can be summarized as follows.

1. More teacher-directed instruction (> 50%) and less seatwork (< 50%).
2. Active presentation of information (could be by teacher, computer, another student).
    1. Gain students' attention
    2. Providing motivational clues
    3. Use advance organizers
    4. Expose essential content
    5. Pretesting/prompting of relevant knowledge
3. Clear organization of presentation. This includes:
    1. component relationships
    2. sequential relationships
    3. relevance relationships
    4. transitional relationships
4. Step-by-step progression from subtopic to subtopic (based on task analysis).
5. Use many examples, visual prompts, and demonstrations (to mediate between concrete and abstract concepts).
6. Constant assessment of student understanding (before, during and after the lesson).
7. Alter pace of instruction based on assessment of student understanding (you're teaching students, not content).
8. Effective use of time and maintaining students' attention (appropriate use of classroom management techniques).

Koslov et al. (1999) identify the following typical phases of a lesson (see also Gagne's nine events of instruction.

1. Attention and Focus: Short wake-up
2. Orientation or Preparation: Teacher presents goal of the lesson demonstrates how the lesson builds on prior work.
3. Model: Teacher demonstrates concepts, propositions, strategies and/or operations. This can include repetitions, variations with different examples in order to help generalization. Teacher also can ask short questions and accept focused questions from learners.
4. Lead: Teacher organized some guided practice. Firstly all together (*choral responding*) and then more individually. If necessary, he goes back to model.
5. Test: Students have to practise individually (written).
6. Feedback: Students are corrected (using positive rewards)
7. Error correction: Persistent errors are identified and if necessary teacher has to start over with model/lead/test.
8. Additional material: Learners are engaged with different materials where the same strategies have to be applied to a common feature (more generalization)

- Problem solving and strategy discrimination skills are introduced in future lessons (once students master a certain vocabulary of basic strategies).

More generally, there is probably a wide consensus in the instructional design community that the structure of programme sequences should lead to shifts from overt to covert problem solving, from simple contexts to complex contexts that include irrelevant stimuli, from immediate to delayed feedback, from teacher-oriented presentation to the learner as chief form of information, etc. (Kenny, 1980).

More recent models like 4C/ID, Elaboration theory or Instructional transaction theory aim at integrating part-task and whole task practise.

Direct instruction today seems to be most popular in special education where this model actually came from in the beginning.

Variants

- A lot of lesson planning models, e.g. the Madeline Hunter method
- General instructional design models like Nine events of instruction
- Instructional systems design methods usually favor some kind of direct instruction approach.

Links

Direct instructions sites

- Zig Engelmann and Direct Instruction [1] (**includes many papers** and other materials)

Commercial programs

- Association for Direct Instruction [2]
- National Institute for Direct Instruction [3]
- Direct Instruction Resources [4]

Summaries

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- Teaching Methods - Direct instruction [6]
- Wikipedia direct instruction [7] (good overview)
- Some Basic Lesson Presentation Elements [8] (presents the Madeline Hunter Method).
- What Direct Instruction Is and Is Not [9]
- An Overview of Direct Instruction [10]

Other

- Project Follow Through [11]

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Discovery learning

Draft

Definition

Discovery learning refers to various instructional design models that engages students in learning through discovery. Usually the pedagogical aims are threefold: (1) Promote "deep" learning, (2) Promote meta-cognitive skills (develop problem-solving skills, creativity, etc.), (3) Promote student engagement.

According to van Joolingen (1999:385): “ Discovery learning is a type of learning where learners construct their own knowledge by experimenting with a domain, and inferring rules from the results of these experiments. The basic idea of this kind of learning is that because learners can design their own experiments in the domain and infer the rules of the domain themselves they are actually constructing their knowledge. Because of these constructive activities, it is assumed they will understand the domain at a higher level than when the necessary information is just presented by a teacher or an expository learning environment.”

According to Borthick & Jones (2000:181): “ In discovery learning, participants learn to recognize a problem, characterize what a solution would look like, search for relevant information, develop a solution strategy, and execute the chosen strategy. In collaborative discovery learning, participants, immersed in a community of practice, solve problems together.”

According to Judith Conway's Educational Technology's Effect on Models of Instruction [1]: “ Jerome Bruner was influential in defining Discovery Learning. It uses Cognitive psychology as a base. Discovery learning is "an approach to instruction through which students interact with their environment-by exploring and manipulating objects, wrestling with questions and controversies, or performing experiments" (Ormrod, 1995, p. 442) The idea is that students are more likely to remember concepts they discover on their own. Teachers have found that discovery learning is most successful when students have prerequisite knowledge and undergo some structured experiences.” (Roblyer, Edwards, and Havriluk, 1997, p 68).

Discovery Learning provides students with opportunities to develop hypotheses to answer questions and can contribute to the development of a lifelong love of learning. Students propose issues or problems, gather data and observations to develop hypotheses, confirm or refine their hypotheses, and explain or prove their problems. Apple Teaching Methods, Discovery Learning [2]

Discovery learning is based on this "Aha!" method. [3]

Theory and models of discovery learning

Discovery learning can be traced back to authors like Rousseau, Pestalozzi and Dewey. In particular Dewey's emphasis on "experience" is in vogue again.

Modern discovery learning approaches relate to constructivist theory and therefore Bruner is considered a father of discovery learning by many authors. E.g. in the Encyclopedia of Educational technology [4] one can find the following quote from Bruner “"Emphasis on discovery in learning has precisely the effect on the learner of leading him to be a constructionist, to organize what he is encountering in a manner not only designed to discover regularity and relatedness, but also to avoid the kind of information drift that fails to keep account of the uses to which information might have to be put." ”(Bruner, 1962).

Another strong influence for some kinds of discovery learning (see microworlds is Seymour Papert's constructionism. Donald Clark in his discovery learning [3] page puts the following statement: “ "You can't teach people everything they need to know. The best you can do is position them where they can find what they need to know when they need to know it." - Seymour Papert”

Discovery learning is also strongly tied to problem solving (or learning how to solve problems under a more meta-cognitive perspective): “"Learning theorists characterize learning to solve problems as discovery learning, in which participants learn to recognize a problem, characterize what a solution would look like, search for relevant information, develop a solution strategy, and execute the chosen strategy."” (Borthick & Jones, 2000:181)

Some authors point out that discovery learning may increase content relevance and student engagement (actually an argument that can be made for all sorts of project-oriented learning.

Discovery learning, like most constructivist instructional design models is not easy to implement, since learners need to possess a number of cognitive skills and be intrinsically motivated to learn.

van Joolingen (1999:386) makes the following point:

In research on scientific discovery learning, it has been found that in order for discovery of learning to be successful, learners need to posses a number of discovery skills (De Jong & Van Joolingen, in press), including hypothesis generation, experiment design, prediction, and data analysis. In addition, regulative skills like planning and monitoring are needed for successful discovery learning (Njoo & De Jong, 1993). Apart from being supportive for learning about the domain at hand, these skills are usually also seen as a learning goal in itself, as they are needed in a complex information society. Lack of these skills can result in ineffective discovery behavior, like designing inconclusive experiments, confirmation bias and drawing incorrect conclusions from data. In its turn, ineffective discovery behavior does not contribute to creating new knowledge in the mind of the learner.

Therefore one must try to support discovery learning processes, however with the risk of disrupting the very nature process that should engage the learner in autonomous knowledge construction.

Of course, there *is* a lot of disruption of this "pure model". A lot of research has pointed to out that "unguided instruction" can fail to meet precise instructional goals. Therefore, in practice, most current forms of discovery learning are guided in various ways.

Models of discovery learning

we should add a sort of common blueprint here maybe

- Collaborative discovery learning
- Discovery learning with microworlds
- Experiental learning (to some extent)
- Guided discovery learning
- Incidental learning
- Learning by exploring (exploratory learning)
- Simulation-based learning
- Case-based learning
- Problem-based learning
- inquiry-based learning

Technology

- Cognitive tools
- Simulations
- Hypertext
- Microworlds
- A simple combination of webpages (read/write) and forums or alternatively a Wiki

Advantages and disavantages of discovery learning

Advantages

The discovery learning literature often claims the following advantages:

- Supports active engagement of the learner in the learning process
- Fosters curiosity
- Enables the development of life long learning skills
- Personalizes the learning experience
- Highly motivating as it allows individuals the opportunity to experiment and discover something for themselves
- Builds on learner's prior knowledge and understanding
- Develops a sense of independence and autonomy
- Make them responsible for their own mistakes and results
- Learning as most adults learn on the job and in real life situations
- A reason to record their procedure and discoveries - such as not repeating mistakes, a way to analyze what happened, and a way to record a victorious discovery
- Develops problem solving and creative skills
- Finds new and interesting avenues of information and learning - such as gravy made with too much cornstarch can become a molding medium

These sorts of arguments can be regrouped in two broad categories

- Development of meta cognitive skills (including some higher level cognitive strategies) useful in lifelong learning.
- Motivation

Disadvantages

Most researchers would argue that pure discovery learning as a general and global teaching strategy for beginning and intermediary learners doesn't work. The debate on how much guiding is needed is somewhat open. See Kirschner et al. (2006) for a good overview (or Mayer, 2004; Feldon) and also Merrill's first principles of instruction model that does promote unguided problem-based learning at the *final stages* of an instructional design.

Typical criticisms are:

- (Sometimes huge) cognitive overload, potential to confuse the learner if no initial framework is available, etc.
- Measurable performance (compared to hard-core instructional designs) is worse for most learning situations.
- Creations of misconceptions ("knowing less after instruction")
- Weak students have a tendency to "fly under the radar" (Aleven et al. 2003) and teacher's fail to detect situations needing strong remediation or scaffolding.
- Some studies admit that strong students can benefit from weak treatments and others conclude that there is no difference, but more importantly they also conclude that weak students benefit strongly from strong treatments.

DSchneider thinks that despite very strong arguments (Kirschner et al., 2006) in disfavor of even guided discovery learning models like problem-based learning, the debate is still open. Most really serious studies concerned high-school science teaching. Now, science is very hard and indeed puts a very heavy load on short-term memory. In addition, in order to solve even moderatly complex problems a person must engage many schemas. If nothing is available in long term memory, the learner is stuck.

As an example, DSchneider (from his own experience) doesn't believe that object-oriented programming could be taught by a discovery approach. Making web pages on the other hand could. Students can incrementally work on their own projet and integrate independent concepts like HTML, CSS, Ergonomics, Style, Color etc. on their own pace. A project-oriented approach to web page making probably also would be less effective than a strategy like direct instruction. On the positive side, students engaged in discovery with some scaffolding and monitoring provided by the teacher will learn to find resources, to *read* technical texts found on the Internet, to adapt a solution to their skill level (learn something about the economics), to decompose a problem, etc. I.e. they learn some skill that are probably transferrable to similar autonmous learning situation (e.g. learning SVG on their own).

Planning a Discovery Learning Experience

(paste by Stek, from http://members.aol.com/kitecd2/artcl_disclearn.htm#PLANNING)

- **select an activity**. To begin pick an activity that is relatively short so that follow-up attempts are easier to predict and plan for. Select a subject with which you are personally familiar and comfortable. Also in the beginning it is often best to choose an activity that does not have just one correct answer. Role-playing, creating sculptures, observing characteristics of objects, or searching for or classifying similar items all work well.
- **gather materials**. Remember to have enough materials for each learner to repeat the activity at least once.
- **stay focused**. Avoid learning tangents that may be interesting but will keep the learner from finishing the project, unless they are truly of great curiosity and value. Instead take notes concerning the new interest to follow-up on once the initial activity is completed.
- **use caution**. While the idea of discovery learning is for the instructor to step back and observe allowing the child to work independently, be sure that safety is observed. Activities such as cooking and cutting should always be supervised by an adult and experimenting with magnets is nice unless an important video or cassette tape is ruined.
- **plan extra time**. Understand that children working on their own will most likely take longer than they would with an adult moving them from step to step. Also be sure to plan time for repeated activities in case there is a failure or other reason to repeat the activity.

- **record process and results**. Include in the activity a requirement for older children to record their procedure and results. For young children guide, assist, or model record keeping.
- **discuss and review**. After and activity is completed and before it is repeated a second time (if needed), discuss the activity and its outcome with the child. Use the records which were kept to assist during this step. Once the activity has been analyzed, record any observations or mistakes.
- **try again**. Have the child repeat the activity if necessary. Encourage her to take into account what was done and the discussion that occurred. Allow her to use any records that were kept to assist her in successfully completing the activity. Give assistance and guidance as necessary.
- **plan for more discovery learning activities**. Think over how this activity worked for the child. As you plan more discovery activities take the answers to these questions into consideration. What went well? What could have gone better? How can any problem areas be corrected or alleviated?

Examples

- See http://copland.udel.edu/~jconway/EDST666.htm#dislrn (to be inserted in simulations.)

Links

- http://copland.udel.edu/~jconway/EDST666.htm#dislrn
- Apple Teaching Methods, Discovery Learning [2]
- http://www.nwlink.com/~donclark/hrd/history/discovery.html
- Alternative modes to delivery, Discovery Learning [5]

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Dukes simulation and gaming model for sociology teaching

Definition

The *'Dukes simulation and gaming model for sociology teaching* is an instructional design model in the field of simulation and gaming.

DSchneider believes that it refers to non-computerized role-playing games.

It has been published as such on the old Simluation and gaming Journal [1] web site in 1997. Since Prof. Duke is now retired and difficult to contact and this web site may disappear any day we took the liberty to reproduce the entire model here with some minor changes.

The model: Suggestions For Running Simulations/Games In The Classroom

(A synthesis of ideas from Garry Shirts, Richard D. Duke, Cathy S. Greenblat)

Preparation

1. Read the director's manual.
2. Do a trial run (use friends, relatives, etc.).
3. In minimum terms, being prepared means:
   - Know what physical arrangements are needed;
   - Know the sequence of events;
   - Know what to say to get things started;
   - Know the artifacts and how and when to use them;
   - Know how you want to debrief the activity (especially questions you want to ask).

Directions

Do not give too many directions at the start:

1. Explain the main objective of the exercise.
2. Explain enough of the game to get them started.
3. Answer more complicated questions as they arise.
4. Walk through the first round if it cannot be explained simply.
5. Use handouts or wall charts if the rules and sequences are lengthy.

Assistants

1. Use assistants for routine operations
2. Discourage nonparticipant observers. Use those who do not want to play as assistants.
3. Assistants can pass out routine items, so your time is free to monitor the game, answer questions, and keep things moving.

Assigning participants to groups/roles:

1. Your strategy should appear to be random rather than selective.
2. Assignment of two or more persons to one role will increase interaction, and it will cushion against the effects of players leaving early or nonperformance.

Simulation speed and stop

1. Keep the simulation moving
   - It is better to go too fast than too slow.
   - All decisions called for in the game should be somewhat rushed.
2. The game should be stopped at the peak of interest. Do not let it start to drag.

The game rules are like natural laws

1. They should not be broken by the participants.
2. Do not allow cheating.
3. However, "person laws" (or those which emerge between participants) can be violated if the parties feel so inclined.

The debriefing

Should proceed from simple descriptive questions about what happened (giving participants a chance to vent their feelings) to questions dealing with explanation, analysis, and finally to generalizations about the referent system that the game mirrors.

1. What happened?
2. Why does it happen in most plays of the game?
3. How does what happened compare with real world?
4. What would happen if . . .?

Links

Simulation and Gaming and the Teaching of Sociology [1] 6th edition, 1997. Compiled by Richard L. Dukes Colorado University, Colorado Springs.

E-moderation five-stage model

Draft

(needs some tuning)

Definition

- Gilly Salmon's 5-stage model of e-moderating describes to design an course that strongly uses computer-mediated communication, in particular forums
- A description of a five-stage model of teaching and learning online (Gilly, 2002:X).

The five stages - Overview

1. Access & Motivation. Exploring the technology and motivation building are key issues. The e-moderator helps meeting people and learn the environment.
2. Socialisation. Building on the first stage, this stage focuses on social processes and 'community building'. Moderator does bridge building.
3. Information Exchange. Information is exchanged and co-operative tasks can be achieved. Interaction happens with contents, other participants and the e-moderator that assists exploration activities.
4. Knowledge Construction. Knowledge development and discussion activities become important. Participants start recognizing the value of text-based asynchronous interaction and take control of knowledge construction.
5. Development. Participants become responsible for their own learning and that of their group. Ideas are applied to individual contexts. This stage is characterised by reflection and assessment.

The 5-stage model is also at the core of Salmon's e-tivity frameworks for enhancing active and participative online learning by individuals and groups.

Comments

Salmon's books are easy reading and are suitable for beginners:

- She provides a lot of examples.
- She works with simple technology (e.g. forums and email).
- There are practical "how-to" sections (recipees).

Globally speaking, her own books do a very good job for her stages 1-3. They also are a must read for practitionners of content-oriented e-learning. I don't think that her approach goes far enough to support deeper project-oriented teaching. What I miss most are scenarios to build tangible knowledge or projects that are reified on-line .. a price to pay for using only simple communication tools (no Wikis, no C3MS, etc.)

11:03, 11 April 2006 (MEST)--DSchneider

Links

- E-tivities book companion site [1]
- E-moderation book companion site [2]

References

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  - See also the review at elearning.surf.nl [4]

E-tivity

Definition

The term E-tivity was coined by G. Salmon [1] of Open University (England). It means "task online"; it is a framework to learn something in a dynamic and interactive way. This activity is based on intense interaction and reflective dialogue between a number of participants, such as learners / students and teachers, who work in a computer-mediated environment. E-tivities are text-based and led by an e-moderator (usually a teacher).

See also: E-moderation five-stage model (also by G. Salmon) and more general entries like activity, pedagogical scenario, learning activity and pedagogic strategy.

Structure

All e-tivities "are designed to engage online students in meaningful work that captures their imagination and challenges them to grow" (Salmon, 2002). All the participants cooperate in order to get used to computers and, in particular, the Internet. They follow a basic structure:

Spark: a small piece of information, a sort of "input".

Task: the moderator asks participants to do an activity online. In doing the activity, participants have to complete a task and try to solve a problem by themselves.

Timeline: the moderator, who orchestrates the whole process, gives participants a deadline to do the activity. This timeline is useful to organize work and make sure that all participants will complete it by the same time. The timeline should give participants a little time to complete the "respond" part before the assignment of the following e-tivity.

Respond: participants are invited to read other participants' e-tivities and comment on them whenever they have something interesting to add or disagree with some observation; constructive criticism is a key aspect of online activities. This last part plays an important part in the overall process for it fosters collaboration between participants. It is quite helpful for everyone as it gives each of the participants the possibility to improve their work method quality.

Examples of e-tivities

There are some examples of e-tivities below, each related to one stage in Gilly Salmon's five-step process. (see also Learning technologies [2])

E-tivity 1 (related to Stage 1- Access & Motivation)

Purpose - to be able to access the VLE Asynchronous Discussion tool

Task - to post an initial message introducing yourself to others

Interaction - the e-tutor checks that students can access and provide feedback for motivation.

E-tivity 2 (related to Stage 2 - Online Socialisation)

Purpose - to introduce yourself to others in your group

Task - to post a message introducing a topic of the student's choice via the Conference Room tool

Interaction - contributions from others in the group within a 'threaded' discussion. Participation and summary by e-tutor.

E-tivity 3 (related to Stage 4 - Knowledge Construction)

Purpose - to analyse your preferred methods of learning and to consider alternative processes or models

Task - to post thoughts on a particular piece of reading on learning methods

Interaction - others members of the group provide their own interpretations and thoughts. E-tutor moderate and summarise.

E-tivities in the context of foreign language teaching

In my opinion (Maria Chiara) the use of e-tivities is an innovative teaching method which has three important consequences:

- it renders English classes more dynamic and, therefore, more stimulating;
- it gives students the possibility to get used to the computer, in particular to social softwares;
- it fosters team work and collaboration between students and between students and their teachers. What really counts is not only the single work of one student, but above all the way he/she interacts with the other members of the group. The final "output" is like a jigsaw puzzle [3] made up of the "material and human contributions" given by the group as a whole.

By clicking on the following links you can look at a few examples of e-tivities

- Bloggingenglish [4]
- e-master [5]
- assessment components [6]

References

- Salmon, Gilly (2002), "E-tivities. The Key to Active Online Learning", London: Tayler & Francis. ISBN 0749436867
  - See also the review at elearning.surf.nl [4]
  - Have a look at http://www.umuc.edu/distance/odell/cvu/brownbag/salmon/ppt/sld011.htm
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  - See also the review at elearning-reviews.org [3].

E2ML

Draft

Definition

E2ML is an educational modeling language for describing instructional design issues such as learning goals, roles, actions, and resources.

An E2ML blueprint consists of three sets of documents. Each of them provides support for specific design tasks. The three sets are:

1. Goal Definition, i.e., a declaration of the educational goals. This is composed by two documents: the goal statement and the goal mapping.
2. Action Diagrams, i.e., the description of the single learning and support activities designed for the instruction.
3. Overview Diagrams, i.e., two different overviews of the whole design, the dependencies diagram and the activity flow.

(Botturi, 2006)

Goal definitions and mappings

The goal (learning outcome) statement table is an orderly summary of the goals of the instruction. It includes several columns:

- Tag: an identifier
- Statement: A short verbal definition of the learning outcome
- Target: Who is concerned (e.g. all students)
- Stakeholder: Who is interested (e.g. the head of a company)
- Approach: Pedagogical strategy
- Importance: A numeric score.

These goals then can visualized “by mapping them on a visual grid or representation, such as Merrill’s Content-Performance Matrix (1983), the revised Bloom’s taxonomy (Anderson & Krathwohl, 2001), or the QUAIL model (Botturi, 2003 a; Botturi, 2004 a).” (Botturi, 2006).

Dependencies diagram

According to Botturi (2006), learning activities are represented by *boxes* and then should be related with *arrwos*: The relationships supported by E2ML are:

1. **Learning prerequisite**: the first action provides a learning outcome that is the prerequisite for the second action (e.g., a lecture provides concepts for the following analysis work);
2. **Product**: an activity produces some artefact that is required as input for a second one (e.g., a group-work activity produces a presentation which is shown during the following class discussion). Products can be name as arrow label (e.g., *mind-map");
3. **Aggregation**: an activity can be a sub-activity of another activity. Finally actions can be grouped into *trails* or or *logical groups of actions*, e.g., all lectures, or all the actions that form a specific activity in a course, etc.

The dependencies described here are *not* learning sequences, but they allow to identify cross-unit connections and dependencies.

Activity flow

"The activity flow is a visualization of the instruction calendar and provides an overview of educational activities during the course time span. It is similar to a flowchart diagram that represents each learner's path through the instruction. Actions are sequenced or ordered into more parallel branches. Each action can take place at a defined moment in time (e.g., on a particular date/time) or be allocated for free execution within a defined timeframe. Splits (branches) can be added to the action flow as advanced elements, indicating conditions, options, multiple selections, parallel activities or non-sequenced actions (or any-order actions, i.e., branches in the activity path where a number of activities should be completed in any order)" (Botturi, 2006).

Action diagrams

Action (activity) diagrams "provide a synthetic yet detailed description of the very bricks of the instruction: teaching and learning activities.". These are the most complex construct in Botturi's design language.

Links

- Luca Botturi's publications on Scientifc Commons [1]

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Educational design language

Draft

Definition

An educational design language is a notation system for creating educational designs, e.g. courses, modules, or scenarios.

An educational design language is “ a tool that designers use to communicate designs, plans, and intentions to each other and to the users of their artifacts” (Botturi, 2006: 268). “Notational systems, used in mature fields of study, are closely related to design languages. The future of a technological field depends on the ability to communicate ideas and changes with others in the field. Instructional technology is one field that can benefit from a notation system enabling designers to duplicate, execute, and communicate their ideas” (Waters & Gibbons 2004: 57).

See also: educational modeling language, design pattern and pedagogical vocabulary. These entries partly look at the same issue under a different perspective.

History

Daniel K. Schneider doesn't know much about the history of educational design languages. I have the impression that their emergence is tied to computer-based training (Bork, 1984) and in particular drill and practice programs where flow-charts were used to define educational sequences.

Implicit design languages also were defined by authoring environments and that culminated in systems like (the now dead) Authorware that supported a visual design/programming environment. There exists also a link to instructional design methods, in particular Instructional systems design methods like ADDIE where at some point designers create scripts and/or flowcharts.

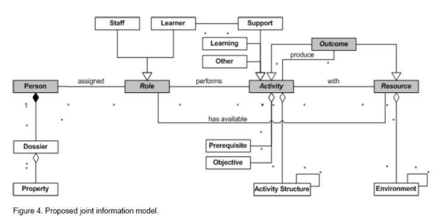
An earlier *formal design language*, i.e. educational modeling language was defined by Eckel (1998). : “The immediate aim of Instruction Language is a clear-cut written representation of preconceived instruction. Clear-cut implies that the *instructional script* written on the basis of Instruction Language, from now on referred to as *instructogram*, is uniequivocal as well as fully readable, criticizable and improvable. This is possible since *instruction is very simple in its core* [...] Instruction Language is based on the understanding of instruction as a mere *alternative sequence of teaching and learning activities*” (Eckel, 1993:XV).

His book defines a written notation, but also used flow diagrams. E.g. he defines the flow of Minimum Instruction with the following kind of diagram:

The rest of his model concerns management of different kinds of answers, i.e. R:right, W:wrong, P:Partially right, I:Inadmissible, V:Vague, U:Unexpected, N:Neutral. Flow of instruction must deal with all kinds of possible answers.

IMS Simple Sequencing (IMS SS) can be considered as being in that tradition, but we are not aware if there exist attempts to use a visual design language to define simple sequencing modules. Despite that fact that IMS SS is part of SCORM 2004 profile, we didn't find any authoring tools...

More recent trends (since the early 2000's) are much more oriented towards a model based on a "play" (theatre) metaphor. IMS Learning Design (IMS LD) is today's most popular formal language in research and it is based on Koper's Educational Modelling Language (EML) informally published in the early 1990s. Several visual design languages create within research projects compile into IMS LD. Other design languages either do not rely on a formal language or adopt another formal representation. A joint information model of EML-like approaches was proposed in a workshop document [1] (Koper, 2002)



Proposed joint information model for educational modeling languages, (Koper, 2002).

This UML diagram basically states that educational modeling means defining activities where persons playing a role produce outcomes using resources. Some of these resources are environments (tools). The activity can be divided into objectives, prerequisites, sub-activities (the activity structure). Support, learning, other and outcome are kinds of activities.

Such diagrams are are specifications, but not design languages that are usable by end users. They represents the formal foundations on which design languages could be built. Also at this level of specification, it remains open if/how design languages "à la Eckel" or very specialized formalisms such a quizzing languages like IMS QTI could be integrated within an activity defined in a "EML"-like framework.

Most current educational design languages adopt some kind of "activity flow" approach. Designs for educational sequences then can be defined with several notations, for example:

- Some kind of visual flow chart (e.g. a UML activity diagram or similar), e.g. the formal coUML design language.
- Logical descriptions with a specialized concept mapping language, e.g. the formal MOTPlus editor for IMS LD or the informal CompendiumLD editor.
- Forms-based editors where sub-activities are described as lists (e.g. the ReCourse editor for IMS LD
- Sequences of tools use, i.e. activities are described by configuring how the tool should be used at some point), e.g. LAMS or CoFFEE.

In practice, design languages are rarely used. Several factors could explain this: Tools are difficult to use and at the same time there is a lack of training opportunities, in particular in teacher schools. Most tools are badly maintained and difficult to find. Tools that can exectute designs barely exist or again, they hardly work. Finally, industrial designs are simple (both in industry and academia) and more complex designs are put in place informally by individual teachers.

Types of design languages

Botturi, Derntl,Boot & Figl (2006) propose a classification system to describe educational design languages. See also Developing design documents (3D) model.

- **Stratification**: *flat* or *layered*. Is there unique representation or are there several "tools" to describe various objects like in coUML ?
- **Formalization**: between *formal* or *informal*. E.g. UML and XML-based vocabularies are both formal languages.
- **Elaboration**: *conceptual*, *specification* or *implementation*. These levels are based on the UML model (Fowler, 2003): the conceptual level allows to gain a global view of a design and its rationale, the specification includes all the details, and the implementation level includes includes sufficient precision to create executive code. E.g. CompendiumLD is a concept map editor, coUML can be considered a set of specification languages, the LAMS editor produces directly executable code.
- **Perspective**: *singular* or *multiple*. Is there a same view or different views to describe a design? E2ML for instance allows to model both structural and temporal relations between activities.
- **Notation system**: *none*, *textual*, *visual*. If there is a notation system, it can be either visual (e.g. like in the informal CompendiumLD editor or a formal UML-derived language) or textual like the typical XML-based

educational modeling languages like IMS Learning Design.

A list of systems for educational design

This list lists systems for educational design through more or less "natural" categories. We don't include just design languages or design tools, but all kinds of systems that in one way or another support pedagogical design.

IMS Learning Design and basic editors

IMS Learning Design is a formal language (UML and XML) that is standardized. Designers are not really expected to directly use this language, it's rather expected that they use a high-level editor that then can export to IMS LD. In the same way the e-learning content editors don't need to understand SCORM 1.2.

- IMS Learning Design (IMS LD, the formal language)
- Reload Editor A low-level and difficult to IMS LD editor.
- ASK Learning Designer Toolkit (ASK-LDT) (developed and maintained by Research Unit on Advanced Learning Technologies and Services for Education and Learning (ASK) [2]
- ReCourse editor, a live project in Feb 2009. Mostly a forms-based LD editor with some visual components. Easier to use than Reload.
- GRAIL [3] (Gradient RTE for Adaptive LD in .LRN) is a LD player package for the .LRN LMS. (del Cid et al., 2007).

Design tools that can export to IMS-LD or another executable formalism

There exist several variants. This category includes both visual design tools and form-based editors. Some of them can export to IMS LD. Some are general purpose and some like Collage are specialized. Some tools are operational, some just research systems.

- DialogPlus Toolkit a forms-based scenario definition editor that can export to IMS-LD
- MOTPlus formal concept map editor (used within the MISA instructional design method.)
- Collaborative learning flow patterns and the Collage editor)
- EduWeaver Course, lesson, model design tool that can produce SCORM 1.2 compliant code.

Visual design/modelling languages

Some designers use one or several UML languages like UML activity diagrams. Other extend the UML framework and others use their own notational system. Most of these systems are only used by a very small population. Except for the UML tools which are popular in computer science, these languages are all very recent. Usually, they don't produce executable code.

- BPMN (Business process modeling notation) and BPEL (Business Process Execution Language, used in Model-Driven Learning Design)
- UML (in particular UML class diagrams and UML activity diagrams)
- E2ML Visual scenario design language
- coUML Visual scenario and content design language
- PALO Visual scenario design language
- poEML Visual collaborative scenario design language
- MoCoLaDe Visual scenario design language, LD compatible
- SCY-SE Visual scenario design language

Visual design languages

Same as above, but easier to use, since not formal. Doesn't produce executable code.

- CompendiumLD. A concept map editor for learning design. Compendium LD maps also could be given to learners.
- **Table éditor** (does it have a name?). See Sobreira and Tchounikine (2014).

Formalisms and tools different from IMS LD

Attempts to enlarge or to modify the IMS-LD framework. These projects include their own meta-model (i.e. their representation of what a pedagogical scenario is) plus a toolkit for design and execution. Most are still very much under development.

- fr:Learning design language (LDL)
- fr:Modèle conceptuel ISIS

Design and execution systems in production

This category includes operational online authoring and execution systems that support learning design. LAMS has a visual design editor, CeLS a forms-based interface.

- LAMS (see also LAMS) (système d'édition/exécution learning design)
- CeLS

CSCL research

The Computer-supported collaborative learning (CSCL) community also started to work modelling what they called scripts and to develop notational systems, e.g. see Kobbe et al. (2007) or Dillenbourg & Tchounikine (2007).

- See CSCL script) for the concept
- CPM (a UML profile and system somewhere in between CSCL and learning design) - dead project ?
- Collage A macro-script configuration tool (based on the idea of flow patterns) - was distributed at some point
- Cool Modes A system that includes several visual design tools for learners (and teachers). There exist also other microworld systems that include visual design languages. - live project, tools are available
- S-COL (Wecker, 2010) - probably never distributed ?
- XSS framework (Streng, 2011) - probably was never distributed
- T^2 (Sobreira & Tchounikine, 2012). According to the authors (p. 586), 25 CSCL macro-scripts collected from the literature could be represented. - not distributed ?

Traditional sequencing

IMS Simple sequencing is a formalism that supports mastery learning. It is included in the SCORM 2004 profile (version 3 and later), but it is very difficult to find an LMS and design tools that support this standard.

- IMS Simple Sequencing (IMS SS, XSD schema)
- Reload Editor. The latest version can edit IMS SS, but it's not simple.

Systems that focus on the semantics of contents

These formalisms and associated tools allow to create pedagogical documents with semantic structure (and therefore markup).

- Learning Material Markup Language (schema and editing/export tool to HTML/SCORM 1.2)
- eLML (schema, editing and export to HTML/SCORM 1.2)

Light-weight systems

These systems are often included under "teacher tools", i.e. tools that allow a teacher to prepare lessons without too much insisting on detailed scenario design.

- OASIF (modèle et éditer de scénarios)
- lesson planning tools like Phoebe pedagogic planner or London Lesson Planner.
- General purpose "story-boarding" tools like Celtx
- Filling in forms, and optionally using Design pattern repositories. I.e. the design tool is a form the user has to fill in. A simpler and generic version of the DialogPlus approach. The form can be paper (see the learning activity reference model

Alternatives and anti-models

- Pédagogie de l'activité (Taurisson). This is a model that uses cognitive paper tools to drive learner activities.
- Many variants of inquiry-based learning, like the knowledge-building community model insist on a necessary *dynamic planning* of project-oriented teaching. They may make strong use of tools (e.g. knowledge forum, but the scenarios are emergent from the investigation.

Visual multimedia authoring languages

- Authorware (a now dead visual authoring tool that was very popular in the 1990'

There exist other products, e.g. hypercard revival systems.

Microworld design languages

Most of these microworlds are considered to be an expressive digital medium for the learners themselves. Nevertheless, the teacher also can create pedagogical designs like simulations or CSCL scenarios for use by learners. Or he can use these as demonstration tool. He also can create half-baked models that are then given to the learners for further work. Some examples are:

- AgentSheets
- BioLogica
- ToonTalk
- Squeak-based systems

Repositories

Web sites to share designs and scenarios. There exist several types. Some tools just point to an associated learning object repository. Sometimes the tool integrates direct access to the repository. Here are some examples

- Cloudworks is repository for designs (in simple verbal form)
- Systems like LAMS point to a community page [4] where registered users can upload and download executable and editable LAMS packages.
- Systems like CeLS include the repository in the interface.

Non-educational languages

- BPMN, the business process Modeling Notation. As of 2010, the current version is the BPMN 1.2 design language and can be translated to BPEL. BPMN 2, under preparation, is both a design and an execution language and partial implementations exist.
- SCUFL, an e-science format (see Taverna workbench)

Evaluation schemes

Since most design languages and systems are recent as of 2009, evaluation criteria and methods may yet be open to debate. Most evaluation schemes are designer-oriented, i.e. proposed by people who invent design languages and implement design systems.

Botturi (2005:335) proposed an *issues*- and *elements*-based evaluation framework for instructional design languages: "

1. Issues are critical aspects that should be considered in the definition of the experimental setting. They are: context sensitivity, eclectic benefits, course quality, and time. 2. Elements are indications for the identification of key variables in the study. They are: impact on sub-activities, communication events, institutional changes, and expressive power."

LeJeune et al. (2009) summarize the following vital issues and challenges:

- Comprehensibility: how can EMLs be made usable for educational practitioners ? (Pernin & Lejeune, 2006; Hernãndez-Leo et al., 2007) ?
- Pedagogical neutrality: how can an EML realize one unified, pedagogical neutral notation for supporting a large variety of pedagogically sound scenarios (Miao et al, 2005, Miao et al., 2008) ?
- Flexibility: how can EMLs support design of wellsupported, but flexible environments (Dillenbourg, 2002; Dillenbourg & Tchounikine, 2007) ?
- Interoperability: how can EMLs build on existing learning platforms and contents (Ardito et al., 2006).

To that we would like to add another most important one: To what extent is the system available, operationable, documented and maintained ?

Finally, we would like to argue that such top-down evaluation schemes should be complemented by idiographic methods, e.g. repertory grid technique based analysis.

Links

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- Revue international des technologies en pédagogie universitaire [6] volume 4 - 2007 - numéro 2.
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Educational modeling language

Draft

Definition

A **Educational modelling language** (or educational modeling language) formally describes educational materials and/or pedagogical scenario. It is a kind of educational design language that may or may not be executable. Currently (2008), the most interesting projects are carried out within learning design research.

“Educational modelling refers to the modelling of educational systems or sub-systems, such as instructional design or assessment. Such a model is a framework that contains important concepts, processes and relations. Instructional design, for example, is modelled in Educational Modelling Language (EML) [...] Educational modelling can be seen as the building of an ontology - an interrelated collection of entities and their relationships. Although educational modelling is a highly specialized field within educational technology, its products may have a wide-reaching impact through consortia such as IMS and IEEE that foster the development of interoperability specifications and standards in education.” (Giesbers et al., 2007)

This article provides an overview. You may find other entries in the category Educational modeling languages.

See also educational design language (looking at the same issue in a different way) and also learning object (since LOs can be modeled with such languages) and the standards page, which provides an overview on various specifications and languages used in education.

Purposes of modeling languages

Objectives

Dessus and Schneider (2006) identify four kinds of objectives:

- Define pedagogical scenarios
- Exchange learning units (learning objects, scenarios)
- Execute a unit in a platform (see LMS)
- Sketch, design, plan and discuss pedagogical scenarios

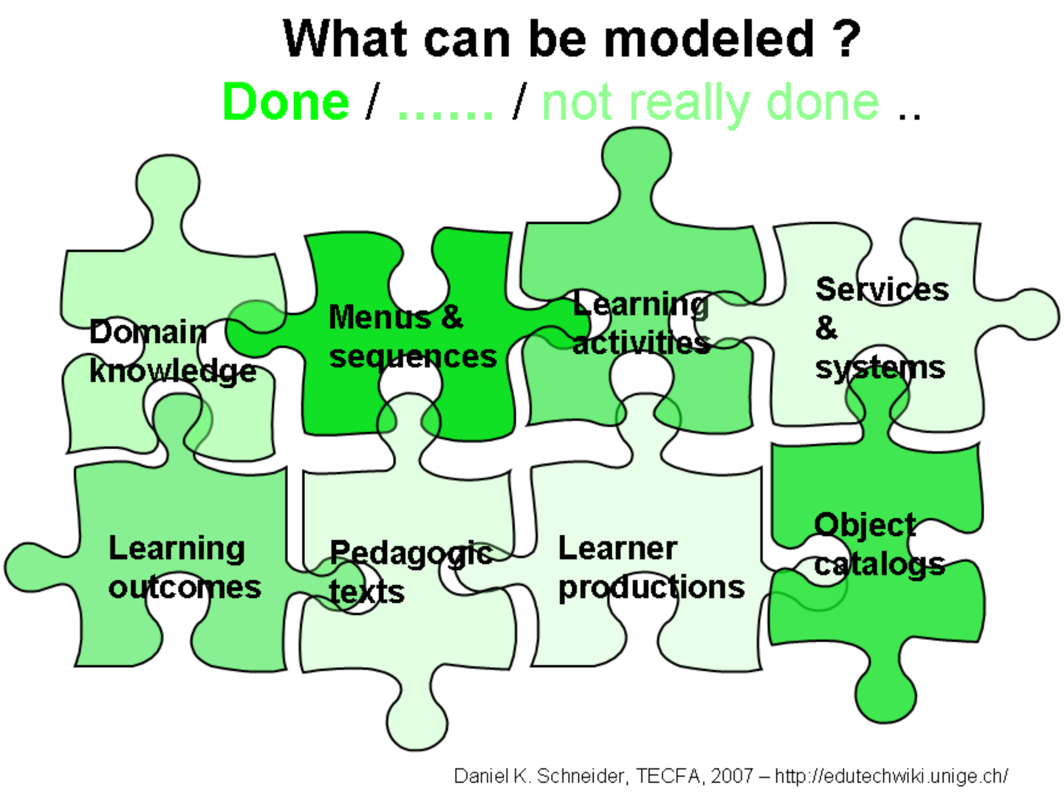
What can be modeled ?

In educational technology, we can distinguish three main areas for which formal design languages are being used:

1. Domain knowledge. There are no standards specifically designed for education, but sometimes World-Wide-Web standards such as OWL can be used.
2. Learning outcomes (knowledge and skills to be learnt)
3. Component aggregation / Sequencing of learning materials (IMS CP, SCORM SCO and IMS Simple Sequencing). These standards are defined in XML and are executable. I.e. authored content can be run by system
4. Learning activities (Learning design can both be defined in UML and executable XML as in the case of IMS Learning Design).

Additional areas that can be formally described with design languages and for which standards exist:

1. Architecture of computer systems
2. Repository information (metadata)
3. Semantic elements of a pedagogic „text“
4. Learner information



What can be modeled in education ?

Some areas are much less explored, e.g. there is no serious and widely used standard for pedagogic text (e.g. a language like eLML. Also student productions or even educational services and systems rely on no standards or models. This means in practical terms: (a) only data like IMS Content Packaging are portable, the rest is lost if you change systems and (b) most systems are not interoperable.

Typology of modeling languages

Modeling languages are developed by different sorts of institutions:

- Real standardization bodies like IEEE
- De facto standardization bodies like IMS or SCORM
- International research networks like Ariadne or Kaleidoscope
- Various research laboratories

Categories that might be used to describe a modeling language:

- Formality: Strictly formal (e.g. an XML grammar) vs. semi-formal (e.g. ideas on how to make use of UML or verbal description)
- Executability: Modelling only (see educational design languages / execution (or compilation in executable code / or both
- Status: Formal standard / standard-like / experimental (see standards.
- Scope: Global / specialized / in between (Note: DSchneider doesn't think that there is a single language that has truly global scope)
- Pedagogic orientation (see pedagogic strategy).

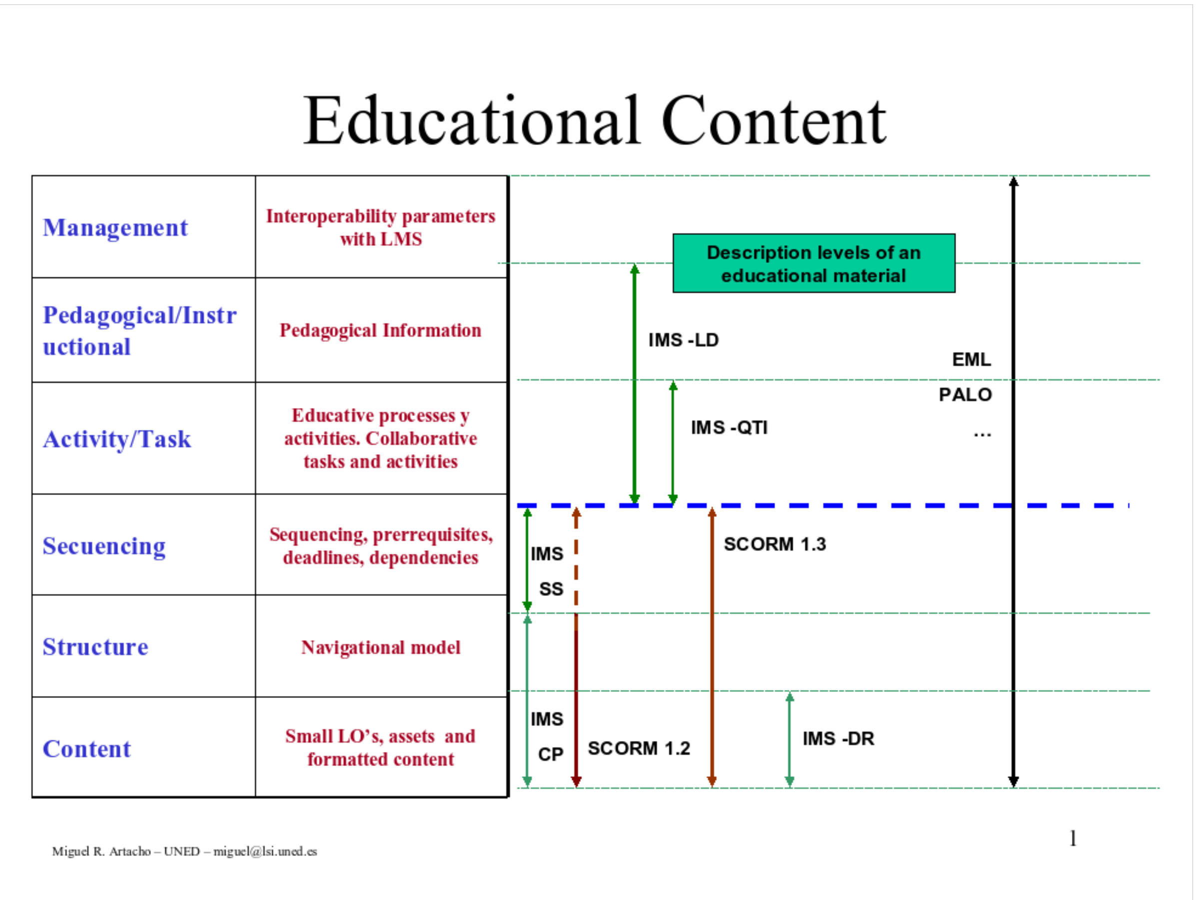
Representational Frameworks

According to Artacho and Verdejo (2004),

- Learning material is composed by pedagogical and instructional information that can be represented using an abstract information model and binding in an specification.
- The different elements of the specification are classified /grouped into categories called layers.
- As a formal specification, each element has an associated pedagogical meaning or operational semantics that require a process of interpretation or compilation by the LMS.

Layer	Functionality
Management Layer	LMS interoperability
Pedagogical/Instructional	Pedagogical information
Activity/Task Layer	Activity, community, Roles, resources, tools
Sequencing Layer	Scheduling, prerequisites, deadlines, dependences
Structure Layer	Navigational model, Table of contents
Content Layer, RIO, Reusable learning object's, Conceptual Domains, Multimedia Assets	Learning content, Learning Objects, Ontology-based instructional Knowledge

According to Rodriguez-Artacho *Authoring Learning Content: Why Learning Objects and why Modelling Languages* talk [1] in 2004 (retrieved 18:20, 29 May 2007 (MEST)), various specifications exist for different levels, but rarely a specification covers all these levels.



A view of Learning Content - Miguel Rodriguez-Artacho PPT Slide 2003.

See also how this is implemented in PALO

Executable "standardized" languages

- IMS Simple Sequencing incarnates typical behaviorist/cognitivist approach (e.g. mastery learning). It is part of SCORM 2004.
- IMS Learning Design and its ancestor EML (Educational Modelling Language) incarnates a cognitivist main-stream instructional design model
- IMS Content Packaging implements simple tell or tell-and-ask strategies by default, i.e. the design is menu of resources.
- IMS Question and Test Interoperability (IMS QTI). describes a data model for the representation of question (assessmentItem) and test (assessmentTest) data and their corresponding results reports. As of Feb 2009, there exist several tools and IMS for this standard.

IMS Simple Sequencing, IMS Learning Design organizations as well as IMS Question and Test Interoperability modules are embedded in IMS Content Packs. In November 2006 we didn't find any production-ready player for IMS Learning Design or Simple Sequencing. In Feb 2009 we still couldn't find any system that is suitable for the masses. Commercial products may exist for Simple Sequencing since it's part of the SCORM 2004 version 3/4 profiles, but we were unable to identify any of these.

Design languages

Most educational design languages formally describe a pedagogical design, often with a visual language. Some (e.g. MISA) can then be compiled into an executable format, e.g. MISA to IMS LD, Level A. Yet others are integrated within an LMS. Here are a few examples:

- Specialised concept map editors like the diffucult MOTPlus (Paquette et al.) that can export to IMS LD Level A or the relatively user-friendly CompendiumLD editor
- Visual semi-formal langauges based on UML, (*the* modeling language for software engineering). It can be used "as is" e.g. Roku et al. (2004) but there exist extensions like coUML to model several facets of a design or CPM, a UML Profile to design cooperative PBL situations (Nodenet et Laforcade)
- Other visual languages like E2ML, a high-level design language

As of Feb 2009, most of these languages remain research projects and/or are still under development. MOT is a mature product (but difficult to understand), Compendium is probably the best choice for a teacher interested in using such a tool.

Languages that model contents

- eLML - eLML [2] is an open source XML framework for creating eLessons using XML. It is a "spin-off" from the GITTA project: GITTA is a Swiss e-Learning project about GIS and it is the abbreviation for Geographic Information Technology Training Alliance.
- Learning Material Markup Language (LMML) - LMML - Learning Material Markup Language Framework LMML [3] based on the PTM - The Passau Teachware Model [4].

Design and executable languages from other domains

Since thing don't move very in fast in education (as of Jan 2011, there is still not good IMS learning design development and execution environment), we may have to look into technology developed elsewhere.

- Business process modeling, in particular BPMN (for design of educational workflows)
- E-science, e.g. systems like Taverna workbench (for the modeling/automation of data processing)

Research systems with combined intentions

Some are maybe used in production and there are many more, ...

- PALO
- LDL - Learning Design Language (Martel et al., 2006), an EML-like language adapted to modeling collaborative activities.
- ISIS model (french)

Older or less known attempts

... not sure if these systems have been used or are still in use - Daniel K. Schneider 18:20, 29 May 2007 (MEST)

- Hyper-Text Tutorial Markup Language [5] (**HTTML**), by Brian L. Stuart. An HTML extension to include quizzing plus lessons structuring.
- Mentoring Activity and Query-Response Ontology [6] (**MAQRO**). An RDF ontology for describing query and response scenarios.
- QuizzIT, by Lucio Cunha Tinoco, Virginia Technical Institute
- QML, by Robert Bamberger, Christopher Shorey and Richard Simpkinsson, Washington State University.
- PML (Procedural Mark-up Language)
- Tutorial Markup Language [7] (**TML**/Netquest) by Daniel Brickely, University of Bristol. An interchange format designed to separate the semantic content of a question from its screen layout or formatting.
- TArgeted Reuse and GEneration of TEAching Materials [8] (**TargeTeam**) by Gunnar Teege et al., Technische Universität München. Based on TeachML, a system for supporting the preparation, use, and reuse of teaching materials.

Packaging languages

- By definition, packaging languages are not educational modeling languages per se, but can wrap up for distribution "executable" bricks defined with modeling languages.
- However, IMS Content Packaging for example does include some simple sequencing information.

Tools

See also educational design languages, since design tools of various sorts often can produce executable models.

Please also have a look at the various modelling languages, in particular:

- IMS Learning Design

See also tools that implicitly define modeling languages or that can export to these formats, e.g.

- LMSs,
  - in particular more creative systems like LAMS and CeLS implement scenarization through activity planning and can enact these scenarios.
  - the most popular open source system only do IMS Content Packaging or tricky SCORM 1.2 extensions

    - Some commercial systems are SCORM 2004 compatible and claim to implement IMS Simple Sequencing (none tested - Daniel K. Schneider 14:55, 30 January 2007 (MET))
- CSCL tools, e.g.
    - CoFFEE
    - Collage
- Lesson planning tools (not many go far)
- Pedagogical scenario building tools of various sorts, like EduWeaver, OASIF, MISA/MOT or the Dialog Plus Toolkit
- Educational design languages that come with an visual editor like CompendiumLD

Discussion

Both general utility and utility of currently popular modeling is of hotly debated. E.g. According to Rodríguez-Artacho (2004), " a) Firstly, current specifications do not provide authors of learning material with a pedagogical authoring layer based on instructional elements, originating -therefore- a tight dependence between the learning content and the final delivery format, mainly internet-based technology; b) secondly, specifications themselves are currently isolated representational frameworks, which provide a fragmented view of certain aspects of learning material; c) Thirdly, there is no room for cognitive approaches or instructional and pedagogical knowledge representations;"

There are also more principled interrogations, like interrogations about situatedness of teaching (good teachers decide a lot of things on the fly)

In brief, DSchneider believes (see also Dessus & Schneider, 2006) there are several advantages and disadvantages:

Advantages

- Rationalization, formalization and standardization of design processes
- Information and materials sharing between teachers and content producers
- Reuse on different platforms (no vendor lock-in)

Disadvantages

- Political and ethical problems (fear of industrialization of the school system, recolonization of developing countries through content domination, dumbing down of teachers)
- Cost (unless production and distribution is large scale, nothing can be gained by investing a lot of time into formalization)
- Technical (adaptability, lack of good implementations and tools for most standards)
- Pedagogical (tools are not neutral, lack of affordances can kill design goals)
- Teachers create while they teach and this "situated act" can not as easily be transcribed into a formalism as some instructional designers believe.
- Break downs. Formal computerized systems tend to break down when unplanned events occur. Current execution environments are not flexible enough to allow for quick and easy run-time modifications.

Links

- EML [9], at Learning Networks (Dutch-led consortium)
- Wilson, Scott, Europe focuses on EML [10] Good overview, dated 2001.
- JISC e-Learning Focus [11] (The British JISC program is one of the key actors in promoting modeling languages and design for learning).
  - e-learning pedagogy programme [12]
  - Innovating e-learning conference 2006 [13]. See in particular the Design for learning: Proceedings of Theme 1 [14] (PDF).
- Topic: Education Modelling Language (EML) [15], Stephen's Web (collection of postings by Stephen Downes).

Slides for teaching

- You can find a lot of slides on the Internet, in particular for LD, not that much for SCORM.
- I made some for a one day preconference workshop (100 pages PDF. Not top quality, since it was the first time I gave this topic a try ...) - Daniel K. Schneider.

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Eight-component framework for e-learning

Definition

The **Eight component framework for e-learning** is global instructional design method designed by Badrul H. Khan.

According to the framework's webpage [1] (accessed on 12:33, 19 May 2006 (MEST)), Khan's framework for e-learning has the following purpose:

- Design, development, implementation and evaluation of open, flexible and distributed learning systems require thoughtful analysis and investigation of how to use the attributes and resources of the Internet and digital technologies in concert with instructional design principles and issues important to various dimensions of online learning environments.
- After reflecting on various factors important to open, flexible and distributed learning environments, I developed A Framework for E-learning. These factors can encompass various online learning issues, including: pedagogical, technological, interface design, evaluation, management, resource support, ethical and institutional. Various factors discussed in the eight dimensions of the framework can provide guidance in the design, development, delivery and evaluation of flexible, open and distance learning environments.

The components

Khan distinguishes the following components (slightly modified and commented by DSchneider):

1. The **pedagogical** dimension of E-learning refers to teaching and learning. It includes analysis of objectives, subject matters etc., and pedagogical design including choice of pedagogic strategy.
2. The **technological** dimension of the E-Learning Framework concerns the technical infrastructure (e.g. platforms used, standards chosen, hardware).
3. The **interface design** refers to the overall look and feel of e-learning programs (page and site design, content design, navigation, and usability testing).

4. The **evaluation** for e-learning includes both learner assessment, teacher evaluation and evaluation of the learning environment.
5. The **management** of e-learning refers to the maintenance of learning environment and distribution of information.
6. The **resource support** dimension of the E-Learning Framework examines the online support and resources required to foster meaningful learning environments.
7. The **ethical** considerations of e-learning relate to social and political influence, cultural diversity, bias, geographical diversity, learner diversity, information accessibility, etiquette, and the legal issues.
8. The **institutional** dimension is concerned with issues of administrative affairs, academic affairs and student services related to e-learning.

For a picture and more details, consult his website [1] (accessed on 12:33, 19 May 2006 (MEST)) and buy one of his books.

> *In our opinion this model is quite useful to factor out dimension to consider in a larger project. However there are some dangers in "flattening" out elements like "interface design" and "resource support". These elements are strongly tied to the pedagogical dimensions, i.e. interface design is not just about usability but also about cognitive usability (do learners really learn?), a very hot debate in the academic multimedia research community. Also see the tutoring article that demonstrates how closely tutoring is associated with pedagogical design. - DSchneider*

Links and references

- The framework home page [1]
- Badrul H Khan (ed.), Web-Based Training, Educational Technology Publications , ISBN 0-87778-303-9

Elaboration theory

Draft

Definition

Elaboration theory helps users “ select and sequence content in a way that will optimize the attainment of learning goals” Reigeluth (1999a:426) quoted by Wiley (2000:37)

See also: the 4C/ID model of Merriënboer et al., Merril's first principles of instruction and component display theory

The model

According to Wilson and Cole (1992), Elaboration Theory's basic strategies can be summarized as follows:

1. Organizing structure: conceptual, procedural, or theoretical
2. Simple-to-complex sequence of lessons
3. Within-lesson squencing:
    - For conceptually organized instruction "present the easiest, most familiar organizing concepts first"
    - For procedures, "present the steps in order of their performance"
    - For theoretically organized instruction, move from the simple to the complex.
4. Summarizers: Content reviews at both lesson and unit levels
5. Synthesizers, e.g. diagrams that help the learner integrate contents elements into a meaninful whole.
6. Analogies: relate the content to learner's prior knowledge.
7. Cognitive strategy activators: cues that can trigger cognitive strategies for appropriate processing of materials.

8. Learner control: allow learners to exercise informed control over both content and instructional strategy.

The **simplifying conditions method** (SCM) is an associated design model and method of elaboration theory. It integrates initial critiques concerning previous content-structure-based sequencing methods. SCM is based on two principles: (1) finding the simplest version of the task to teach and that is still representative of the entire task (**epitomizing**) and (2) teaching increasingly complex version of the task (**elaborating**). Elaborated versions are always slightly more complex, equally or more authentic and equally or slightly less representative of the whole task.

According to Wiley (2000:38) and based on Reigluth (1999a), SCM can be summarized in the following nine steps:

1. Prepare for the content analysis and instructional design.
2. Identify the simplest version of the task to be taught, paying careful attention to the simplifying conditions (i.e., the conditions which make this version of the task simpler than others).
3. Analyze the organizing content for this task. (This is called "organizing content" because different organizational strategies are presented for procedural, heuristic, and tasks containing a combination of the two).
4. Analyze the supporting or prerequisite content.
5. Decide the size of the individual instructional episodes. "Too big is bad ... Too small is bad" (p. 447). Appropriate size is situational, and varies depending on delivery constraints (such as time, learner ability, content difficulty, etc.) Episodes need not be of equal size.
6. Determine within-episode sequencing of the content.
7. Identify the next version (first elaboration) of the task.
8. Analyze organizing content, supporting content, and determine size and within-episode sequencing of content (steps three - five) for the next version of the task.
9. Cycle back to step seven to identify the remaining versions of the task and design the instruction for each.

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Engagement theory

Draft

Definition

- **Engagement Theory** is a framework for technology-based teaching and learning. " The fundamental idea underlying engagement theory is that students must be meaningfully engaged in learning activities through interaction with others and worthwhile tasks. While in principle, such engagement could occur without the use of technology, we believe that technology can facilitate engagement in ways which are difficult to achieve otherwise. So engagement theory is intended to be a conceptual framework for technology-based learning and teaching." (Kearsley & Schneiderman, 1999).

The model

Engagement theory is based upon the idea of creating successful collaborative teams that work on ambitious projects that are meaningful to someone outside the classroom. These three components, summarized by Relate-Create-Donate, imply that learning activities:

1. occur in a group context (i.e., collaborative teams)
2. are project-based
3. have an outside (authentic) focus

(Kearsley & Schneiderman, 1999).

- *Relate* emphasizes team work (communication, management, planning, social skills)
- *Create* emphasizes creativity and purpose. Students have to define (or at least identify in terms of a problem domain) and execute a project in context
- *Donate* stresses usefulness of the outcome (ideally each project has an outside "customer" that the project is being conducted for).

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Exploratory learning

Draft

Definition

Exploratory learning is based on constructivist theories of learning and teaching.

See discovery learning and maybe inquiry-based learning for more in-depth discussion of exploratory approaches.

According to Rieber (:587) all exploratory learning approaches are based on the following four principles:

- Learners can and should take control of their own learning;
- knowledge is rich and multidimensional;
- learners approach the learning task in very diverse ways; and
- it is possible for learning to feel natural and uncoaxed, that is, it does not have to be forced or contrived.

Tools

There are different kinds of tools for exploratory learning.

- Microworlds
- Hypertexts
- Some forms of games and simulations

References

- Rieber, L. P. (1996) Microworlds, in Jonassen, David, H. (ed.) Handbook of research on educational communications and technology. Handbook of Research for Educational Communications and Technology. Second edition. Simon and Schuster, 583-603 ISBN 0-02-864663-0

FEASP

Definition

- The F(ear)E(nvy)A(nger)S(ympathy)P(leasure)-approach for designing positive feeling instruction postulates that the instructional designer has to analyze emotional problems before and during instruction (Astleitner, 2000: 175).
- See also:
  - MacFadden's constructivist emotionally-oriented model.
  - Further related issues like motivation and motivation-based design models like ARCS.

The FEASP model

According to Astleitner (2000: 175):

There are five basic categories of emotional conditions that the instructional designer must understand and use in order to produce instruction which is emotionally sound, " Fear" refers to a negative feeling arising from subjectively judging a situation as threatening or dangerous. "Envy" is a negative feeling resulting from the desire to get something that is possessed by others or not to lose something that one is possessing. "Anger" refers to a negative feeling coming from being hindered to reach a desired goal and being forced to an additional action. "Sympathy" is a positive feeling referring to an experience of feelings and orientations of other people who are in the need of help. "Pleasure" is a positive feeling based on mastering a situation with a deep devotion to an action.

Accordingly, Fear, envy, and anger should be reduced during instruction, sympathy and pleasure should be increased.

The following FEASP overview table is **copyright by Astleitner**, **reproduced here with permission** and retrieved 16:18, 27 May 2006 (MEST) from http://www.sbg.ac.at/erz/feasp/overview.htm by DKS)

This table associates all instructional strategies of the FEASP-approach with examples in traditional and technology-based instruction.

Instructional strategies	**Examples from traditional instruction**	**Examples from instructional technology based instruction**
Fear reduction		
F1 Ensure success in learning	Use well-proven motivational and cognitive instructional strategies	Cognitive learning design
F2 Accept mistakes as opportunities for learning	Let student talk about their failures, their expectations, the reasons for errors, etc.	Q&A, success statistics
F3 Induce relaxation	Apply muscle relaxation, visual imagery, autogenics, or meditation	Trainings via media players
F4 Be critical, but sustain a positive perspective	Train students in critical thinking, but also point out the beauty of things	Cognitive tools (semantic networking)
Envy reduction		
E1 Encourage comparison with autobiographical and criterion reference points instead of social standards	Show students their individual learning history	Student progress tracking, using target lists
E2 Install consistent and transparent evaluating and grading	Inform students in detail about guidelines for grading	Programmed fact-based evaluation and feedback
E3 Inspire a sense of authenticity and openness	Install "personal information boards" telling others who you are	Personal homepages

E4 Avoid unequal distributed privileges among students	Grant all students or no student access to private matters	Rule-based granting of privileges
Anger reduction		
A1 Stimulate the control of anger	Show students how to reduce anger through counting backward	Anger buttons
A2 Show multiple views of things	Demonstrate how one problem can be solved through different operations	Linked information
A3 Let anger be expressed in a constructive way	Do not accept escaping when interpersonal problem solving is necessary	Anger-help option
A4 Do not show and accept any form of violence	Avoid threatening gestures	Non-violent action: motivational design
Sympathy increase		
S1 Intensify relationships	Get students to know other students friends and families	Synchronous and asynchronous communication tools
S2 Install sensitive interactions	Reduce students` sulking and increase their directly asking for help	On-/offline trainings for empathic communication
S3 Establish cooperative learning structures	Use group investigations for cooperation	Collaborative learning tools
S4 Implement peer helping programs	Let students adopt children in need	Social networks within the world-wide-web
Pleasure increase		
P1 Enhance well-being	Illustrate students a probabilistic view of the future	User-friendly interface design
P2 Establish open learning opportunities	Use self-instructional learning materials	Virtual classrooms
P3 Use humor	Produce funny comics with students	Story/comic/cartoon production systems
P4 Install play-like activities	Use simulation-based instructional games	Instructional computer games

Note that the FEASP approach is not a closed theory, but an open research program telling people what to do in order to improve any kind of instruction in respect to emotional issues.

References

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Felder design model

Draft

Definition

The **Felder design model** is an instructional design model based on learning style consideration. While some learning style people argue that pedagogical designs (in particular electronic learning environments) should accommodate different learning paths, Felder (in the context of class teaching) argues that it is sufficient to incorporate a variety of teaching modes.

Note: This "Felder design model" is not something that is being "sold" by Felder, but a construct we (DSchneider 16:55, 24 August 2006 (MEST)) have reconstructed from various recommendations by Felder.

See also: teaching style (its alter ego in classroom teaching).

The Felder-Silverman model

According to Felder (1996, 1993, this model classifies students along the following dimensions:

1. What type of information does the student preferentially perceive :
   - *sensing learners* (concrete, practical, oriented toward facts and procedures) or
   - *intuitive learners* (conceptual, innovative, oriented toward theories and meanings);
2. Through which modality is sensory information most effectively perceived:
   - *visual learners* (prefer visual representations of presented material--pictures, diagrams, flow charts) or
   - *verbal learners* (prefer written and spoken explanations);
3. With which organization of information is the student most comfortable ?
   - *inductive learners* (prefer presentations that proceed from the specific to the general) or
   - *deductive learners* (prefer presentations that go from the general to the specific);
4. How does the student prefer to process information ?
   - *active learners* (learn by trying things out, working with others) or
   - *reflective learners* (learn by thinking things through, working alone);
5. How does the student progress toward understanding ?
   - *sequential learners* (linear, orderly, learn in small incremental steps) or
   - *global learners* (holistic, systems thinkers, learn in large leaps).

Note: See the learning style article from which this is copied.

Instructional design considerations

According to Felder (1993) “ Students whose learning styles fall in any of the given categories have the potential to be excellent scientists. The observant and methodical sensors, for example, make good experimentalists, and the insightful and imaginative intuitors make good theoreticians. Active learners are adept at administration and team-oriented project work; reflective learners do well at individual research and design. Sequential learners are often good analysts, skilled at solving convergent (single-answer) problems; global learners are often good synthesizers, able to draw material from several disciplines to solve problems that could not have been solved with conventional single-discipline approaches. Unfortunately---in part because teachers tend to favor their own learning styles, in part because they instinctively teach the way they were taught in most college classes---the teaching style in most lecture courses tilts heavily toward the small percentage of college students who are at once intuitive, verbal, deductive, reflective and sequential.”

“ Major transformations in teaching style are not necessary to achieve the desired balance. Of the ten defined learning style categories, five (intuitive, verbal, deductive, reflective, and sequential) are adequately covered by the traditional lecture-based teaching approach, and there is considerable overlap in teaching methods that address the style dimensions short-changed by the traditional method (sensing, visual, inductive, active, and global). The systematic use of a small number of additional teaching methods in a class may therefore be sufficient to meet the needs of all of the students” (Feldman, 1993)

Here is summary of Feldmans (1993, 1996) recommendations (copy/paste with minor modifcations. Please read the originals for details - in particular if you are interested in engineering education):

1. Teach theoretical material by first presenting phenomena and problems that relate to the theory
    - Motivation is increased through prior presentation of phenomena that the theory will help explain and of problems that the theory will be used to solve (sensing, inductive, global).
2. Balance conceptual information (intuitive) with concrete information (sensing).
    - Have both descriptions of physical phenomena, results from real and simulated experiments, demonstrations, and problem-solving algorithms (sensing)---with conceptual information---theories, mathematical models, and material that emphasizes fundamental understanding (intuitive)---in all courses.
3. Make extensive use of sketches, plots, schematics, vector diagrams, computer graphics, and physical demonstrations (visual) in addition to oral and written explanations and derivations (verbal) in lectures and readings.
    - E.g on the visual side, show flow charts of the reaction and transport processes that occur in particle accelerators, test tubes, and biological cells before presenting the relevant theories, and sketch or demonstrate the experiments used to validate the theories.
4. To illustrate abstract concepts or problem-solving algorithms, use at least some numerical examples (sensing) to supplement the usual algebraic examples (intuitive).
5. Use physical analogies and demonstrations to illustrate the magnitudes of calculated quantities (sensing, global).
6. Occasionally give some experimental observations before presenting the general principle, and have the students (preferably working in groups) see how far they can get toward inferring the latter (inductive).
    - Give some experimental observations before presenting the general principles and have the students (preferably working in groups) see how far they can get toward inferring the latter (inductive).
7. Provide class time for students to think about the material being presented (reflective) and for active student participation (active).
    - Occasionally pause during a lecture to allow time for thinking and formulating questions. Assign "one-minute papers" close to the end of a lecture period, having students write on index cards the most important point made in the lecture and the single most pressing unanswered question. Assign brief group problem-solving exercises in class in which the students working in groups of three or four at their seats spend one or several minutes tackling any of a wide variety of questions and problems.
8. Encourage or mandate cooperation on homework (every style category).
    - See collaborative learning
9. Demonstrate the logical flow of individual course topics (sequential), but also point out connections between the current material and other relevant material in the same course, in other courses in the same discipline, in other disciplines, and in everyday experience (global).

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First principles of instruction

Draft

Definition

- **First principles of instruction** is a attempt by M. David Merrill to identify fundamental invariant principles of good instructional design, regardless pedagogic strategy. It can be used both as an instructional design model and as evaluation grid to judge the quality of a pedagogical design
- **First principles of instruction** is the title of a frequently cited on-line paper in several versions, e.g.
- Merrill, M. D. (2002). First principles of instructions [5], Educational Technology Research and Development, 50(3), 43-59.
- Merrill, M. D. (2010). First Principles of instruction [1], in C. M. Reigeluth and A. Carr (Eds.). Instructional Design Theories and Models III. Lawrence Erlbaum Associates Publishers.

The five principles of instruction

Merrill's first and central principle of instruction is *task-centered learning*. Task centered learning is *not* problem-based learning, although it shares some features.

The task / problem

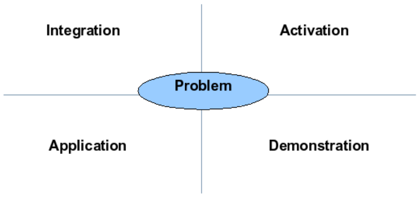
A task is a **problem** that represents a problem that may be encountered in a real-world situation. Learning objectives or samples of the types of problems learners will be able to solve at the end of the learning sequence may also substitute for a problem. A progression through problems of increasing difficulty are used to scaffold the learning process into manageable tiers of difficulty.
Does the courseware relate to real world problems?

1. ... show learners the task or the problem they will be able to do/solve ?
2. are students engaged at problem or task level not just operation or action levels?
3. ... involve a progression of problems rather than a single problem?

This *progressive teaching approach* is also related to Merriënboer's 4C/ID model.

The five principles of instruction (Merrill, 2006)

- **The demonstration principle**: Learning is promoted when learners observe a demonstration
- **The application principle**: Learning is promoted when learners apply the new knowledge
- **The activation principle**: Learning is promoted when learners activate prior knowledge or experience
- **The integration principle**: Learning is promoted when learners integrate their new knowledge into their everyday world
- **The task-centered principle**: Learning is promoted when learners engage in a task-centered instructional strategy



Phases / Components of Merrill's First Principles of Instruction

The task (or problem) is center stage. Here is a summary of the four remaining components

1. **Activation** of relevant previous experience promotes learning by allowing them to build upon what they already know and giving the instructor information on how to best direct learners. Providing an experience when learners previous experience is inadequate or lacking to create mental models upon which the new learning can build. Activities that stimulate useful mental models that are analoguous in structure to the content being taught can also help learners build appropriate schemas to incorporate the new content.
   Does the courseware activate prior knowledge or experience?
   1. do learners have to recall, relate, describe, or apply knowledge from past experience (as a foundation for new knowledge) ?
   2. does the same apply to the present courseware ?
   3. is there an opportunity to demonstrate previously acquired knowledge or skill ?
2. **Demonstration** through simulations, visualizations, modelling, etc. that exemplify what is being taught are favoured. Demonstration includes guiding learners through different representations of the same phenomena through extensive use of a media, pointing out variations and providing key information.
   Does the courseware demonstrate what is to be learned ?
   1. Are examples consistent with the content being taught? E.g. examples and non-examples for concepts, demonstrations for procedures, visualizations for processes, modeling for behavior?
   2. Are learner guidance techniques employed? (1) Learners are directed to relevant information?, (2) Multiple representations are used for the demonstrations?, (3) Multiple demonstrations are explicitly compared?
   3. Is media relevant to the content and used to enhance learning?
3. **Application** requires that learners use their knew knowledge in a problem-solving task, using multiple yet distinctive types of practice Merrill categorizes as *information-about*, *parts-of*, *kinds-of*, and *how-to* practice that should be used depending upon the kind of skill and knowledge identified. The application phase should be accompanied by feedback and guidance that is gradually withdrawn as the learners' capacities increase and performance improves.
   Can learners practice and apply acquired knowledge or skill?
   1. Are the application (practice) and the post test consistent with the stated or implied objectives? (1) Information-about practice requires learners to recall or recognize information. (2) Parts-of practice requires the learners to locate, name, and/or describe each part. (3) Kinds-of practice requires learners to identify new examples of each kind. (4) How-to practice requires learners to do the procedure. (5) What-happens practice requires learners to predict a consequence of a process given conditions, or to find faulted conditions given an

unexpected consequence.
2. Does the courseware require learners to use new knowledge or skill to solve a varied sequence of problems and do learners receive corrective feedback on their performance?
3. In most application or practice activities, are learners able to access context sensitive help or guidance when having difficulty with the instructional materials? Is this coaching gradually diminished as the instruction progresses?

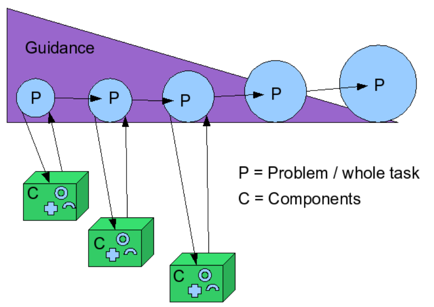
4. **Integration** in effective instruction occurs when learners are given the opportunity to demostrate, adapt, modify and transform new knowledge to suit the needs of new contexts and situations. Reflection through discussion and sharing is important to making new knowledge part of a learner's personal store and giving the learner a sense of progress. Collaborative work and a community of learners can provide a context for this stage.
Are learners encouraged to integrate (transfer) the new knowledge or skill into their everyday life?
   1. Is there an opportunity to publicly demonstrate their new knowledge or skill?
   2. Is there an opportunity to reflect-on, discuss, and defend new knowledge or skill?
   3. Is there an opportunity to create, invent, or explore new and personal ways to use new knowledge or skill?

Implications for educational technology

The task-centered principle

This section needs to be completed a lot, see First principles of instruction: a synthesis [2]*, p 7ff.*

Learning is promoted when learners engage in a task-centered instructional strategy **'and'** when a progression through problems of increasing difficulty is used to scaffold the learning process into manageable tiers of difficulty **and** whole-tasks are broken down to part-tasks (components)



The Instructional Sequence in Merrill's First Principles of Instruction

To design the first four phases (activation - demonstration - application - integration), whole tasks have to be broken down into components and the components have to be analyzed. Then one has to decide what should be taught in what way.

Merrill suggests to teach individual components with a direct instruction approach (which is more efficient and often also more effective). Most tasks or problems include **five different instructional compontents**. Firstly. initial "telling" should always activate prior knowledge. Demonstration (phase 2) should focus on adequate portayals of components (but linked to the whole), before the application phase is entered. Here are few hints on how to tell/demonstrate different sorts of components:

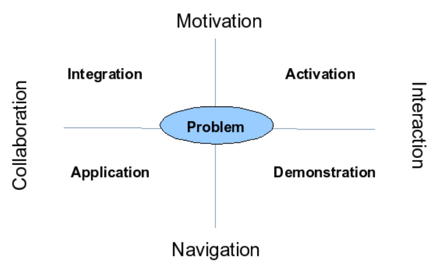
- Information-about
  - Tell facts or associations and link them to previous knowledge
- Parts-of
  - Tell names and descriptions
  - Portrayal: Show location

- kinds-of
  - Tell definition
  - Portrayal: Show examples and counter-examples
- how-to
  - Tell about steps and sequence
  - Portrayal: Illustrate steps for specific cases (work-through examples)
- what-happens
  - Tell about the process as a whole, conditions, consequences
  - Portrayal: Illustrate specific conditions and consequences for specific cases

In the third (application) phase students have to work on skills related to portayals and then put "things together" in the forth (integration) phase.

Each increasingly difficult whole task (problem) requires going back and forth from (1) demonstration of the whole task (2) to component "teaching" and (2) back to integration. Once the whole task is mastered, this procedure is repeated which the next whole task until the "real world" problem is mastered without much "direct component teaching".

A few principles for teaching materials and learning activities



Components of Merrill's First Principles of Instruction

Navigation

- Learners should see how contents are organized
- They should be able go forth and back, correct themselves

Motivation

- Learning environments should be interesting, relevant and achievable
- Real tasks are more motivating than formal objectives, glitz and novelty
- Known content is not motivating, students should be able to skip over
- Performing whole tasks is more motivating then decontextualized actions and operations
- Immediate feed feedback decreases motivation - delayed judgement increases (*interesting, this is not like direct instruction*)

Collaboration

- Favor small groups (2-3) to optimize interactions
- Group assigments should be structured around problems (whole tasks), i.e. "real" products or processes

Interaction

- Navigation is *not* interaction (i.e. it is not cognitive interactivity)
- Interaction means solving real-world problems or tasks
- Key elements are: a context, a challenge, a learner activity and feedback.

See also the pebble in the pond model that outlines a simple instructional design method that can be used to design a learning environment according to Merrill's principles of instruction. Additionnally there is also the issue of levels of instructional strategies , i.e. what we get when we do less ...

Links

- M. David Merrill's home page [3] (old home page [4]). Includes many papers he wrote.
- A New Framework for Teaching in the Cognitive Domain [5] by Molenda, Michael, ERIC Digest.
- [6] Includes a summary of research related to First Principles of Instruction.

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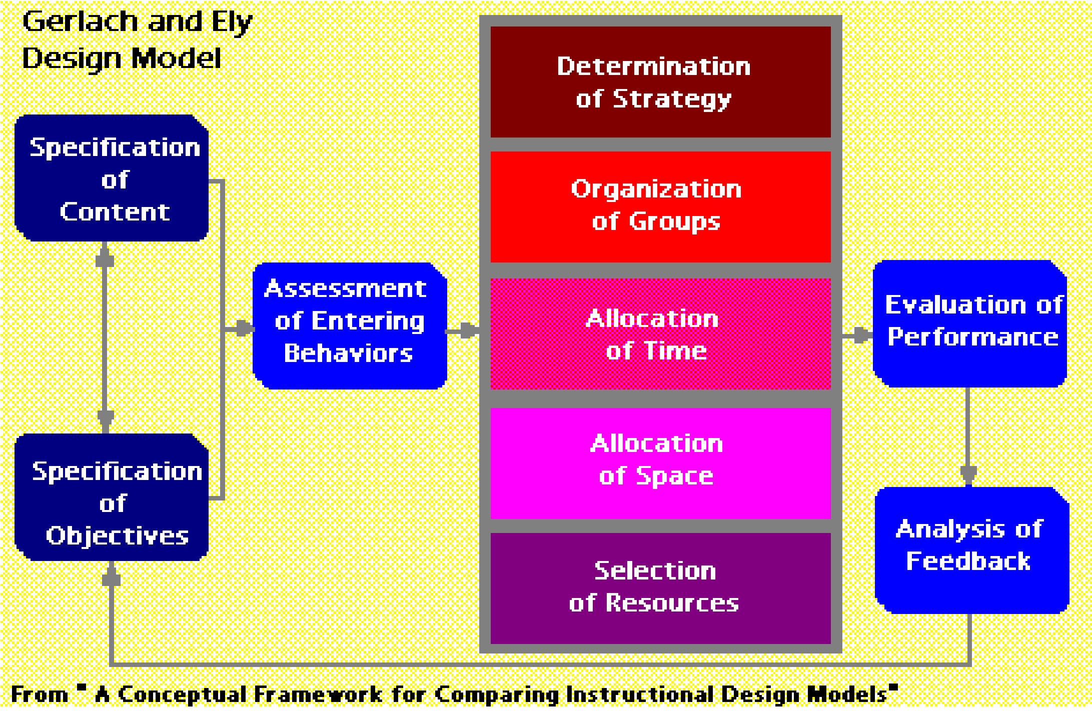
Gerlach and Ely design model

Draft

Definition

Gerlach and Ely is a relatively simple prescriptive design method and model.

Here is a summary with a figure taken from a Carl Berger [1] course on Educational Software Design and Authoring [2]



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Gerson's e-class

Draft

E-CLASS: A model for distance online course development

Developed by Dr. Steven M. Gerson, English Professor at the Johnson County Community College specifically for online courses, the e-class model of instruction has 7 distinct phases of instruction and details the aims of each phase as

Explain
Clarify
Look
Act
Share
Self Evaluate/Submit

Explain

The start of an instructional unit. Should provide an overview that may explain: - what's to be discussed - the context - a scenario or case to situate the assignment - why a topic is being introduced - the historical perspective of an assignment **E** explains why the assignment is being given and what is expected of the learner

Clarify

C should provide details on how an assignment will be approached; which laws or principles will be employed and what resources will be used.

Look

L should provide the student with examples of similar assignments or problems using simulations and modelling. All ranges of multimedia can and should be exploited to this effect.

Act

The focus here is to have learners put to practice what has been introduced and detailed in the previous phases. Exercises and activities should allow learners to participate in the application of what has been learnt.

Share

Gerson admits this to be the most difficult phase in a distance learning environment aggravated by it's asynchronous nature. Learners should engage in interaction to benefit from the learning that occurs within a community of learners. Educational technology tools that are available to this end are email, blogs, chats and forums for reflection, discussions, and collaborative work. The point is to simulate the interaction that takes place in a classroom environment.

Self Evaluate/Submit

This point in the sequence serves to allow learners to evaluate and revise their own work according to feedback received from peers and the criteria set out and finally submit their assignment.

Examples

eLML (a modified version)

References

Gerson,Steven M.(2000), E-CLASS: Creating a Guide to Online Course Development For Distance Learning Faculty, Online Journal of Distance Learning Administration, Volume III, Number IV, Winter 2000, State University of West Georgia, Distance & Distributed Education Center <[[1]]> (accessed May 31, 2006)

Hypermodel

Definition

- **Hypermodel** probably refers to a lot things...
- In educational technology, **hypermodel** has probably been coined by Robert Tinker and refers to a sort of pedagogically structured microworld or computer-based manipulative (CBM) and a model-based learning design.
- The "hypermodel," a new type of learning technology that blends aspects of models, simulations, and hypermedia. [1]

The instructional design model and the systems architecture

Draft

> *We should this topic to some other page some day, below just a series of quotes for starters - DSchneider 16:21, 21 July 2006 (MEST)*

- “Hypermodels integrate stored information in the form of multimedia materials, experimental data, and text, with a manipulable model of the subject domain. Just as hypertext enables one to navigate through textual materials by clicking on individual words and phrases, with hypermodels students navigate through a learning activity by manipulating a computer-based model. The activity typically presents a more or less open-ended challenge (e.g., "Breed these organisms as efficiently as possible, trying to get all the offspring to look like this.") and then leaves the students alone and monitors them (Which organisms do they choose to breed? How do they react to the outcome?) as they try to accomplish the goal. ” [2].
- “ Hypermodels share some characteristics with CAI (computer assisted instruction) applications, which also control what the learner sees, evaluate progress, and, if they are "intelligent," can adapt to student responses and learning styles. The critical difference is that hypermodels have at their core a sophisticated tool that students can use to learn content through exploration and inquiry; a constructivist educational strategy. In contrast, CAI software is usually much more directive and "instructivist."” (Tinker: 2001).
- “ Our underlying tools embody a pure constructivist philosophy that permits students to learn through open-ended exploration. Even though this type of learning is powerful, students can take too much time and miss important topics and the tool can be difficult to disseminate and confusing for beginners. Pedagogica converts the tool into a hypermodel that is somewhat instructivist, because the script constrains the tool and guides the learner to discover specific concepts that a curriculum developer has selected. Done well, students still learn through their own explorations, but within constrained domains and with guidance that ensures that most students discover the important concepts.”

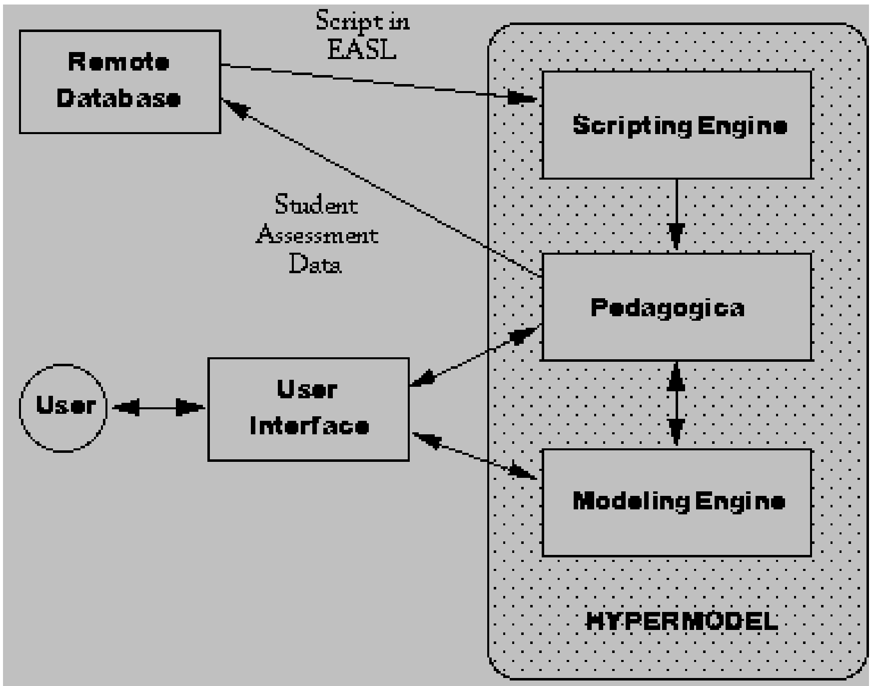

Figure 1. Hypermodel architecture. The three software layers designed to separate functions relating to domain content from more general ones relating to pedagogy, and to give control over both.

Note: A different picture of this hypemodel architecture is shown in the Pedagogica article. But the principle is the same. There is a distinction between the model (simulation software) and some kind of pedagogical shell that runs the software plus additional pedagogical functions.

Examples

- See systems built with Pedagogica (Tinker: 2001).

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Hypertext

Draft

Definition

- A hypertext is a non-linear text that connects various elements (nodes, pages) through links.
- "Hypertext is text with links, or pointers, showing relationships between parts of the information. Hypermedia extends this concept - information with links - to collections including text, audio, video, photographs, or any multisensory combination" (Alessi & Trollop, 2001:138).
- From the Wikipedia [1]: " In computing, hypertext is a user interface paradigm for displaying documents which, according to an early definition (Nelson 1970), "branch or perform on request." The most frequently discussed form of hypertext document contains automated cross-references to other documents called hyperlinks. Selecting a hyperlink causes the computer to load and display the linked document."
- Hypertext is *not* just HTML.
- Hypertext systems allow users to author, edit and follow links between different bodies of text. Hypermedia systems, are similar to hypertext systems, except that the user can use other forms of media as well.

Hypertext and hypermedia architecture

Semantic and rhetorical link types

Burbules (1998) made a categorization based on rhetorics:

- Metaphor: " a comparison, an equation, between apparently dissimilar objects, inviting the listener or reader to see points of similarity between them while also inviting a change in the originally related concepts by "carrying over" previously unrelated characteristics from one to the other."
- Metonymy: " an association not by similarity, but by contiguity, relations in practice".
- Synecdoche: " figurations where part of something is used as a shorthand for the thing as a whole or, more rarely, vice versa. [..]. In the context of Web links, this trope is particularly influential in identifying, or suggesting, relations of categorical inclusion"
- Hyperbole: exaggeration for the sake of tropic emphasis (or its opposite, understatement for the same effect), i.e. " there is a tacit implication with each collection, each archive, each search engine, of a degree of comprehensiveness beyond its actual scope"
- Antistatis: the "same" word - in a different or contrasting context.
- Identity: identity denies difference and emphasizes equivalence
- Sequence and cause-and-effect: indicate real relations, not simply allusive ones.
- Catechresis: "far-fetched" uses of familiar words in a new context. " In the context of the Web, catechresis becomes a trope for the basic working of the link, generally: any two things can be linked, even a raven and a writing desk, and with that link, instantaneously, a process of semic movement begins"

Harrison's (2002) paper explores the semantic and rhetorical principles underlying link development of web sites and proposes a systematic, comprehensive classification of link types that could be of use to researchers and Web production teams:

- Authorizing: Describes an organization's legal, formal policies, contact information, etc. that authenticate the site and its content.
- Commenting: Provides opinion about the site and/or its content.

- Enhancing: Provides more factual information about site content by offering greater detail or painting the "bigger picture."
- Exemplifying: Provides a specific example of content within a broader category.
- Mode-Changing: Moves users from the reading mode to one that requires a different kind of activity.
- Referencing/Citing: Provides information that "informs" or supplements the site's content.
- Self-Selecting: Allows users to narrow a search by making choices based on their age, sex, geographical location, life situation, personal interests, and so on ([2], retrieved 18:47, 6 November 2006 (MET))

A technical classification of links

In the history of hypertext we can distinguish "minimal" technology such as HTML and systems that provide a richer set of link types. E.g. the XLink standard which did/does not have much success with industry defines a whole lot of linking attributes.

Simple links

- One element on the screen/document (e.g. a word or a button) points to another screen or other element within the loaded screen/document. After clicking the link, current content is replaced by target content. These are links that one can find in HTML (web contents).

Complex links

There are many, e.g.:

- Fat (multi-tailed) links: a fat link can open several windows simultaneously with one click of the mouse.
- Multiple-choice links: the user can choose among several options from a menu.
- Labelled links: A user can see what a link is good for (e.g. "example", "theory", "further reading", "reference", etc.)
- Aggregations: (include various smaller documents into a single text)
- Inclusions: A link that expands contents in place to include other contents.
- Transclusion: A text that is composed as an aggregation of other text. E.g. in a Mediawiki like this on can build pages out of other pages by using this syntax
- Bilinks: See AboutUs:BiLinks [3]

Hyperlinks

Alessi & Trollop (2001:155) suggest to pay attention to a few factors when creating hyperlinks of various forms, which we shortly outline here:

Object types of links

- Word links are easy to spot but decrease readability and influence on browsing behavior ()
- Links in pictures and videos may be less easy to spot depending on how they are made

Purpose of links

- Clearly, links should be used for a reason. Firstly, there should a general concept about the media type to be constructed (e.g. see the overview of genres below) and then there should a be a use case analysis (what it will be used for) in terms of one or several instructional design models.

Density of links

- For reference works, it's in principle a good a idea to include many links (e.g. like in this text)
- However, in education one may limit links in texts that should be read in its entirety, or only show them after explicit request or some other control function (e.g. learner level). There is actually a lot of research on adaptive hypertext

Visibility of links

- Links should be clearly visible, however there is a tradeoff with readability.
- In general, one should not users require to move the mouse over an object that then will highlight in order to find available links. A compromise, might be a visibility of links turn on/off button. E.g. in a modern web browser this is very easy to implement.

Screen Location

- In particular menu links should be placed in standard locations (e.g. on top or to the left)

Confirmation

- The authors put several things into this category, e.g.
- Confirmation of link selection (not activation): E.g. display a mouse-over effect. Then the links can for example offer a preview, or let the user display contents in different locations. (In web browsers, the latter functionality is the *right-click* menu, and the further can be implement with Javascript.

Finally, one also may ask confirmation from the user to open or navigate to different sites.

Marking

- Recently selected links can be specially mark (e.g. by default, word links in web browsers change color from blue to violet)
- One also can implement user trails, i.e. display somewhere a list or the path of visited links. Typically, this is implemented in shopping applications like amazon (also in this wiki, if you use a login).

Semantic Cueing

- A semantic cue identifies the relation to the link target or at least its kind (e.g. use a color code or little icons that characterize the links)
- Other options are to use a menu or to display links relationships in a separate window with a concept graph.

Distance

- This is partly same issue as above, partly the problem that in education it's a difficult decision whether you can rely on external links. E.g. if you teach about hypertext in education, would you trust us to keep this page alive ?
- Typically in web design, one tries to make a distinction between internal and external links (e.g. this is being done in this wiki). However the question whether we trust other people to keep their links online is a very difficult one.

Modifiability

- In earlier systems users were able to modify or at least to annotate a hypertext. Also they could add links.
- In more recent hypermedia (including most web pages) this is not usually the case.
- There is a difference between hypermedia that can be changed (e.g. like this wiki), those that can be annotated and those where the changes are only seen by the user who made those changes (the latter version is the most difficult to implement). Annotation systems are successfully used in education, e.g. the Diplo Foundation [4] uses annotation of online text as primary teaching medium.

Navigation types from a GUI perspective

In a hypertext or hypermedia system, there can be many kinds of navigational devices (most of which are links). E.g.:

- Simple word or button links
- Menu bars
- Context menus
- Graphics (concept maps, maps, time lines)
- Table of contents, Indexes, Glossaries
- Search

Hypertext and hypermedia in education

This chapter provides an overview of educational uses.

A deeper analysis of learning activities with hypermedia and kinds of supported learning types is missing though.

Overview of educational genres

“ Hypertext/hypermedia is a field of study which comes with a number of issues, which we will explore, for example:what it means to learn in a nonlinear fashion and the related implications for designing online learning and learning from the current structure of the Web: learner control, navigational problems, cognitive overload, issues of type of structure and how much structure, and so on. Hypertext has two main features: nonlinearity and changeability. That is, the user may follow someone else's links, or s/he may design her own.These two different purposes have important learning consequences.” (Diane McGrath [5], retrieved 18:47, 6 November 2006 (MET)).

Hodges and Asnett (1993) cited by [6], retrieved 6 November 2006) identified six groups of educational applications that were made with ATHENA developed at MIT and one of the earlier hypermedia systems.

1. Virtual Museums
2. Simulations, in particular interactive fiction for language learning
3. Analysis Tools, in particular analysis of films (see e.g. cognitive flexibility hypertext)
4. Editors, e.g. color editors, lesson tools
5. Information management, e.g. meeting tools, calendars, etc.
6. Electronic Books

Alessi and Trollop (2001:142) describe in their textbook 8 hypermedia formats to which we would like to add the hypermodel.

1. General reference (encyclopedias, dictionaries, atlases, etc.)
   - These are typically sold as commercial products on CD-ROM (E.g. Encarta) but may also be available over the Internet (e.g. Britannica [7]). A well known free one is Wikipedia [8]
   - Such systems are useful for reference, e.g. as a resource in project-oriented learning
2. Specific subject matter reference
   - Same principle as above but focused on a given domain, e.g. the human body, astronomy, a genre of music. An example would be Shakespeare's world [9]. There are lots of simple web sites that are made by teachers on given subjects (see some Learning objects repositories). While technically simple, such resources can be very efficient in education.
3. Analysis of a domain
   - Such systems go beyond presentation and analyze complexities, arguments, provide multiple viewpoints etc. In other words, they are specifically made for a kind of educational design.
   - A typical example would be a cognitive flexibility hypertext like the KANE system

4. Case study
    - These are similar to the above, but focus on some very specific objects, e.g. a historical event, a person, a piece of art. The user will have access to a variety of information (e.g. firstly the entire work, then essays, photographs, video-clips, etc.). Also available are analysis tools and sophisticated navigation and search tools. In other words, such a hypertext should provide learners with the opportunity to study an object inside out and from many angles.
    - A typical example are multimedia virtual bodies. Some can be found on the Internet, e.g. BBC Human Body and Mind [10]. An other example are sites on literature in the tradition of Intermedia, e.g. George Landow's Victorian Web [11].
5. Construction sets
    - These systems allow learners to build their own hypermedia. We distinguish two kinds: (1) Any sort of multimedia authoring system, (2) Microworlds like AgentSheets, ToonTalk or Squeak Etoys.
6. Edutainment
    - The programs are both recreational and entertaining. E.g. children can virtually travel to places and gain points when they pick up some objects. There are hundreds of such programs on the market and most are sold as CD/DVDs.
    - An example would be Where is Carmen Sandiego [12]. Note: There are other edutainment categories, e.g. that fall more into some drills and practice category.
7. Museum
    - Museums are virtual exhibits that mimic a real one or not. In both cases exhibits are arranged in some topological format. Technology can be simple web pages, hypermedia systems on CD, Desktop virtual reality e.g. made with computer game technology or X3D.
8. Archive
    - Digitalization of contents or systematic cataloguing of existing contents. This includes addition of menus, indexing and so forth
    - E.g. all national geographic magazines
9. Hypermodel
    - Hypermodels are hybrids between simulations, hypermedia and microworlds, i.e. the user can interact with models (modify parameters, sometimes build them) and access to information describing a subject domain (both textbook information and raw facts)
    - E.g. systems like BGuILE, BioLogica or WISE

Technically speaking, almost any software today is a hypermedium. However, the question is to know when to call an application a hypermedia in the proper narrow sense and when it rather should be called a microworld, an educational game, CBL software, CBT software etc. Daniel K. Schneider thinks that one should in a conceptual context use the word hypermedia to describe systems that essentially contain:

- lots of information that is linked in various ways
- flexible user-driven navigation
- some tools (but not too many)

We think, that it is important to be able to distinguish various forms of interactive multimedia or educational technologies in general. Because each format is not "innocent" and does have its constraints regarding educational use.

Instructionalist designs

In main-stream instructional design, hypertext is usually a component to build learning activities that include strong sequencing constraints (at least at module level) and MCQ's. Some very general design guidelines for more open hypertexts usually include:

- clear structure
- navigational transparency
- consistency

See e-learning, mastery learning, etc.

Constructivist designs

Hypertext requires the reader to be an active participant in the evolution of the learning path and therefore are of interest to various constructivist designs.

- Cognitive flexibility theory that focuses on the nature of learning in complex and ill-structured domains and builds on top of cognitivist thinking shows interest for hypertext technology.
- Exploratory learning designs
- Some microworlds, like BioLogica or WISE all include hypermedia. This technology is also known as Hypermodel and refers to a type of learning technology that blends aspects of models, simulations, and hypermedia

Constructionist designs

- Students write hypertext (e.g. Lohr et. al, 1995).
- See writing-to-learn

Dumb designs

- Why do we add Hypertext to the Category:Instructional design models ? Because there are people who believe that one can learn by surfing through hypertext. It's the constructivist "spray and pray" equivalent to the "page turning" design idea popular with some LMS users ....
- Or in other words, hypertext in good educational designs is usually used not as a pedagogical model, but as a technology that supports designed learning activities, sometimes as a stand-alone tools, sometimes (as in modern microworlds) in conjunction with other tools.

Language theoretical models

Tom Boyle (2002) argues that a central concept for educational multimedia design is context, “a construction that makes selective, holistic sense of the environment of interaction. This construct then guides adaptive action in that environment, e.g. what type of learning actions to undertake. The central challenge for educational multimedia designers is to create contexts that promote effective learning.”

He then identifies two major challenges arise in the design of contexts:

1. the structuring of contexts in relationship to each other;
2. the creation of the internal structure of the context.

He calls the structuring of context *montage*, that in education usually implies the the framing of content along with associated interactivity. A good examples are certain kinds of Microworlds, e.g. the DOVE system which implements a kind of virtual field trip in Biology.

Regarding the formal internal structure of context, Boyle (2002) then refers to the concept developed in systemic linguistics and that argues “that language has evolved to provide communication in context, and the deep structure of language reflects this fundamental influence. It argues that there are three abstract macro-functions that underpin the production of all linguistic communication”

According to Boyle (2002), these macro-functions concern:

- the construction of the content of the message - the coherent linking of agents, actions states and objects to convey a message (called the ideational function);
- the management of the interpersonal roles and relationships in the communication - whether the message is embedded the form of a statement, question, order etc. (called the interpersonal function);
- the integration of all the other elements to create of a coherent overall communicative 'text', e.g. a coherent description stretching over several sentences (called the textual function).

Boyle (1997) argues that the creation of multimedia contexts involves the action of three corresponding macro-functions. In the construction of educational multimedia these involve:

- the content structuring macro-function: the selection and structuring of the learning content in the multimedia context;
- the interactivity macro-function: designing for user interaction with this content;
- the compositional macro-function: the creation of a coherent overall composition, both within and across contexts.

These macro functions strongly relate was is called sequencing and that concerns both structuring of contents and structuring of learner interactions.

History

This is a very incomplete time-line:

1. 1945: V. Bush, As We May Think
2. 1965: Ted Nelson invents the word "Hypertext"
3. 1968: Engelbart [13] demoes "HyperMedia" over the network
4. 1981: Start of Ted Nelson's Xanadu project [14] which never managed to take off, however there finally was an available implementation in 1999 (?)
5. 1985 Intermedia was the best known hypertext project to emerge from Brown University, after HES (1967) and FRESS (1969). It was started by Norman Meyrowitz and became popular in literature criticism and education through the work of George Landow.
6. 1987 HyperCard, a hypermedia authoring system (but with limited text linking).
7. 1992 First commercial hypertext system by Eastgate (still sold as Storyspace [15]). This system was based on Intermedia.
8. 1989: Tim Berners-Lee builds the first prototype of the WWW and invents HTML, formally as a SGML application.
9. 1991: Gopher (Menu-based navigation through files and services on the Internet)
10. 1992-1993: The WWW starts spreading
11. 1992 / 1997 Hytime [16] is a complex SGML application. Hytime is an ISO standard that has rarely been used, but it had a big influence on the definition of more recent Web Standards like XLink.
12. Early 90' (?) Adaptive hypertexts
13. 1995 Ward Cunningham invented the first Wiki. Wikis are probably the only popular CMSs that are compatible with the Hypertext concept.

(To do: add more recent developments + exotic hypertexts)

Links

Hypertext examples on the Internet

There are not many good hypertext examples on the Internet. Some exceptions are:

Encyclopedias

- The Wikipedia [17]

Subject-related websites

Victorian Web [11]

Concept mapped hypertexts

- Beat's Biblionetz [18]

(Simple) hypertext books

- The Theory into Practise DataBase [10] (TIP)

Some social software

- E.g. citation indexes

Some interactive visualizations or 3D models

- E.g. human bodies

PS: For hypermedia, see Learning objects repositories

Standards

- Internet resource locators (URLs, URNs)
- HTML / XHTML and associated linking mechanisms (e.g. the "A" tag and the "href" attribute)
- XML Linking standards like XLink [19] and associated mechanisms to point to documents and parts of documents (XPointer [20] and XPath [21])
- Topic Maps, a ISO standard to define maps for information spaces
- Some languages based on RDF, e.g. ontology languages like OWL or social software standards like FOAF.
- HyTime
- Text Encoding Initiative Guidelines

Software and technology

- Some gaming engines
- Wikis
- Web-based solutions (also need a Wikipedia:HTTP Server):
  - Wikipedia:HTML clients
  - Wikipedia:XML clients that support Wikipedia:XLink
  - Wikipedia:SVG clients
- Storyspace [22] (quote: "is widely considered the tool of choice for hypertext writers."
- Interactive fiction engines and MUDs/MOOs
- Multimedia authoring system, such as ToolBook and Authorware or earlier systems like HyperCard
- Some concept maps, e.g. the ones that are used to visualize information spaces in search engines like Kartoo, wikis, etc.
- Various other diagram software (see visualization).

Other

- George Paul Landow [23] Professor of English and the History of Art, Brown University (according to DSchneider, *the* pioneer for hypertext in higher education).
- Hypermedia for Educators [5], retrieved 18:47, 6 November 2006 (MET). A seminar given by Dian McGrath at college of education, Kansas State University. This page has good links.
- Exemplary Hypertext applications [6] (author ??)
- ACM Computing Surveys Hypertext and Hypermedia [24] Symposium. A huge index by names and keywords.

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Links

- Hypertext 2.0: An Interview With George Landow [37]
- Martin Ryder's collection of hypertext links [38]
- ACM Hypertext 2006 conference [39]
- Vision and Reality of Hypertext and Graphical User Interfaces [40] (Master thesis by Matthias Müller-Prove), *as* hypertext.

Inquiry-based learning

Definition

Inquiry-based learning (IBL) is a project-oriented pedagogic strategy based on constructivist and socio-constructivist theories of learning (Eick & Reed, 2002).

“Inquiry learning is not about memorizing facts - it is about formulation questions and finding appropriate resolutions to questions and issues. Inquiry can be a complex undertaking and it therefore requires dedicated instructional design and support to facilitate that students experience the excitement of solving a task or problem on their own. Carefully designed inquiry learning environments can assist students in the process of transforming information and data into useful knowledge” (Computer Supported Inquiry Learning [1], retrieved 18:31, 28 June 2007 (MEST).

Inquiry-based learning is often described as a cycle or a spiral, which implies formulation of a question, investigation, creation of a solution or an appropriate response, discussion and reflexion in connexion with results (Bishop et al., 2004). IBL is a student-centered and student-lead process. The purpose is to engage the student in active learning, ideally based on their own questions. Learning activities are organized in a cyclic way, independently of the subject. Each question leads to the creation of new ideas and other questions.

This learning process by exploration of the natural or the constructed/social world leads the learner to questions and discoveries in the seeking of new understandings. With this pedagogic strategy, children learn science by doing it (Aubé & David,2003). The main goal is conceptual change.

IBL is a socio-constructivist design because of collaborative work within which the student finds resources, uses tools and resources produced by inquiry partners. Thus, the student make progress by work-sharing, talking and building on everyone's work.

Models

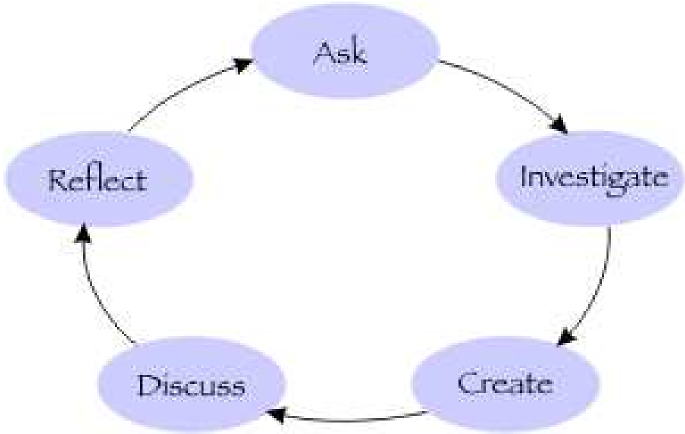
There are many models described in the literature. We shall present as an example the *cyclic inquiry model* presented on the inquiry page [2] sponsored by "Chip" Bruce [3] et. al of the University of Illinois at Urbana-Champaign (UIUC).

Cyclic Inquiry model

The purpose of the UIUC inquiry model is the creation of new ideas and concepts, and their spreading in the classroom.

The Inquiry cycle is a process which engages students to ask and answer questions on the basis of collected information and which should lead to the creation of new ideas and concepts. The activity often finishes by the creation of a document which tries to answer the initial questions.

The cycle of inquiry has 5 global steps: Ask, Investigate, Create, Discuss and Reflect. We will give an example for each step using the "rainbow" example from Villavicencio (2000) who works on light and colors every year with 4 or 5 years old children.



from: [The Inquiry Page [4]]

During the preparation of the activity, teachers have to think about how many cycles to do, how to end the activity (at the *Ask* step): when/how to rephrase questions or answer them and express followup questions.

Ask

Ask begins with student's curiosity about the world, ideally with their own questions. The teacher can stimulate the curiosity of the student by giving an introduction talk related to concepts that have to be acquired. It's important that student formulate their own questions because they then can explicitly express concepts related to the learning subject.

This step focuses on a problem or a question that students begin to define. These questions are redefined again and again during the cycle. Step's borders are blurred: a step is never completely left when the student begins the next one.

Rainbow Scenario : The teacher gives some mirrors to the children, so they can play with the sunlight which are passing trough the classroom's windows. With these manipulations, students can then formulate some questions about light and colors.

Investigate

Ask naturally leads to *Investigate* which should exploit initial curiosity and lead to seek and create information. Students or groups of students collect information, study, collect and exploit resources, experiment, look, interview, draw,... They already can redefine "the question", make it clearer or take another direction. *Investigate* is a self-motivating process totally owned by the active student.

Rainbow Scenario : Once questions have been asked, the teacher gives to the children some prisms which allow to bend the light and a Round Light Source (RLS), a big cylindrical lamp with four colored windows through a light ray can pass. Then the children can mix the colors and see the result of their mixed ray light on a screen. They begin to collect information...

Create

Collected information begins to merge. Student start making links. Here, ability to synthesize meaning is the spark which creates new knowledge. Student may generate new thoughts, ideas and theories that are not directly inspired by their own experience. They write them down in some kind of report.

Rainbow Scenario : Some links are created from collected information and children understand that rainbows have to be created by this kind of phenomenon.

Discuss

At this point, students share their ideas with each other, and ask others about their own experiences and investigations. Such knowledge-sharing is a community process of construction and they begin to understand the meaning of their investigation. Comparing notes, discussing conclusions and sharing experiences are some examples of this active process.

Rainbow Scenario : children often and spontaneously sit around the RLS. They discuss and share their newly acquired knowledge with the purpose to understand the mix of colors. Then, they are invited to share their findings with the rest of the class, while the teacher takes notes on the blackboard.

Reflect

This step consists in taking time to look back. Think again about the initial question, the path taken, and the actual conclusions. Student look back and maybe take some new decisions: "Has a solution been found ?", "did new questions appear?", "What could they ask now ?",...

Rainbow Scenario : teacher and students take time to look back at the concepts encountered during the earlier steps of the activity. They try to synthesize and to engage further planning on the basis of their recently acquired concepts.

Continuation

Once the first cycle is over, students are back the *Ask* step and they can choose between two options:

1. Ask: a new cycle starts, fed by the new questions or reformulations of earlier ones. The teacher can create groups to stimulate discussions and interest.
2. Answer: the activity is ending. The teacher has to finish it by broadening: The initial questions with their responses, the reformulated ones, new ones that appeared during the activity. Making a synthesis is always a better solution, even if this step is not the purpose of an entire cycle.

Rainbow Scenario : the teacher sets students free to repeat their experiments or to try different things. Some students try to replicate what their friends have done, others do the same things with or without variants. A new cycle begins.

The advantage of this model is that it can be applied with lots of student types and lots of matters. Moreover, the teacher can design the scenario by focusing on a part of the cycle or another. He can use one, few or more cycle. Most often, a single cycle (formal or not) is not enough and because of that, this model is often drawn in a spiral shape.

Other models

The model we presented above represents probably the dominant view of inquiry learning. It combines more radical open-ended socio-constructivist principles (Discovery learning) with a model of guidance. As opposed to Learning by design, most inquiry-based models do advocate opportunistic (i.e. adaptive) planning by the teacher. Other models include

- knowledge-building community model (a much more open ended version, geared toward "design mode")
- Scaffolded knowledge integration
- Learning by design
- Computer simulation (The "Dutch school")

Examples cases

- Le Monde De Darwin (Le monde de Darwin [5]) : Internet educational environment mostly for 8 to 14 years old students. The pedagogy is socio-constructivist, with treatment and organization of the information with collaborative work
- Cyber 4OS Wiki de l'IBL en cours [6] Lombard, F. (2007). Empowering next generation learners : Wiki supported Inquiry Based Learning ? (Paper [7]) presented at the European practise based and practitioner conference on learning and instruction Maastricht 14-16 November 2007.
- P. S. Blackawton et al. [Blackawton bees [8], December 22, 2010, doi: 10.1098/rsbl.2010.1056.
  - See also: 8-Year-Olds Publish Scientific Bee Study [9].

Tools and software

- BGuILE
- WISE
- Microworlds
- Any sort of tool that allows for collaborative writing, e.g. groupware, portals, wikis.

There are also microworlds and computer simulation environments that support inquire learning. A good example is represented by the CoReflect [10]/Stochasmos [11] project and tools.

See Also

constructivism, socio-constructivism, Case-based learning, discovery learning, WebQuest, Le Monde De Darwin, Project-based science model, ...

Links

- inquiry page [2]
- Computer Supported Inquiry Learning [1] Kaleidoscope and EARLI Special Interest Group (SIG)

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Instructional design model

Draft

Definitions

- “ Design is more than a process; that process, and resulting product, represent a framework of thinking” (Driscoll & Carliner, 2005:9)
- Usually, an *instructional design model* tells how to organize appropriate pedagogical scenarios to achieve instructional goals. In more abstract terms an *instructional design model* is a kind of abstract design rule for a given instructional design approach or a given pedagogic strategy.
- “ Instructional Models are guidelines or sets of strategies on which the approaches to teaching by instructors are based. Effective instructional models are based on learning theories. Learning Theories describe the ways that theorists believe people learn new ideas and concepts. Often, they explain the relationship between information we already know and the new information we are trying to learn.” Learning technology Service, NC State University [1] - 18:11, 18 May 2006 (MEST)]

This is just a short overview article, see also:

- learning theory for background information,
- instructional design for a definition of the field,
- pedagogic strategy for a different view on almost the same subject
- pedagogical scenario for more concrete teaching models
- instructional design method for design methods, these are also called instructional design models !
- educational technology for introduction to the field of educational technology (not technologies).

Types of design models

This section needs yet to be written

There are probably 2 broad categories:

1. Instructional Systems Design (ISD) Models that are what DSchneider calls instructional design methods, i.e. “ systematic guidelines instructional designers follow in order to create a workshop, a course, a curriculum, an instructional program, or a training session” (McGriff, 2001). A typical example would be ADDIE.
2. More general guidelines for designing and developing instruction at various levels of granularity. I.e. such models state what should happen during instruction, e.g. what kinds of activities learners and teachers are involved in. Typical examples are Gagne's behaviorist/cognitivist nine events of instruction or the socio-constructivist model for problem-based learning.

This quotation from Elean Qureshi's webpage (2004) shows again this ambiguity between the pursuit of instructional (or even educational) strategy and design methodology: “ Models for instructional design provide procedural frameworks for the systematic production of instruction. They incorporate fundamental elements of the instructional design process including analysis of the intended audience or determining goals and objectives (Braxton et al., 1995). An instructional design model gives structure and meaning to an ID problem, enabling the would-be designers to negotiate their design task with a semblance of conscious understanding. Models help to visualize the problem, to break it down into discrete, manageable units. A model should be judged by how it mediates the designer's intention, how well it can share a work load, and how effectively it shifts focus away from itself toward the object of the design activity (Ryder, 2001). Instructional models prescribe how combinations of instructional strategy components should be integrated to produce a course of instruction (Braxton et al, 1995)."

You can find some models by looking at the instructional design models category

Typology of different sorts of models

DSchneider belives that the term **instructional design model** is overloaded with various meanings. He suggests that we can find at least six kinds (at least for now):

1. Models that describe a pedagogic strategy in detail
   - Examples: Nine events of instruction (behaviorist/cognitivist), inquiry-based learning (constructivist)
2. Models that relate to the quality of a design.
   - Example: Merrill's First principles of instruction
3. Models that provide a method to create a design: See instructional design method
   - Example: Instructional systems design models like ADDIE
   - There exist submodels for things like defining goals, analysing a domain of knowledge, evaluation, etc.
4. Complementary models that will enhance a design
   - Examples: FEASP (emotion), Self-regulated strategy development model (strategy development), POME (self-regulation) ,Felder design model (learning styles)
5. Change management related models that specifically address the issue of introducing new pedagogics and associated instructional design models
   - Example activity theory-based expanded learning
6. Models that describe the functions of a learning environment
   - The Sandberg learning environment functions

These types can be complementary in certains ways, but not in every way. I.e. a typical instructional systems design method is probably not appropriate for the design of a open-ended project-based learning design.

Typology of pedagogic strategy models

These models define a pedagogic strategy as a design, i.e. something that you can take and adapt to produce an interessting pedagogical scenario.

This typology is based on learning types and formal vs. non-formal education.

For the moment, table entries are not very complete, also consult the list of instructional design models.

Learning Type	Formal situation	Open / informal situation
Learning I-a (information)	Lecturing, teleteaching, "page turners", drill and practise, ...	On-demand tutorials, handbooks, ...
Learning II-b (concepts)	Writing-to-learn, Exploratory concept learning	Literature review
Learning II-a (small know how)	Exercising, e-instruction, simulations, ...	on-demand e-instruction, self-learning with textbooks, ...
Learning II-b (big know how)	Problem-based learning, Inquiry-based learning, Simulation and gaming,...	help desk model, on-demand tutoring, knowledge management,...
Learning III (knowing in action)	Project-based learning, formal learning e-portfolios, ...	Communities of practice, Mentoring, ...

List of instructional design models

- see entries of the category " instructional design models"

Bare-bones

Instructional design models and instructional design methods can be very complex. However, there are some common questions an educator or a course designer should ask:

1. What do the learners have to learn ? This does not just include definition of the subject matter but also the learning type (in particular the learning level) and a sort of description of what the learner should be able to do with his new knowledge.
2. Who are the learners ? This includes assessment of their entry skills and maybe learning styles.
3. What is the setting ? How many learners ? How much resources can you spend ? Who is teaching ? Is the design "industrial" (i.e. a canned product) or can it be dynamically changed ?
4. Given these constraints, what are the appropriate strategies and instructional design models. Do we need a formal instructional design method ?
5. How should we evaluate the learning ? Are their institutional rules ?

Brent Wilson (1997) asks: “ Is 'content' defined as "What is," "What is presented to the student," or What is expected to be learned?"”. Most likely, we have to answer at least all these three questions. Once we answered these questions, we have to figure out how to design teaching and learning activities.

A bare-bone's instructional model is outlined in Alessi and Trollop (2001:7-10) and called **process of instruction**. It has four components that usually, but not necessarily, are implemented in this order:

- Presentation of information to learners (e.g. with tutorials or hypermedia)
- Guidance of leaners' first interaction with the material
- Learners practicing the material to enhance fluency and retention (drills, simulations, construction tools, etc.)
- Assessment of learners to determine how well they have learned the material and what they should do next.

Links

needs to be completed

- The *best meta resource* regarding serious theory on the Internet is Martin Ryder's Instructional Design Models [2]
- Applying Learning Theories to Online Instructional Design [3]
- Instructional Design & Learning Theory [4]
- Depover Christian, Bruno De Lièvre, Jean-Jacques Quintin, Filippo Porco et Cédric Floquet. Les modèles d'enseignement et d'apprentissage [5]
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Instructional systems design

Draft

Definition

- **Instructional Systems Design (ISD) Models** that are what DSchneider calls instructional design methods, i.e. “ systematic guidelines instructional designers follow in order to create a workshop, a course, a curriculum, an instructional program, or a training session” (McGriff, 2001). Typically, ISD models adopt a behaviorist/cognitivist stance.
- In a narrow view: ISD == ADDIE
- Donald Clark states the reasons of ISD:

Simply stated, this process provides a means for sound decision making to determine the who, what, when, where, why, and how of training. The concept of a system approach to training is based on obtaining an overall view of the training process. It is characterized by an orderly process for gathering and analyzing collective and individual performance requirements, and by the ability to respond to identified training needs. The application of a systems approach to training insures that training programs and the required support materials are continually developed in an effective and efficient manner to match the variety of needs in an ever rapidly changing environment.

Examples

- You may explore the category design methodologies and maybe instructional design modes to find other models.

Typical examples for the ISD approache are:

- ADDIE (seems to be *the* model).
- Reeves multimedia design model
- Systematic Design of Instruction (Dick & Carey Model)
- SAT (System Approach to Training) seems to by a homonym of ISD.

Links

(Note: There should be more links ...)

- Instructional Design & Development [1] (Entelechy.com). This is a typical and simple "how-to".

References

- Donald Clark (2000), Introduction to Instructional System Design, web site [2]. Recommended on-line introductory handbook.
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Instructional time

Draft

Definition

- “ The fact is that instructional time. has the same scientific status as the concept of homeostasis in biology, reinforcement in psychology, or gravity in physics. That is, like those more admired concepts, instructional time allows for understanding, prediction, and control, thus making it a concept worthy of a great deal more attention than it is usually given in education and in educational research” (Berliner, 1990).

Types of instructional time

"When we speak of instructional time we refer to a family of concepts, some of which have not yet achieved the status of concepts in other, more mature scientific fields" (Berliner, 1990).

We shortly present Berliner's different dimensions (read the original [2] for details):

1. **Allocated time**, usually defined as the time that the state, district, school, or teacher provides the student for instruction.
2. **Engaged time**, usually defined as the time that students appear to be paying attention to materials or presentations that have instructional goals.
3. **Time-on-task**, usually defined as engaged time on particular learning tasks. Engagement in particular kinds of tasks is what is wanted (not just general engagement).
4. **Academic learning time** (ALT), usually defined as that part of allocated time in a subject-matter area (physical education, science, or mathematics, for example) in which a student is engaged successfully in the activities or with the materials to which he or she is exposed, and in which those activities and materials are related to educational outcomes that are valued.
5. **Transition time**, usually defined as the noninstructional time before and after some instructional activity.
6. **Perseverance**, usually defined as the amount of time a student is willing to spend on learning a task or unit of instruction.
7. **Pace**, usually defined as the amount of content covered during some time period.

Time to learn

“ Gettinger (1984) reviews a substantial body of research in which measures of time to learn a particular kind of subject matter and conventional measures of intelligence, have both been used to predict learning. The time to learn (TTL) measures are usually as good or better predictors than are the intelligence measures. Moreover, the variance shared by these two measures is not too large, indicating they are different, though related, measures of aptitude. For school people, however, aptitude measured as simple TTL would yield much more useful information than aptitude measured as intelligence. ” (Berlinger, 1990)

Therefore, Berlinger claims that “ The transformation of aptitude from a mysterious and hard-to-modify quality of the individual into an instructional time variable, and an alterable one at that, is an important contribution to our thinking about students and about schools. The increased understanding of instructional processes through this insight may itself be worth all the contemporary fuss about the importance of instructional time for our thinking about schooling.”.

See also the Carroll model of school learning that was very influential for framing the "instructional time" questions and the mastery learning instructional design model.

The ALT model

Academic learning time (ALT), is defined by Berliner (1990) as that part of allocated time in a subject-matter area (physical education, science, or mathematics, for example) in which a student is engaged successfully in the activities or with the materials to which he or she is exposed, and in which those activities and materials are related to educational outcomes that are valued (Berliner, 1987; Fisher et al., 1980).

This is a complex concept that includes or related to others:

1. allocated time (the upper limit of ALT)
2. time-on-task (engagement in tasks that are related to outcome measures, or, stated differently, time spent in curriculum that is aligned with the evaluation instruments that are in use);
3. success rate (the percent of engaged time that a student is experiencing a high, rather than low, success experience in class)
4. degree of alignment of the curriculum with the outcome measure.

Compared to the Carroll model, ALT attempts to provide a time metric for all variables and therefore makes it more suitable for empirical investigation.

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Instructional transaction theory

Draft

Definition

- Merril's Instructional transaction theory aims to develop instructional algorithms.

The model

The instructional transaction

Merrill et al. propose an activity-based model of instruction that is based on two important concepts: The **instructional transaction** and a delivery tool, the **transaction shell**. See also the more recent IMS Learning Design educational modeling language.

" **Instructional transactions** are instructional algorithms, patterns of learner interactions, usually far more complex than a single display and a single response, which have been designed to enable the learner to acquire a certain kind of knowledge or skill. Different kinds of knowledge and skill would require different kinds of transactions. The necessary set of these instructional transactions are designed and programmed once, like other computer applications such as spread sheets. They can then be used with different content topics as long as these topics are of a similar kind of knowledge or skill. " (Merrill, Li and Jones, 1991).

" An instructional transaction is a mutual, dynamic, real-time give-and-take between an instructional system and a student in which there is an exchange of information. It is the complete sequence of presentations and reactions necessary for the student to acquire a specific type of instructional goal. It requires active mental effort by the student. Its effectiveness is determined by the match between the nature of the student's interaction and resulting mental processing with the type of task and subject matter content to be learned." (Merrill, Li and Jones, 1991).

" A **transaction shell** is the structure of a transaction identifying the interactions, parameters, and knowledge representation needed for a given class or family of transactions. When a transaction shell is instantiated with a particular subject matter and with particular values for its parameters, it is called a transaction instance. Both a transaction shell and a transaction instance are pieces of computer code that, when delivered to a student via an appropriate delivery system, cause a transaction or set of transactions to occur." (Merrill, Li and Jones, 1991).

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Kemp design model

Draft

Definition

The Jerold Kemp instructional design method and model defines nine different components of an instructional design and at the same time adopts a continous implementation/evaluation model.

Kemp adopts a wide view, the oval shape of his model conveys that the design and development process is a continuous cycle that requires constant planning, design, development and assessment to insure effective instruction. The model is systemic and nonlinear and seems to encourage designers to work in all areas as appropriate (Steven McGriff).

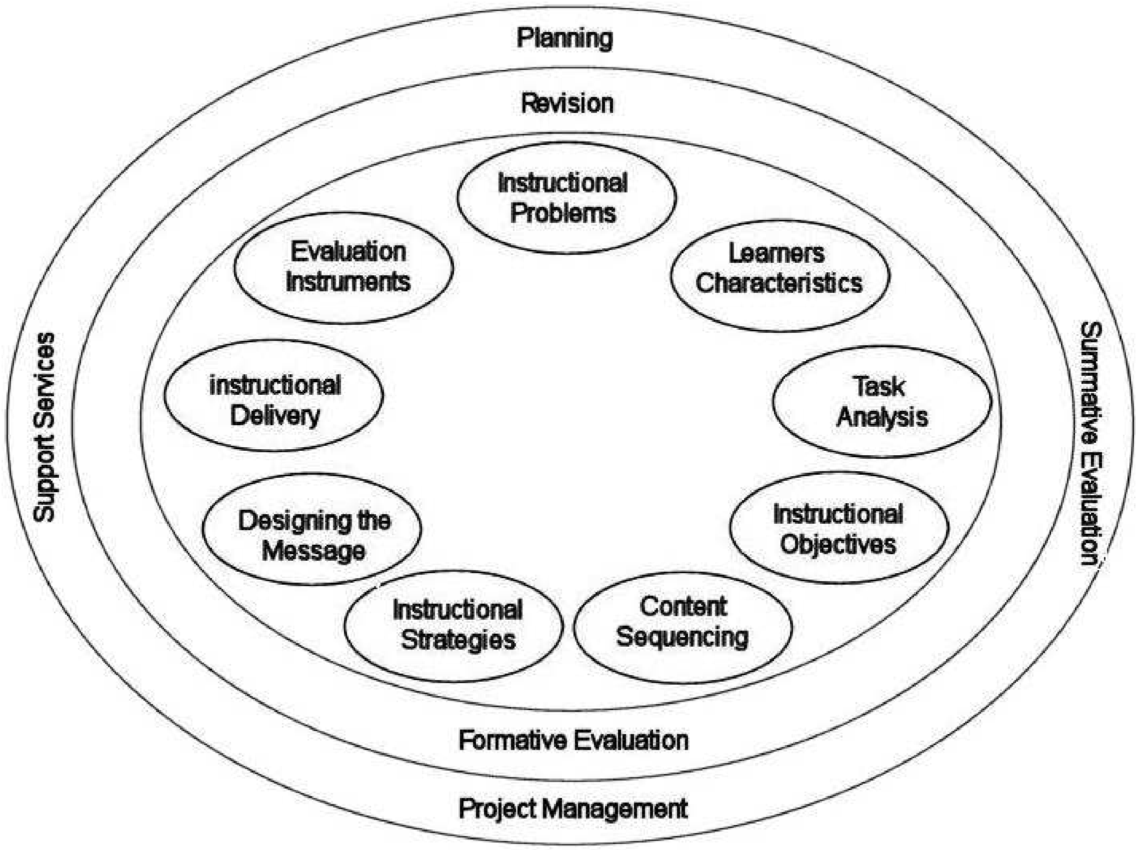
The model is particularly useful for developing instructional programs that blend technology, pedagogy and content to deliver effective, inclusive (reliable) and efficient learning.

The model

According to Steven McGriff's web page [1] (retrieved 18:37, 19 May 2006 (MEST)), Kemp identies nine key elements

1. Identify instructional problems, and specify goals for designing an instructional program.
2. Examine learner characteristics that should receive attention during planning.
3. Identify subject content, and analyze task components related to stated goals and purposes.
4. State instructional objectives for the learner.
5. Sequence content within each instructional unit for logical learning.
6. Design instructional strategies so that each learner can master the objectives.
7. Plan the instructional message and delivery.
8. Develop evaluation instruments to assess objectives.
9. Select resources to support instruction and learning activities.

According to Elena Qureshi's web-page [7] on instructional design: " The Kemp (1994) design model takes a holistic approach to instructional design. Virtually all factors in the learning environment are taken into consideration including subject analysis, learner characteristics, learning objectives, teaching activities, resources (computers, books, etc.), support services and evaluation. The process is iterative and the design is subject to constant revision. The immediate feel of being iterative and inclusive, and particularly the fact that the central focus is the learner needs and goals are the strengths of this model. There is also a focus on content analysis, as there would be in any educational design and a focus on support and service, which is not present in other ID models. Much like the Knirk and Gustafson design model, Kemp's model is also small scale and can be used for individual lessons."



Links

- Elena Qureshi & Larry Morton (2006) http://lts.ncsu.edu/guides/instructional_design/selecting_models2.htm (Large web page with good comments, good for comparison also), retrieved 17:42, 19 May 2006 (MEST).
- http://www.quasar.ualberta.ca/edit573/modules/module4.htm
- Steven McGriff's Instructional Systems Design Models page HTML [6]
- Steven McGriff's Kemp Model Page HTML [1].

References

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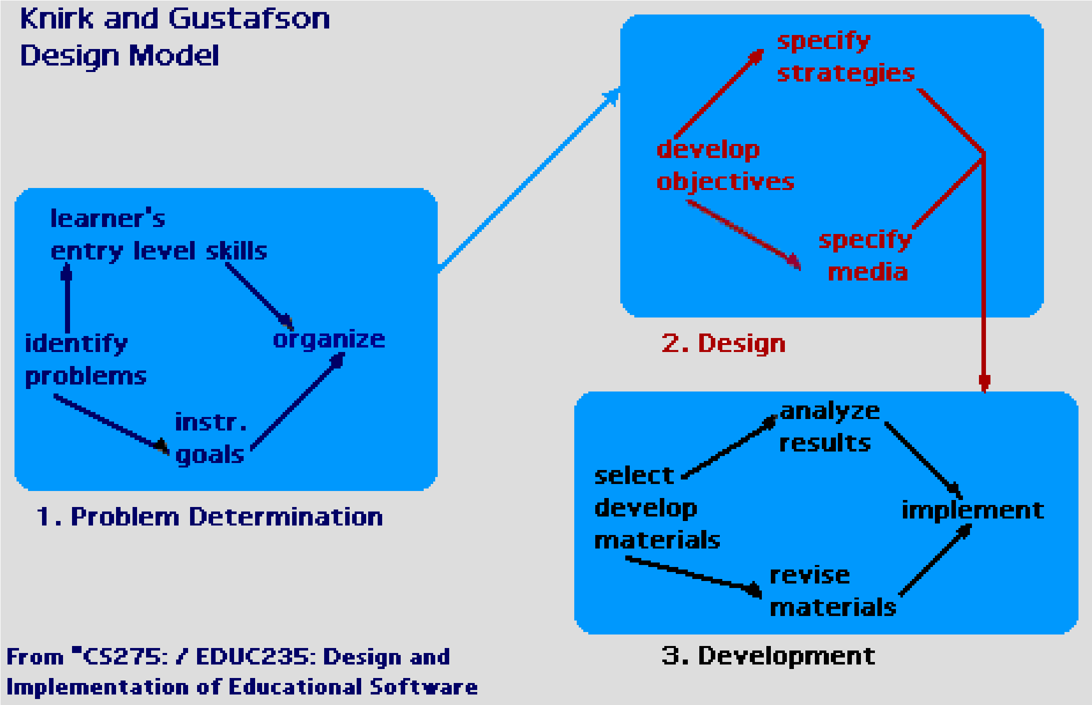
Knirk and Gustafson design model

Draft

Definition

The Knirk and Gustafons design method and model is prescriptive stage model for instructional designers.



The Model

Knirk and Gustafson (1986) designed three stage process which includes problem determination, design and development.

1. The problem determination stage includes identification of the problem, definition of the pedagogical goals and identification of what the learners can do (knowledge, skills, learning styles, affect, etc.)
2. The design stage includes developing objectives and specifying strategies.
3. The development stage includes development of materials, testing and revision.

Links

- http://ed.isu.edu/isdmodels/Knirk/Knirk.html
- http://delta.ncsu.edu/teach/instructional_design/

LAMS

Draft

Definition

Learning Activity Management System (LAMS) is a learning design system for authoring, delivering and monitoring learning activities, i.e. a learning activity management software supporting pedagogical workflows.

See also:

- The CeLS and DialogPlus Toolkit systems (other LD systems)
- Educational modeling language and IMS Learning Design (general topic)
- LAMS installation and configuration (administrators)

Description

LAMS provides:

- a visual authoring interface to design and create learning sequences from a list of building blocks of individual or collective activities
- a monitoring tool through which teachers can track students' progress through an activity sequence.

According to a LAMS website, LAMS includes environments for user administration, student run-time delivery of sequences, teacher run-time monitoring of student sequences and, most importantly, teacher authoring/adaptation of sequences. LAMS is inspired by, and heavily based on, IMS Learning Design and EML. Originally, LAMS was not designed to be a reference implementation of either specification - however LAMS is expected to be IMS Learning Design conformant in the future.

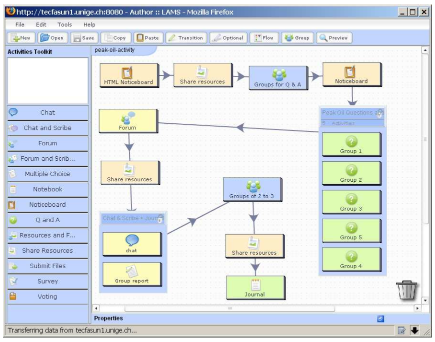
According to Krann (2003), “ The heart of the system is a visual editor that allows educators to choreograph a whole learning activity around a particular topic. By dragging and dropping acts like synchronous discussion (chat), web polls, students posting material and structured debates, a series of online lessons can be planned much like a conventional lesson. The player part of the system then allows a group of students to take part in all these activities, and presents the right tools at the right time, and divides the group into smaller groups, if that's what the teacher designed.”

The LAMS 2 environment

Authoring

Basically, an author has to do the following tasks:

1) Assemble a learning sequence with a on-line visual authoring tool.



The LAMS on-line authoring toolkit

Here is a summary of the authoring steps:

- Drag an activity component from the activities toolkit to the main central panel.
- Connect these with the sequence tools on top (e.g. use the "transition" link").
- Double click on an instance of the tool to edit and configure each tool.
- Preview the sequence.
- Save the sequence.

2) Assign learning sequences to groups (administrator must give him the rights). Otherwise LAMS may be available through your LMS (e.g. Moodle) and rights will be transparently handled. E.g. A Moodle student of a Moodle course can use a LAMS activity of this course.

Getting started as an author

Best method is to look at examples.

- You may download dozens of good scenarios from the public LAMS Sequences [1] repository. Probably it's easier to start from the community home page [4].
- You can through the file menu of the authoring tool simply import these (V2 will also load V2 scenarios).

Members and courses

This part is not obvious if you don't read the documentation.

Learning Areas

- LAMS is organized by "Groups". These are in fact areas where learning/teaching happens. You can consider them as "courses" for instance.
- Therefore, first thing to do as an administrator is to create groups

```
MyGroups -> Group Mgmt
```

Learning Groups

- These are Groups withing LAMS Groups (what I called learning areas)
- Within each "group" the admin must assign roles, at least a teacher who has the right to author and to assign users to a subgoup.

Note: LAMS 2.1 may be easier, and using it through Moodle is even easier.

Standardization of LDs and services

LAMS and Learning Design

LAMS initially adopted a very similar design rationale, i.e. authoring of scenarios that is based on learning activities. It particularly support a rich conversational framework à la Laurillard.

Plans are there to become IMS Learning Design compatible (DSchneider didn't look at details yet). LAMS 2.0 exports to learning design level A. Daniel K. Schneider thinks that this is only true at a very formal level, i.e. the LD export contains code like this:

```
<method>
 <play>
   <act>
     <role-part>
       <role-ref ref="Learner" />
        <activity-structure-ref ref="A-Sequence" />
        </role-part>
   </act>
  ....
```

```
<activity-structure xmlns="http://www.imsglobal.org/xsd/imscp_v1p1" structure-type="sequence" identifier="A-sequence">
  <title>LAMS Learning design sequence</title>
  <learning-activity-ref ref="A-lanb11-109" />
```

.....

```
<learning-activity xmlns="http://www.imsglobal.org/xsd/imscp_v1p1" identifier="A-lanb11-109">
 <title>Noticeboard</title>
  <environment-ref ref="E-lanb11-109" />
  <complete-activity>
    <user-choice />
  </complete-activity>
  <lams:lams-tool-activity>
     <lams:activityID>113</lams:activityID>
     <lams:activityUIID>64</lams:activityUIID>
     <lams:description>Read noticeboard</lams:description>
     <lams:activityTitle>Noticeboard</lams:activityTitle>
     <lams:helpURL>http://wiki.lamsfoundation.org/display/lamsdocs/lanb11</lams:helpURL>
     <lams:xCoord>106</lams:xCoord>
```

This means that the LD interpreter must know about LMS tools which is perfectly legal as far as I can tell (XML itself and all IMS specifications '**are**' extensible. In practice however, this means that a Learning Design made with LAMS will only run within LAMS. However, this is not a LAMS issue in itself but instead a lack services definitions in the IMS Learning Design specification. To over come this limitation LAMS has proposed a Tool Contract [2].

I don't know if there is some sort of initiative to standardize vocabularies that describe activities with specific kinds of tools such as the ones that exist in LAMS.

LAMS Tools contracts

One of the core components of the LAMS V2 architecture is the "Tools Contract". To be written, see this [2].

Evaluation

Masterman and Lee

Masterman and Lee (2005:4) who ran an evaluation of LAMS 1.x with 34 participants in the UK reported the following findings:

i) LAMS is capable of supporting a range of pedagogical approaches, in that designers can select those activities that match their preferred style. However, the lack of support for images and graphics can be a hindrance to the design of appropriate learning tasks. The adoption of LAMS within an institution would almost certainly entail an increased workload for teachers, but with time and experience this load could be expected to lessen.

ii) LAMS appears neither to have compromised learning outcomes in comparison with the existing learning environment nor to have resulted in dramatic improvements in achievement. However, using LAMS to raise the level of learning outcomes was not a prime consideration for practitioners. Rather, they perceived its benefits to lie in increasing learners' motivation and in encouraging participation by more reticent students. Feedback obtained directly or indirectly from learners suggests that some appreciated the independence and freedom to work at their own pace, while others did not like the linearity of LAMS sequences or wanted more direct feedback on their progress.

iii) Several participants engaged in some form of reflective activity either while designing a LAMS sequence or afterwards. However, while they recognised the importance of sharing their practice with others, technical and cultural barriers need to be overcome.

D. Schneider

- LAMS is the only stable and free e-learning tool that combines pedagogical sequencing with online activities.
- Authoring of sequences is really easy compared to other tools. So far (Nov 2009/2010), LAMS is the only tool that implements the learning design spirit in a teacher-usable way.
- The documentation is good.

I tested LAMS with a social science methodology sequence and the experience has been rather positive. This includes student's appreciation. In another class, the same students then had to design small sequences and that rather went well.

However, LAMS is not very suitable for project-oriented learning designs. I wonder wether one could envision two LAMS interfaces in the future:

1. LAMS sequencing (the current one)
2. LAMS project (an interface where activities happen around some central tools)

At some point and for some future version of LAMS (e.g. 2.5) we also might discuss the following idea.

As it is, LAMS is a learning design system and based on aplay-act metaphor that you also have in IMS/LD. In addition, in LAMS there is some stuff that can be found in IMS/SS. While "LD" models in principle allow for "Go to" programming (level C in IMS-LD), it's not really meant for non-theatical scenarios.

I now just wonder whether one could image a "LAMS project" version to allow for repetitive and cyclic scenarios. To do so, we need at least another tool I'd call "Teacher announce", i.e. a simple board that tells learners what to do next and also provide feedback. Could be just a "View on a single forum, technically speaking.

Example: Announce-> Wiki->Announce->Wiki->Announce->Resource + Wiki (create a list) (revise list) (expand list)

Wiki is always the same.

Of course, visually, this should then be presented with different transitions (non-linear numbered arrows, only ONE node for the Wiki). The learner UI would also be different and look very much like the authoring interface. Steps that students did not take yet (e.g. announce #4 and beyound) could be hidden. Important also: teachers should be able to add stuff in real time, e.g. the monitoring interface = authoring interface.

This would take time to implement, BUT for starters one could just parametrize all the tools to get rid of the complicated sequencing stuff ;) ... a thought I need to expand - Daniel K. Schneider 23:56, 5 March 2010.

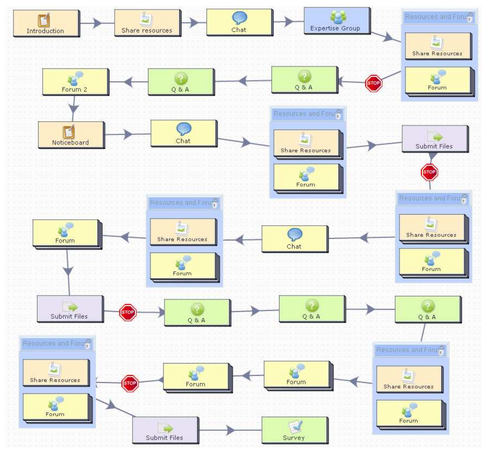
Lams sequence examples

Below we describe two examples found on the the community home page [4]. You can download them yourself in your own LAMS server.

Writing research paper

- Writing Research Paper sequence and description [3], authored by Hanh Vo.

Here is a copy of the description (retrieved 16:30, 9 December 2006 (MET)) and a screen dump of the imported sequence:



Writing research paper sequence authored by Hanh Vo

The course is designed to teach international students in an English Center. These students are graduated students whose first language is not English. They may come from many different countries and different majors. It is two months language skills and academic preparation course for studying at university. The course guides step by step to complete an academic research. Students are expected to acquire skills for university study like researching essay topics, writing assignments and reports. It also aims to help students become an independent and self-directed leaner. Besides, they also have chance to get knowledge on their major. In the course, students will do almost all activities online, but at some stages, teacher will stop and give some helps or consultations to help them complete their project. Some online activities require students to work asynchronously like discussion at a forum, but sometimes they have to work synchronously such as chatting with their friends at scheduled online discussion. The course is divided into 5 stages:

- Choosing topic
- Writing research proposal
- Writing literature review
- Writing findings, conclusions
- Completing

At the end of each stage, students have to submit assignments for teacher to know how students' progress. Then they will get feedback from the teacher at consultation. Consultation is also the time for teacher to correct, encourage, and give advices to help students sharpen their knowledge, increase motivation and improve at the next steps. Knowledge will be acquired and increase through the process. At the end of the course, students are required to have capability to write an academic research by themselves. The end result will be a portfolio of work that demonstrates students' achievement and progress during the course.

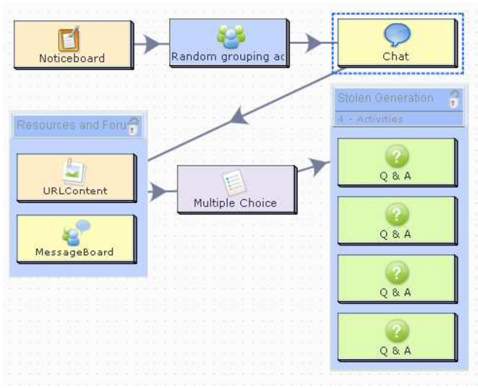
Here is a screendump of the authoring Window. DSchneider imported this LAMS 1.x sequence into LAMS 2.0 and rearranged the icons into a "serpent" position.

Stolen Generation

- Stolen Generation [4], authored by Debbie Evans. Here is the description found in the repository (16:30, 9 December 2006 (MET)) and a screen dump of the sequence imported into our LAMS 2.0 system:

A stage 3 sequence which addresses some of the issues faced by the Stolen Generation of Australian Indigenous Aboriginal and Torres Strait Islanders during the 20th century.

- Keywords: Stolen Generation, Aboriginal and Torres Strait Islanders, Traditions & Heritage
- Subject:Human Society & Its Environment, Australian History
- Audience: Stage 3-4 (Yrs 5-8)
- Run time: 1-2 weeks
- Delivery Mode: off- and on-line
- Resources: Personal stories, Wikipedia,
- Outline of Activities:



Stolen Generation sequence authored by Debbie Evans

1. Read number of personal stories about the Stolen generation: Personal stories [5] and Stolen generations [6].
2. Students would start the LAMS sequence.The grouping tool breaks the class into 4 groups.
3. The chat helps to consolidate understanding of the content of the personal stories.
4. The share resources takes the students to a wiki about the Stolen Generation.
5. The forum allows open discussion about the details in the wiki, in particular the facts and their opinions about this policy.
6. A multiple choice quiz further consolidates the facts about the Stolen Generation.
7. An optional Q & A task appears where students can select to answer a question from a different point of view.

This sequence could be adapted and modified by including a writing task where assessment can be made by submitting a file.

Links

Installation tips

- See LAMS installation and configuration. You'll find not only technical installation links, but also my installation notes for LAMS 2.1x on Solaris (yes I managed) - Daniel K. Schneider 19:18, 20 March 2008 (MET)

Manuals and Tutorials

LAMS 1 (obsolete)

- Getting Started guide [7]
- Teacher's Guide [8]
- Learner's Guide [9]
- Administration Guide [10]

LAMS 2

Here are the IMHO's most important getting started links:

- LAMS Tutorials [11]. A larger set of animated LAMS presentation tutorials (Winks). For people who feel challenged with text ;)
- LAMS authoring [12] (for teachers, one of the best places to start for online reading)
- LAMS 2 Teacher's Guide [13] (75page PDF manual, read this !)

- LAMS learner [14] (important navigation information that should be handed out to learners)

More LAMS links

The LAMS project maintains several websites.

- LAMS Foundation [15], includes manuals, downloads, etc.
- LAMS documentation wiki [16]. **Best place to start** for designers, teachers and learners
  - About LAMS [17]
  - Short technical guide to LAMS [18]
  - much more, e.g. frequently asked questions ...
- LAMS Community.org [4]. A site for course designers and teachers to share
  - You can download public LAMS Sequences [1]. To understand LAMS authoring it is probably a good idea to import a few of these and play.
  - Getting Started FAQ [19]
  - Using LAMS FAQ [20]
  - Presentations about LAMS [21] (For those who prefer to look at PPTs instead of real text).
  - Support forums
  - ... and more, dig around !
- LAMS International [22], provides commercial services around LAMS.
- **Links for technical people** (e.g. those who install servers and program)
  - technical community [23]
  - Internationalization web site [24] - LAMS Wiki explanation page for translators [25]
  - LAMS Technical Wiki [26] (for people who need to install)
  - Bug report server [27] (you may check this before reporting bugs)
- Links to testing servers
  - Translation test server [28] (login restricted to translators)
  - LAMS demo server [29] (for testing you can require a login)

LAMS Conferences (including online papers)

- 3rd International LAMS & Learning Design Conference [30] Sydney 2008
- 2009 European LAMS & Learning Design Conference [31] 7th July, 2009 Milton Keynes, UK
- 2010 European LAMS & Learning Design Conference [32] 15th July, 2010 Wolfson College, Oxford, UK

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- Laurillard, Diana (2008). Perspectives on learning design – a report on the 3rd International LAMS and Learning Design Conference, December 2008, Macquarie University, Sydney, HTML [37]
- Matt Bower (2009),Using LAMS to Facilitate A ‘Pedagogy-First’ Approach to Teaching Learning Design, Teaching English with Technology – Special Issue on LAMS and Learning Design volume 2, 9 (3), 42-52.[38]

Laurillard conversational framework

Draft

Definition

Laurillard (1993,2002) claims that there are four main aspects of the teaching-learning process and that different educational media can be analyzed (and used) in terms of these dimensions.

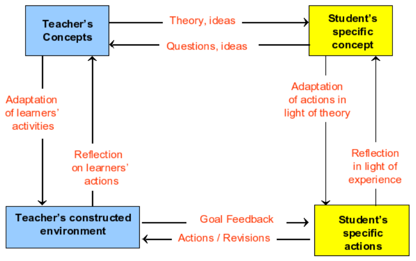
This framework can be considered both learning theory and a practical framework for designing educational environments. Higher education, according to Laurrillard is much about acquiring "ways of seeing the world". Associated pedagogic strategy has to consider different forms of communication and associated mental activities: Discussion, adaptation, interaction, reflection.

See also guided discovery learning

Design of learning environments

Laurillard's framework includes four important components:

- Teacher's concepts
- Teacher's constructed learning environment
- Student's concepts
- Student's specific actions (related to learning tasks).



Laurillard's Conversational framework

Each (larger) pedagogical scenario should include all four kinds of activities (communication forms) that happend in 8 kinds of "flows" in the model.

(1) Discussion

between the teacher and the learner

- Teachers' and learners' conception should be mututally accessible
- Both should agree on learning objectives

(2) Adaptation

of the learners actions and of the teacher's constructed environment.

- Teacher must adapt objectives with regards to existing conceptions
- Learners must integrate feedback and link it to his own conceptions

(3) Interaction

between the learner and the environment defined by the teacher

- Teacher must "adapt to world", i.e. create an environment adapted to the learning task given to the learner
- Teacher must focus on support for task and give appropriate feedback to the learner.

(4) Reflection

of the learner's performance by both teacher and learner

- Teacher should support the learner to revise his conceptions and to adapt the task to learning needs
- Learners should reflect with all stages of the learning process (initial concepts, tasks, objectives, feedback, ...)

Media and activities

According to Philipps (1988), “ Laurillard argues that the only use of technology which can meet these aims is the "multimedia tutorial simulation", characterised in terms of guided discovery learning. Her schema is based on forming an information rich environment in which the student has control in discovering knowledge, but the discovery is supported and scaffolded by extra guidance functions (Laurillard, 1993) which provide support and feedback for subsequent learning. These functions are analogous to the coaching and scaffolding at critical times proposed in the Situated Cognition Theory.”

Laurillard argues that different media *forms* have different affordances, i.e. provide a different level of support for various kinds learning experiences. She identifies five media forms: narrative, interactive, communicative, adaptive and productive. According to Conole and Fill (2005), “ Narrative media tell or show the learner something (e.g. text, image). Interactive media respond in a limited way to what the learner does (e.g. search engines, multiple choice tests, simple models). Communicative media facilitate exchanges between people (e.g. email, discussion forum). Adaptive media are changed by what the learner does (e.g. some simulations, virtual worlds). Productive media allow the learner to produce something (e.g. word processor, spreadsheet).”

The following table is from Peter Clinch [1] (2005)

learning experience	method/technologies	media forms
attending, apprehending	print, TV, video, DVD	narrative
investigating, exploring	library, CD, DVD, Web resources	interactive
discussing, debating	seminar, online conference	communicative
experimenting, practising	laboratory, field trip, simulation	adaptive
articulating, expressing	essay, product, animation, model	productive

Links

- The Conversational Framework [2] (DEAD LINK 24/07/2014)
- A conversational framework for Instruction [3] (nice chart)
- Interaction in Frameworks for Course Design - PPT [4] (DEAD LINK 24/07/2014)
- Diana Laurillard's conversational model [5] Part of a GLOW [6] text on What educational theories apply to web-based learning? (DEAD LINK 24/07/2014)

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Learning by design

Draft

Definition

- **Learning by Design**(tm) (LBD), a project-based inquiry approach to science learning with roots in case-based reasoning and problem-based learning.

Objectives

According to Kolodner et al. (2003), the goal of the LBD group “ [...] has been to use what we know about cognition (see, e.g., Bransford, Brown, & Cocking, 1999) to fashion a educational approach for middle-school science appropriate to deeply learning science concepts and skills and their applicability, in parallel with learning cognitive, social, learning, and communication skills. Our intention was that the approach would lay the foundation, in middle school, for students to be successful thinkers, learners, and decision makers throughout their lives, and especially to help them begin to learn the science they need to know to thrive in the modern world”.

The model

The LBD model has two major connected components:

1. A design/redesign cycle
2. An investigation cycle

Kolodner, Crismond, Gray, Holbrook & Puntembakar (1998) summarize the essential components of **Learning by Design** as follows (paragraph breaks by DKS):

The typical sequence of activities in a Learning-by-Design unit has students encountering a design challenge and attempting a solution using only prior knowledge -- individually and/or in small groups. In whole-class discussions, the teacher helps students compare and contrast their ideas, identify what they need to learn to move forward in addressing the design challenge, choose a learning issue to focus on, and design and/or run a laboratory activity to examine that issue. This discussion provides an opportunity for the teacher to identify student misunderstandings and misconceptions and begin the process of supporting those. The teacher might also present demonstrations, assign readings, and/or present short lessons relevant to discovered knowledge gaps.

Following this are cycles of exploratory and experimental work, followed by reflection on what has been learned, application of what was learned to achieving the design challenge, evaluation of that application, and generation of additional learning issues.

Potential solutions to the design challenge are attempted in each cycle and evaluated by building and testing a model or actual device; comparing different design alternatives based on qualitative and/or quantitative understandings; or analyzing using established design guidelines or the ratings of experts. Within this cycle are several opportunities for students to share their work with others and hear their feedback and ideas. Important during these "gallery walks" and "pin-up sessions" is that students justify their design decisions and explain how their designs work (or would work) using science and engineering vocabulary.

Kolodner et al., 1998 [1], retrieved 18:42, 19 July 2006 (MEST).

For more details, see for the moment What is LBD? [2] and publications below.

Tools and software

- SMILE (software to help students organize their thoughts into logical subjects). [Note: We have to find out if and where this is available]
- Observation Prompt Tool [3] (HTML version of a worksheet)
- LBD Fidelity Report Card [4] (HTML version of a worksheet)

Examples cases

See: http://www-static.cc.gatech.edu/projects/lbd/units.html

- Launcher units (To launch physical science, experiment design, ...)
- Digging in (To launch earth science, modelling, ..)
- Vehicles in motion (Forces and motion)
- Tunneling Across Georgia

Links

- Learning by Design [5] homepage. Hosted at Georgia Institute of Technology.

References

- See also: Learning by Design publications page [6]. Many papers are freely available in PDF or HTML form.
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- Kolodner, J.L., Crismond, D., Fasse, B., Gray, J., Holbrook, J., Puntembakar, S. (2003, in press). Putting a Student-Centered Learning by Design (TM) Curriculum into Practice: Lessons Learned. Journal of the Learning Sciences, Vol.12 No.4. Abstract/PDF [11] (*Access restricted*).
- Chris Quintana, Brian J. Reiser, Elizabeth A. Davis, Joseph Krajcik, Eric Fretz, Ravit Golan Duncan, Eleni Kyza, Daniel Edelson, Elliot Soloway. (2004) A Scaffolding Design Framework for Software to Support Science Inquiry. Journal of the Learning Sciences 13:3, 337-386

Textbook genres and examples

Draft

Definition

“ Does a reprint of a Shakespeare play used as part of a learning programme constitute a textbook? Is an Open University workbook a textbook? Is a collection of mathematical exercises a textbook? Is a shorthand exercise book used by colonial administrative clerks in prewar India a textbook? Would an alien anthropologist be justified in considering the Bible as a textbook? [...] There is such a wide range of uses for the textbook, from garage manual to classroom aid, that a typology of uses offers little analytical consistency.” (Issit, 2005)

This article attempts to identify various genres of textbooks. See also:

- Textbook (Introduction)
- Textbook research
- Textbook writing tutorial

This articles attempts to do three things

- List some criteria to look at textbooks
- Summarize some examples of various kinds
- Come up with a provisional taxonomy

Daniel K. Schneider doesn't have many textbooks at hand (it's really not a tradition in a Swiss research university). But in order to write this article, I looked at some I do have and took a few that I respect. Therefore some of the writing here is biased towards fields I work in and quality textbooks.

Genres of textbooks, a first look at criteria

As argued in the textbook article, according to the educational context and pedagogy adopted by a teacher, textbooks can have very different functions and probably need to be organized in a different way. There are different ways to look textbooks and it may not be easy to define a taxonomy based on good criteria.

Daniel K. Schneider (after a little research) couldn't find any prominently cited list of textbook genres. Therefore I suggest looking at a few kinds of features that might help defined textbook features that might be used to build a taxonomy of genres. In addition, I will summarize features of a few books I have on my shelf.

According to genres of teaching media

(Sigurgeirsson 1990, DsU 1980:4) cited by Johnsen distinguish five kinds "teaching media". In their pure form, Daniel K. Schneider would hesitated to call them textbooks. However, textbooks come in various forms and some of these textbook forms can be close to these genres. In addition, teachers may use these texts as textbooks.

- basic texts
- manuals
- workbooks
- reference books
- exercise books

These forms may be linked to their function in the global pedagogical design. E.g. a university teacher who "owns" his lectures, presents his own work-through example, designs his own assignments, etc. probably is rather interested in a pedagogically well written manual than a typical (lengthy) US textbook.

According to amount of "built-in pedagogy"

There are parameters that this is a manual define how much "built-in pedagogy" is needed. Typically in small classrooms or systems with strong tutoring support, there is less need.

Here are few typical setups for which textbook needs may be different:

- Small classrooms (with less than 20 students)
- Large classrooms (teacher can not monitor individual students)
- Large classrooms with attached seminars/labs run by teaching assistants
- Good distance education (tutored learning
- Low cost distance education (full self-learning)

Cost

There is a question of cost, in particular for the third world where interest is very high in quality Open educational resources.

- Rich / medium / poor context (students can/cannot afford textbooks)

Since textbooks are expensive, cost is also an issue in countries where education is supposed to be free (e.g. in Switzerland) and where textbooks are mainly used for "supplementary reading".

According to any sort of learning or pedagogical theory.

- Learning modes. E.g. Hayes (2005) uses Kolb's experiential learning modes: active / concrete learning, reflective / active learning.
- Learning theory, e.g. behaviorist, cognitivist, constructivist, socio-constructivist like in Horsley and Walker (2005:265)
- Major pedagogic strategy, e.g. Baumgartner's learning I/II/III or Clark's Receptive, Directive, Guided discovery, exploratory instruction

Political / cultural

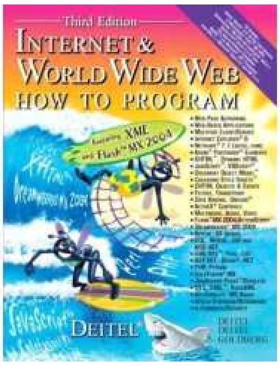
- E.g. Titles that are formally approved by some body (a university, a school district, etc.) as teaching materials.
- E.g. Titles that are sold as textbooks (e.g. everything that is published by Pearson's brands)

According to media

- Published as book (online or offline)
- Informal linear texts (online or offline)
- Non-linear online texts
- Other technology-enhanced online texts (e.g. McGraw Hill [1]'s smartbook [2].

Textbook examples

Internet and the World Wide Web



Frontcover of Deitel et al.

Deitel, Harvey M., Paul J. Deitel, Andrew B. Goldberg, *Internet & World Wide Web How to Program (3rd Edition)*. Prentice Hall; 3 edition, ISBN 0131450913

The home page of the book [3] includes additional resources and for registered uses, downloads of examples and PPT slides

This is a (now) outdated 1500 page thick textbook. It's not a really verbose text, it just covers a lot of subjects (too much I'd say e.g. the PHP chapter is too short). The book is rather well written (although not consistently everywhere) and it's too much focused on non-standard IE/Microsoft technology, but that's not an issue here.

Organization of the Book

The Book is organized in

- Contents
- Preface, including for example
  - Explanation of the teaching approach
  - Font conventions and tips (see below)
  - Tour of the Book
  - Dependency Chart (among chapters)
- 29 chapters
- A CD with 9 extra chapters
- 6 Appendixes
- 2-page bibliography
- Index

Chapter organization

Chapters are organized like this:

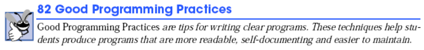
- Objects (one page to the left), includes a picture and (useless) quotes from famous people
- Outline (mini table of contents)
- The usual numbered Sections are: Introduction - Other Chapters - Web Resources
- At the end of the chapter are (not numbered/indexed): Summary, Terminology, Self-review exercises (plus answers), Exercises

Typical functional / typographic elements

Sections look like this:

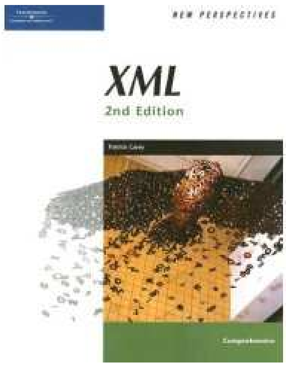
- They are rather short (about 3 pages)
- A big portion of specially marked code (yellow boxes) and associated screen captures usually at the end.
- Some special inserts (tips) are marked by an icon and a colored title:
  - Common Programming Errors
  - Error-prevention tips
  - Good Programming Practise
  - Look and Feel Observation
  - Portability tips
  - Software Engineering Observation

Here is an example from the Preface that explains one of the tips:



Good Programming Practices Insert from the Deitel Book

New Perspectives XML Comprehensive 2nd edition



Frontcover, New Perspectives XML Comprehensive 2nd edition

Patrick Carey (2006) New Perspectives on XML, Second Edition, Comprehensive. ISBN 1418860646, 655 pages

The Book homepage [4]

- Includes downloads student downloads (easy to find) and teacher downloads. The latter are very hard to find. If you are not an American, you are invited to call an obscure phone number in London.
- In this wiki, see XML (if you are interested in the topic)

This is a over 600 pages typical textbook. I used it in a course and find it ok. I didn't like the XSLT part since the author doesn't emphasize how to program with templates, i.e. he uses unnecessary "for" loops. Also, it is weak on some important vocabularies like SVG.

This is what I would call a typical American textbook, i.e. it has a clear and good instructional design behind it. It's also lengthy and repetitive, i.e I wouldn't use if for myself.

Organization of the Book

The book has two parts: Level I and Level II Tutorials (Chapters)

- Preface (with no interesting contents for the student)
- Brief table of content
- Long table of content
- Introduction to Level I Tutorials
- 4 chapters (called tutorials)
- Introduction to Level II Tutorials
- 6 chapters (called tutorials)
- 6 appendices (5 of them reference)
- Glossary/Index

The Introduction to Level I/II Tutorials

- 1-page introductions telling the student to download/use files, a message to the instructor where to find these files and system requirements

Chapter (Tutorial) Organization

- Chapters are called tutorials. Each is divided into sessions
- On the first page, Objectives are defined for each session (between 4 and 6)
- On the bottom of the first page, student data files are summarized
- The rest of the page (i.e. the main part) presents a case problem that will be used throughout the chapter
- Chapters are shown in the running heads on top of the page (but not sessions)
- Each chapter is organized in three sessions (see below)
- At the end of the chapter is a special review/exercising section

Section (Session) Organization

- Sessions (sections) usually start with the presentation of a data structure (XML is about data mostly). This presentation includes a short "story" related to the case problem, a list of elements of the data structure, a figure that can be a diagram, and a little bit of text. Then the student may be invited to look at the real data (open a file).
- This is followed by longer introductory explanations about the technology
- Next are a series of topics. Each topic may include a story, general explanations (including many figures), instructions how to do things, etc.
- At the end of each sessions is a short "Quick check" (1/2 page)

Typical functional / typographic elements

Typical elements one can find in a section are:

- Sub-sections and sub-subsections. These elements are not numbered
- Various kinds of figures:
  - Diagrams
  - Instructions (do ...). These boxes take up less than a page, are rendered in yellow and students really have to do these if they plan to learn something. Instructions include both instructions, code to copy and occasionally a diagram or screen fragment capture.
  - Reference Window (usually code fragments but also of kind "if you want to obtain x, do/use "y").
  - References (i.e. portions of what one could find in a concise reference manual).

Chapter review sections

Chapter review sections include:

- Tutorial summary (1/2 page)
- Key Terms (1/2 page)
- Review assignments (several pages)
- Case problems (long). There are four case problems for each chapter:
  - Practise (work on the same case as the one used throughout the chapter)
  - Apply 1 (work on a case that is structurally similar)
  - Apply 2 (work on a case that is structurally similar)
  - Challenge (somewhat in between applying and designing)
  - Create (design something that is fairly new)
- Answers to Review assignments

The book is part of a series that follows the same pedagogical objectives and design. In contrast to some other textbooks, there is a strong focus on *transfer*. “ The New Perspectives Series challenges students to apply what they are learning to real-life tasks, preparing them to easily transfer skills to new situations. With the New Perspectives Series' approach, students understand why they're learning what they're learning, and are better situated to retain skills and concepts beyond the classroom.” The New Perspectives Series [5], retrieved 22:40, 9 August 2007 (MEST).

This book clearly requires a student to work through the pages. You can't just dive in like with the Deitel Book (which also is a typical textbook). Case problems are well prepared (3 pages of text + materials). It's probably a very good textbook in a context where students are expected to work hard on their homework **and** agree to work on pre-built problem cases (instead of their own projects).

La démarche d'une recherche en sciences humaines

Dépelteau, François (2000), a démarche d'une recherche en sciences humaines, De Boeck ISBN-10 2804135268

In included this book, because I consider it to be the best introductory social science methodology book in French language. Also, it represents Belgium "instructional design" (which is quite different from the french one and rather closer to Dutch thinking I believe)

Book organization

- Table of Contents
- A page that lists with a diagram competences to be acquire performance criteria (what a student should be able to do) with links to concerned chapters
- General introduction (26 pages)
- 6 chapters
- Bibliography

Chapter organization

- Title and synthesis (mostly listed items)
- Numbered sections and numbered subsections
- At the end: a 1-page list of review (synthesis questions)

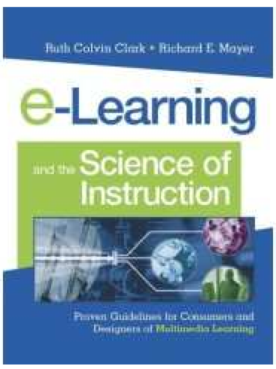
Typical functional / typographic elements

- Strong use of marginalia (typically 1-2 / page). The summarize or give reading/understanding hints. All look the same
- Boxes (vignettes) which may contain
  - definitions
  - pictures
  - Flow diagrams (methodological how-to)
- Figures
  - usually diagrams to explain a concept

Textbooks for professionals and tutored students

This is a category of books that are somewhat in between typical US textbooks, manuals and can also be called "introductory literature".

E-Learning and the Science of Instruction



Frontcover of Clark & Mayer

Clark, Ruth Colvin and Richard E. Mayer (2003). E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning, Pfeiffer, ISBN 0787960519

- In this wiki, see e-learning and multimedia presentation (if you are interested in the topic)

This book can be used both in university teaching but also as a manual for e-learning professionals.

Organization of the book

- Contents
- Preface (personal stuff)
- Introduction:

  - Purpose of the book
  - Overview of chapters
  - Explanation of chapter layouts
  - Overview and nature of examples used

Chapter organization

- First page (left) contains an outline (detailed table of contents)
- Chapter Preview
- A vignette (box) with "design dilemma" (1-2 page case problem)
- Unnumbered sections and sub-sections.
  - The first section provides an *introduction*
  - Next are *design guidelines* (i.e. what you as designer should apply
  - Then *research* is presented that supports these guidelines
- End of the chapter
  - Design dilemma resolution
  - A item list *What to look of in e-learning*
  - A short *coming next*
  - Suggested readings

Typical functional / typographic elements

- Sections cover aspects of the design dilemma introduced at chapter start
- Important concepts are explained with a section
- Sections include text, graphics, tables, screendumps.
- Pedagogical elements are
  - Explanatory text (introducing concepts with examples and diagrams)
  - Summary tables
  - *How-to* lists
  - Summarized prescriptive advice

This book is quite nice to read (I do admit that only read parts of certain chapters). It is well written and well organized. It certainly can be used in content-oriented e-learning design classes, but its up to the teacher to define related review, exercise or design activities.

Similar books

This book is part of a "Essential resources for training and HR professions" series. Other books do not follow exactly the same chapter organization. Let's have a short look at:

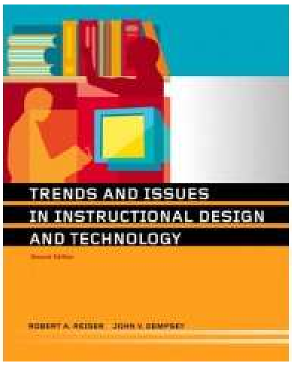
- Driscoll, M., Carliner, S. Advanced Web-Based Training : Adapting Real World Strategies in Your Online Learning, Pfeiffer. ISBN 0787969796

This book organizes chapters into:

- Some quote
- Learning goals (stated with bullets)
- A challenge (not in form of a vignette/box)
- Different looks at the challenge (conceptual, practical, technical)
- Discussion of Examples
- Chapter ending
  - Conclusion
  - Further commented reading and web links
  - Reflection and application

Both books have in common, that they adopt a similar problem case-related strategy.

Trends and Issues in Instructional Design and Technology



Frontcover of Reiser et al.

Reiser Robert A. and John V. Dempsey (eds). (2006). Trends and Issues in Instructional Design and Technology, 2nd edition. Prentice Hall. ISBN 0131708058

This is probably the best buy if you are looking for a single book covering educational technology, learning theory and instructional design. It's in my list of essential reading. Anyhow, it's not a textbook in the "classic" sense, but a collection of "texbook-like" articles that can be read independently. Explicitly mentioned target population are entry-level graduate students and its chapters are written by leading experts (which *is* another plus).

Book organization

- Preface
  - Strength of the book :)
  - Pedagogical features (1/2 explaining how the book and its writings are organized)
  - New edition / Acknowledgements
- Introduction
- The book is organized in 7 parts (called sections), each one contains 3 to 6 chapters
- Short 1/2 epilogue
- Author biographies
- Index (no common bibliography)

The book is about letter size and pages are written in 2 columns

Parts organization (called sections)

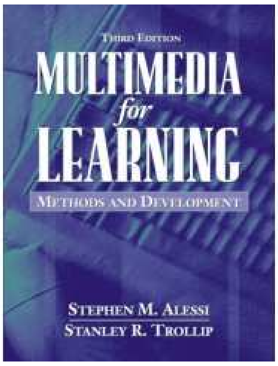
- Each section starts with a section overview that defines topics covered in chapters, their purpose and relation
- Then come the chapters

Chapter organization

Each author could organize its chapter in different ways, but there are common features:

- An introduction by the Editors
- A list of "knowledge and compression question" in a box that takes up the left column. These questions should help understanding of the text.
- Application questions (1/3 page). These questions encourage students to go beyond reading and may be link to individual or collaborative assignments by the teacher using this book.
- References (little to a lot)
- Text is divided into unnumbered sections and sometimes sub-sections and includes figures

Multimedia for Learning



Frontcover of Alessi et al.

Alessi, Stephen. M. & Trollop, Stanley. R., (2001) Multimedia for Learning (3rd Edition), Pearson Allyn & Bacon, ISBN 0-205-27691-1.

This is probably the best textbook on multimedia learning. It's very readable, but not "dumbing down". There are no bullet lists for learning goals, review questions, exercises and such.

Book organization

- Contents
- Preface (mostly the history of this book)
- The book is organized in three parts (with no particular introductions) and 15 chapters

Chapter organization

- Chapters are divided in unnumbered sections and sub-sections
- Each chapter has a longer introduction (in text) presenting aims of the chapter and a conceptual overview of the topic
- The conclusion of the chapter includes
  - A short summary
  - References
  - Sometimes a summary vignette

Typical functional / typographic elements

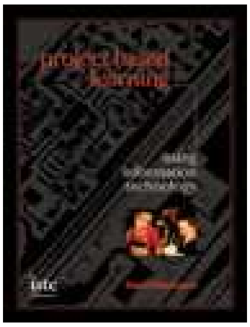
These elements differ a lot from chapter to chapter which can be general conceptual, topic-oriented, technical, cooking, ...)

- Relatively few lists (bullets or definition lists), most text is in paragraph form
- Figures with screen captures
- Figures with diagrams
- Summary vignettes (usually lists of items with sub-items)
- Fill-in tables for planning (also called figures but they take up more space)

Workbooks

This is a more socio-constructivist version of textbook. It aims to engage learners in situated action. Learners typically are adults, e.g. teacher's in training.

Project-based learning: Using Information Technology



Frontcover of Morsund

Morsund, David (2002) Project-based learning: Using Information Technology, 2nd edition, ISTE. ISBN 1-56484-196-0

- A ICT-Assisted Project-Based Learning [6] website
- In this wiki, see Moursund project-based learning model and Project-oriented learning (if you are interested in the topic)

Book organization

- Editor (ISTE) and Author
- Table of contents
- Preface* At t
    - Use of Project-based learning
    - Summary of Chapters
    - Teaching and learning philosophy (focus on constructivism
    - Possible Uses of the book (both preservice and inservice teachers)
- Introductory chapter (includes a short case description)
- 7 other chapters
- 3 Appendixes (goals for IT in Education; Overview of Problem Solving; References and Resources)
- Index

Chapter organization

- short statement of it purpose
- Unnumbered sections with short sub-sections that introduce concepts. Sections contain major subtopics.
- Summary (final remarks)
- Activities

Typical functional / typographic elements

- Various sections are not always organized in the same way (depending on the nature of issues addressed in a chapter)
- Conceptual chapters are mostly in expository style and include figures and tables
- Practical chapters contain lists (some with sub-lists) with instructions and "fill-in" tables whose structure should be reproduced.

This is both a conceptual book and a "how-to" book with detailed recipes

Similar books

- Thom Markham et al. (2003), Project Based Learning Handbook, Buck Inst for Education, ISBN 0974034304

This book is quite similar in structure to the Morsund book.

- It uses fancier layout elements. Also the book is spiral-bound with tabs, so navigation within the book is really fast and painless. This is quite interesting, since I personally find navigation in textbook sometimes awfully difficult.
- It includes paper tools (fill-in tables) that can be copied an used "as-is" to plan teaching.
- It is more practical than Morsund. I'd call it a "cookbook" (although it does require a lot of teacher engagement and intellectual work to get some cooking done).

Examples of manuals that can be used as textbooks

Of these, I got several. E.g. I consider that most O'Reilly computer books fall into this category.

Flash CS3 - The Missing Manual

Frontcover of Veer et al.

- Veer, E.A. Vander and Chris Grover (2007). Flash CS3: The Missing Manual. ISBN 0596510446

There is dedicated page at O'Reilly [7]. The example files can be found on the Missing CD-ROM [8] page.

- In this wiki see Flash (if you are interested in the topic)

This is *not* a textbook, I'd call it an instructional manual. It's organized by topic (not projects) so as a teacher one may have to assign readings not chapter by chapter, but rather a good part of a chapter together with some pages from other chapters. Also, it does not repeat the same concept several times

Organization of the book

- Introduction. It contains
  - motivational elements (what can you do with Flash),
  - A short description of the Flash CS3 authoring environment,
  - Summaries of most important concepts (Anatomy of an Animation, Flash in a Nutshell, The Very Basics),
  - A short summary of parts
  - (Very shortly) typographic conventions.
- The rest of the book is organized in five parts
  - These parts just group together chapters, there isn't any extra text.
- There is a total of 14 chapters
- 2 appendixes
- Index
- At t

Page layout

- Running header left/right page: (unnumbered section title)
- Running footer right page: chapter title

Chapter organization

- Each chapter contains (unnumbered sections and subsections)
- Typically a chapter starts with a short introduction that includes learning goals (formulated with sentences).

- Then, there is an introduction to the first section (that an attentive reader can identify by looking on the running headers).

Pedagogical style is basically direct instruction.

- Explanation of key concepts
- Works-through examples with a lot of screen captures.

There are no review questions, nor assignments. The idea is probably that people who buy this book are mature enough to try it out either with some downloaded files or rather on their own examples (e.g. like did when I wrote some Flash tutorials you can find in this wiki. Btw. I used this book + the help built-in in CS3.

Typical functional elements with typographic rendering

- Text (with a lot of bullets and lists)
- Annotated Screen captures
- Tips (specially marked short inserts)
- Notes (specially marked short inserts)
- Large inserts for various purposes using the same layout. They can labelled for example:
  - "Design Time". E.g. a full page on "tips from the trenches".
  - Workaround workshop
  - Frequently asked questions
  - Up to speed

Writing and Developing Your College Textbook

- Lepionka, Mary Ellen (2003), Writing and Developing Your College Textbook, ISBN 0-9728164-0-2.

The author owns Atlantic Path Publishing [9] on which you may find some extra information, i.e. a good list of links.

This is *not a textbook*, but a introduction and practical manual for "would-be" authors. It could be used as a textbook, since the text is pedagogically structured. Only missing typical elements are review questions and assignments. Also, it is concise, precise and understandable (not always the case with textbooks).

Book organization

- Table of Contents
- Preface (1 1/3 pages): Defines experience of the author and what a good textbook is
- 14 chapters
- Glossary
- References
- Index

Chapter organization

- Chapters start with a show 1-paragraph introduction describing aim, motivation etc. of a chapter
- Most chapter have an appendix that summarize key elements an author should take into account. This can be a "fill-in table", a list of definitions or references to standards,
- Chapter contents are divided into unnumbered sections (topics) and sub-sections

Typical functional elements with typographic rendering

- Lists in various forms (numbered, bulleted, indented definition lists)
- Boxed lists
- Fill-in tables (in particular at the end of each chapter)
- Indented blocks like case studies or other examples

Conclusion

Common elements of textbooks and similar

Textbooks

- Most often explain how the book is to be used
- Are highly structured, but in US books, sections and subsections are not numbered. I find this very strange. Almost if textbook designers really don't want readers to jump back and forth in a text. Interestingly, the only Belgian example presented and which *is* a typical textbook does have numbers
- Use a series of typographic "tricks" (but absolutely not the same) to mark special strands like case problems, examples, tips, to-do-lists, etc.
- Chapters are structured in a similar way
- Chapters (and sometimes section) explicitly define learning goals
- Chapters (at the end usually) self-review questions, exercises and sometimes larger case problems

Textbook-like books (and that are being used as textbooks)

- Most often explain how the book is to be used or at least presents shortly some use cases
- Are also highly structured (but sometimes less consistently). This is probably due to the fact that chapters can have different purposes. US books reviewed don't number sections.
- Usually include at least informal definition of chapter goals
- Mostly do not include review questions
- Mostly do not include exercises, instead they may have "cooking recipes", e.g. in the form of "fill-in tables" that can be used in a design.

A provisional taxonomy of textbooks and similar

Criteria for a taxonomy

I suggest (well after 10 minutes of looking at what I wrote) to distinguish three main axis:

1. Built-in pedagogy and navigation

This is also tied to the question whether one can find something in the book and navigate. The less it has pedagogy the better is navigation.

1. little pedagogy
   - E.g. a typical manual where one can find things (can be used as reference)
   - E.g. an introductory text that summarizes mostly standard knowledge
2. medium pedagogy
   - E.g. a typical guide book
   - E.g. a cook books that rather target professionals
3. lots of pedagogy
   - e.g. a typical undergraduate US textbook whose chapters should be read in linear fashion.

2. Main built-in pedagogical strategy

See pedagogic strategy. This does not mean that corresponding teaching has to follow this. E.g. paradoxically, a constructivist teacher may prefer simple expository manuals.

1. Learning I, i.e mainly expository
2. Learning II, i.e. problem solving or procedure training, including a lot of hands-on activities
3. Learning III, i.e. engaging students to apply things in real-life projects

3. Conceptuality

This may relate to a "dumbing down" factor

1. little, i.e students are exposed to facts or engaged in skills learning without being exposed much principles
2. medium, i.e. students are exposed to principles
3. high, i.e. students are exposed to real research or really difficult engineering issues

Other

Of course, there could be more variables, i.e. textbook research and textbook writing tutorial identify some, but useful typologies are difficult to make with too many variables (unless I could hire someone to code textbook structures and contents and the run a cluster analysis program ...)

A provisional taxonomy

If we reduce the pedagogy and conceptuality dimensions to two values (little/much), we get a cube with 12 types (I should draw this cube once I am convinced of this taxonomy ...). Some types are probably empty, i.e. the combination of expository text with lot's of pedagogy probably doesn't make much sense, since good pedagogy would include some problem solving activities. Well, to be discussed. I really wrote this piece in a few hours only...

1. Expository texts with little pedagogy and little ambition
   - Badly made textbooks (e.g. simple lecture notes)
2. Expository texts with little pedagogy and high ambition
   - Reviews of literature written by a good domain expert
3. Problem solving or (complex) procedure training with little pedagogy and little ambition
   - Simple "dumbed down" manuals
4. Problem solving or (complex) procedure training with lot's of pedagogy and little ambition
   - Introductory textbooks
5. Problem solving or (complex) procedure training with little pedagogy and high ambition
   - Introductory manuals (e.g. in medicine or computer programming)
6. Problem solving or (complex) procedure training with lot's of pedagogy and high ambition
   - Maybe some mathematics or history manuals
7. Learning in action with little pedagogy and little ambition
   - Guidelines
8. Learning in action with little of pedagogy and high ambition
   - Guidelines with well documented case studies and problem assignments
9. Learning in action with lots of pedagogy and little ambition
   - Constructivist introductory textbooks
10. Learning in action with lots of pedagogy and high ambition
    - Constructivist textbooks for advanced levels and professionals

This is a first attempt made by Daniel K. Schneider on 16:30, 10 August 2007 (MEST). I have to let it sit and go over it sometimes ...

A final note on pedagogy

The taxonomy presented above uses words like "little" or "badly made". Such qualifications don't have *per se* an implication on learning outcomes.

E.g. if I tell one of my students to read this article, read follow up links in textbook, textbook research and textbook writing tutorial and then require him to study either textbooks (using a a serious analysis instrument) or to study the *use* of textbooks (e.g. with interviews) he'd learn a lot more than by reading a well written textbook chapter about textbooks... What counts is the global pedagogical design and that must be adjusted to teaching goals.

An often heard statement (that probably is even backed up by serious research) is that "Bad texts can be very beneficial, since they require students to think..."

Finally, analysis of the target population and use cases may tell you that a lot of professionals work by a 20/80 % rule, i.e. they only want to learn 20% in order to get 80% done. I have the hypothesis that most teachers, for example, work that way. Therefore, writing simple "how-to" guides may be real option, if you aim at impact.

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Textbook research

Draft

This article deals with research on textbooks.

See also (and maybe before):

- Textbook (Introduction)
- Textbook genres and examples
- Textbook writing tutorial

For now, this article just includes a list (disorganized) and short strands of textbook research. It should be completed some day, for the moment I just copy/pasted a few quotes and ideas - Daniel K. Schneider 19:57, 8 August 2007 (MEST))

“ The noun "textbooks" provokes many, mostly negative, responses. When I tell my students and colleagues that I study textbooks, tombstones often appear in their eyes expressing painful and buried memories of cramming for exams and repetitious wading through excruciatingly boring pages as directed by teachers who, they felt, could not be bothered to teach the material themselves. One fellow lecturer who was clearly less than sensitive to my sentiments even ventured "what on earth can be interesting in textbooks?"” (Issitt, 2004: 683)

Users (students/teachers)

Reader-book relationship (from a discourse analysis point of view)

A textbook must be interpreted by the reader according to most modern cognitive and text analysis theories.

Rosenblatt (1978) cited by Johnsen (2001) “pointed out that no text is complete until it has been read, and that there must of necessity be several ways to read all texts since they are used by people with vastly different backgrounds, even if they are the same age.” and Fisch (1980) cited by Johnsen (2001) argues that “ groups of reading and interpretation patterns emerge which are determined more by society than by individuals”.

See also Aamotsbakken (2005: 106)'s model readers vs. real readers

How students deal with textbooks

As a whole ...

There is also specialized research on how students understand elements, i.e. shorter units like presentations, in particular combination of illustrations with text. E.g. Wolf

In-classroom use of textbooks

E.g. Hoarsley (2001). Hoarsley (????) argues “that there is need for research that is committed *not* to the empirical search for 'effective' textbook use as defined by the producer (the publisher, designer, author), but to the uncovering of meanings attached to textbooks by the consumer (teachers and pupils). How do teachers and pupils make sense of the textbook within the context of wider learning environments, an make use of them ?”

Textbook - teacher relationship

E.g. Ball and Feiman-Nemser (1988:401) “Although the student teachers were enrolled in two different teacher education programs, all of them developed the impression that if they wanted to be good teachers, they should avoid following textbooks and relying on teachers' guides. They believed that good teaching means creating your own lessons and materials instead. These ideas proved difficult to act on during student teaching when the student teachers worked in classrooms where textbooks formed the core of instruction and they confronted the fact that they were beginning teachers lacking knowledge, skill and experience." (cited by Johnsen, 2001).

"John A. Zahorik demonstrates the teacher-book complexity in his investigation of the relationship between textbooks and teaching styles (Zahorik 1990 and 1991). He based his work on that of K. Hinchman (Hinchman 1987) and D. Alverman (Alverman 1989), both of whom distinguish between three types of usage that also display a strong correlation to three teaching styles. The textbook may be perceived and used as a) a source of facts to be learned ("coverage"), b) a source of different types of activities ("textbook based activities") and/or c) a basis for interpretation and discussion ("higher level interpretation/reference")." (Johnsen [1], 2001).

Textbooks and the educational system

"Tools and media are ambivalent: as institutions they contribute to the stabilisation of the educational institution, but they also challenge the institution and they force it to evolve. The textbook is more than a simple tool. Because of the values that it transmits, and through the instrumentation that it offers to the master and the pupil, it highlights the professionalism of both, it testifies to their specialisation and becomes one of the factors of their social recognition. But, while the textbook officializes and consolidates, it also introduces changes, encourages innovations and facilitates reforms." (Moeglin, 2005:20).

Other research looks into the approval processes and the relation of textbooks with curricula.

Production and Writers

The learner model adopted by authors

Crucially, the passive learner model embodied in textbooks masks three crucially political relationships:

- the text and the learner are positioned such that the learner has a subordinate epistemological status;
- what counts as knowledge is clearly circumscribed by the text and, by default, alternative claims on the same knowledge arena or alternative lines of exploration are cast as irrelevant;
- the purpose of reading the text is end-directed towards an exam or outcome reflecting a goal-carrying social value. (Issit, 2005: 689)

Textbook production

- Roles of publishers and editors

Cognitive processes in textbook production

- The cognitive psychology of textbook composition, e.g. Flower and Higgins (see writing-to-learn for more references.

Analysis of learning modes and styles

Haynes (2005:295), in a study (based on Kolb's experiential learning) of three textbooks he concludes: " In summary, we may say that Beginning Theory, Doing English and The English Studies Book all provide frequent prompts to abstract learning. Two of them - Beginning Theory and Doing English - do this too for concrete learning. Doing English provides more fully than either of the other two texts for reflective learning, though through its learning activities The English Studies Book also does this to some extent. The section in The English Studies Book is the only one that explicitly provides for active learning. None of the books offers balanced provision for all four modes of learning."

Linguistic organization

E.g. Lucas, 2005:57) concludes that “Textbooks are representative of the didactic genre, which cross languages and epochs. This genre is based on explanation but also aims at active implication from the reader. It implies a very careful organisation and layout, in order to guide the reader and provide room for interaction. Exercises are the canonical form of interaction. Due to the many constraints of clear explanation and sufficiently detailed information on each topic, textbooks share many common features. Clear segmentation allows parallel progression between illustration discourse and text discourse. Overall progression through the book is marked by explicit checkpoints. Although textbooks are highly constrained, they still differ widely according to matter and grade, not to mention culture.”

Aamotsbakken (2005:102) considers that textbook both contain open and closed texts (Eco). Open texts are open for interpretation because they challenge the reader with a spectre of explicit and implicit codes, intertextuality and a complicated structure.

Content analysis and politics

According to Johnsen (2001), “Up to the 1970s, the whole field of textbook research was dominated by a few traditions (history book revision and historical content analyses) and by individual and composite works published at long intervals.”. Examples are Fleming (1982) or Anyon (1979)

Cross-sectional / Other

Cultural differences

Textbooks are particularly important in the mainstream US Educational system that has strong roots in more traditional instructional design.

Most of Europe's higher education system is somewhat different

- On one hand more emphasis is put on "Bildung" (education) as opposed to training. Students are supposed to organize knowledge themselves and be able to cope with all sorts of more primary materials (e.g. real academic books and articles).
- Professors are supposed to develop their own lecture (and views). These actually may be considered "spoken textbooks" since often students are just supposed to reproduce contents at exams. University teachers also have a fairly low teaching load (e.g. about 6 hours) since their main job is to do research.

Both of these features (that are in contradiction) make textbooks not very popular in standard universities. However, in most European countries there are higher education institutions with little research and high teaching loads, such as the Swiss Universities of Applied Sciences and these have a lot in common with American "teaching universities".

Questions related to Dumbing down

Critiques of textbooks often claim that there can be dumbing down effect, in particular since some textbook authors indeed overdo simplification.

But one must clearly distinguish between (1) the general question whether systematic use of textbooks (as in teaching universities) can have a dumbing down effect and the (2) the question whether some textbooks are too easy and aim too low and whether this is a global trend in education.

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Disclaimer: I don't have any knowledge in textbook research. I copied some references (e.g. from Johnsen [2], 2001) to have some starting points for further reading ... when I feel so ... - Daniel K. Schneider

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Textbook writing tutorial

Draft

Some sections are missing, but some elements may be useful. Unfortunately it is unlikely that I will finish this sometimes soon - Daniel K. Schneider 19:08, 3 September 2008 (UTC). Maybe someone else ;)

Definition

This article deals with how to write a textbook, i.e. tries to formalize a few recipes. The first sections rather deal with principles.

Disclaimer: I am not a textbook writer. This is just based on a summary of some literature and a superficial analysis of some textbooks. My motivation was twofold: I had to write a small textbook for a distance teaching course on educational technology. I also plan to use this to improve tutorials in this wiki over time - Daniel K. Schneider 10:17, 24 September 2008.

See also (and maybe before):

- Textbook (Introduction)
- Textbook genres and examples
- Textbook research

Textbook writing and pedagogical theory

Firstly, textbook writing is related to instructional design and therefore one might look at textbooks in terms of some instructional design models and methods.

On a prescriptive level, one might argue that authors should use at least some kind of backwards design, i.e. define what students are supposed to be able to do (e.g. solve problems) and then write the books that enables them to do so. In the same spirit, one also could argue that textbooks should respect some first principles of instruction, e.g. let's recall Merrill's:

- **The demonstration principle**: Learning is promoted when learners observe a demonstration
- **The application principle**: Learning is promoted when learners apply the new knowledge
- **The activation principle**: Learning is promoted when learners activate prior knowledge or experience
- **The integration principle**: Learning is promoted when learners integrate their new knowledge into their everyday world
- **The task-centered principle**: Learning is promoted when learners engage in a task-centered instructional strategy

However, textbook writing is a specific activity and one should not forget that textbooks are usually just an **element** in a wider pedagogic strategy. Therefore, writing should be planned together with some possible pedagogical use cases. E.g. Horsley and Walker (2005:265) identify a changing conception of textbooks that is related to changing learning theories. Teaching and learning materials e.g. textbooks are used differently according to pedagogical theory:

- Transmission: Source of information, Basis of transmission, Knowledge authority, Structure of a teaching and learning program
- Constructivist: Activity and inquiry source; Provision of multiple sources for students; student knowledge ;construction Multiple sources for teacher selection.
- Sociocultural: Scaffolds learning; Enculturates students into disciplinary knowledge and practices; Source of inquiry activities; Basis of explicit teachings.

See also the related discussion around the pedagogical purpose of various kinds of learning objects.

This short discussion only tells us that textbooks can be analyzed in terms of their **function** and in this perspective it becomes less clear what a textbook is. E.g. Johnsen (2001) argues that “the definition of a textbook may be as general as to include other books made and published for educational purpose, or even any book used in the classroom. The textbook may also be a subset of an even broader and increasingly more commonly-used term "teaching media"”.

Daniel K. Schneider adheres to the idea that a textbook is a special genre of teaching media and that includes some kind of "built-in" pedagogy or at least affordances to support a range of pedagogies.

Pedagogical objectives

Textbooks are written with pedagogical objectives in mind. But since teachers and learners must construct their own representation, they sometimes re-purpose a text in ways not anticipated. E.g. a textbook could be used just for reference instead of for direct instruction. The opposite is also true, a good reference book also could be used as textbook.

For an author, there are several ways to manage objectives (each ISD model or extensions like the Kemp model will tell you more). Often, advise on writing textbooks suggests to plan book chapters in terms of desired learning level outcomes. But, again, the author should be aware that **teachers** define reading assignments (textbooks as a whole or portions of it) in function of *their* pedagogical objectives. These may not be compatible with the original intent of the author.

The most important objectives concern learning objectives, e.g. what the student should master after having worked through parts of the textbook. Reading is usually linked to other class/homework activities. Again, both authors and teachers (and one could argue, learners too) should also engage in this exercise. For example, the IOWA [1] writing assistant identifies 6 levels of emphasis based on Bloom's taxonomy of learning that we reproduce here exactly as defined in Applying your results [2] (retrieved 20:03, 27 July 2007 (MEST)):

1. Knowledge: rote memorization, recognition, or recall of facts.
2. Comprehension: understanding what the facts mean.
3. Application: correct use of the facts, rules, or ideas.
4. Analysis: breaking down information into component parts.
5. Synthesis: combind parts to make a new whole.
6. Evaluation: judging the value or worth of information or ideas.

Depending on global objectives of the book, an author can put different emphasis on each of "Bloom" levels.

Objectives at book and chapter level should also be associated with **activities**, **assessment**, etc.

Here is an example for *Synthesis*-level objective. Target students are students in educational technology. The learning activity handed out is to prepare an e-Text about e-learning standards.

- Objective: "By the end of this section, you (as a student) will be able to design a learning object that introduces key components of e-learning standards, and in particular modeling languages.
- Activities: Make your own summary of the most important concepts you can find in articles on educational modeling languages and then design a course module with eXe
- Assessment: Quality of your course module (details to be announced)
- Key Words: Design, formulate, build, invent, create, compose, generate, derive, modify, develop.

Usually in textbooks, objectives are not just used to plan the text, but they are **made explicit**. Objectives can be written out at the start of chapters and/or sections and activities inserted where appropriate. Hints for self-assessment can added too.

Textbook language and organization of contents

Textbooks, in language research seems to be identified as a genre (or genres). Most research focuses on structural analysis of textbooks, but some research also produces knowledge that can be used for prescriptions: According to Jones (2005), textbook writers have three choices: simplification, easyfication, or the scaffolding of concept knowledge. We shall summarize some prescriptions can be derived from this article.

Simplification strategies - enhanced cohesion/coherence

- simplification of content: explain new technical terms as they arise
- simplification of form: make sure that the text has cohesive links and restores implicit relationships, e.g. when using general-specific of problem-solution progressions.
- simplification by including explanations and exemplifications
- using similar structures, i.e. syntactic repetition acts as a form of syntactic scaffolding.

Note that simplification may turn against learning. For example NcNamara et al. (1996) found that “ text coherence improved readers' comprehension, but also that giving readers with sufficient background knowledge an incoherent text that forced them to infer unstated relations engaged them in compensatory processing, allowing deeper text understanding than might occur with a coherent text.”

Easyfication strategies - enhancing structure

The purpose easyfication is to “give learners an additional instructional appahttp://en.wikipedia.org/wiki/Textbookratus by developing a kind of "access structure" around the text without his [sic] having gone through the intervening stages of simplified materials” Bhatia cited by Jones (2005:9). Examples of such devices are:

- Provide introductory paragraph(s) to a text (or text segment)
- Provide a structural analysis ('tagging' sections) to a text (or text segment), e.g. as in Advance Organizers.
- Provide a schematic representation of a text (or text segment)
- Add annotations/explanations to the text, e.g. marginalia
- Add metadiscursive commentaries (before, in the middle, or after)
- Add questions to encourage interactions with the text

Scaffolding - providing domain knowledge

“Scaffolding in the sense intended here means the provision of a series of carefully designed pre-task exercises (or *activities*) which allow students to familiarize themselves with concepts of increasing complexity and to explore these concepts in terms of their reactances and interrelations.” Jones (2005:10)

Typical scaffolding activities can be:

- filling in gaped texts
- complete sentences
- propositional clusters
- produce or complete tables and flow charts
- write summaries of various sorts, e.g. include critique, most things relevant, organize information, etc.

Of course these activities can be assigned by teacher, i.e. they must not necessarily be part of the text itself.

The book structure and genre

Objectives and genres

Let's recall that a textbook should be written with respect to an identified set of objectives. These should include an analysis of learning objectives and pedagogical function of the book *within* potential learning situations/environments. You may have to compromise here, i.e. anticipate different use cases.

In addition, in some areas you may consider switching genres in different chapters. E.g. a text on educational multimedia animation may include a chapter on learning theoretical background (e.g. cognitive load) and a introduction to flash. Clearly, such chapters are not of the same kind and may adopt different rhetorics.

See Textbook genres and examples for a discussion of some genres we superficially analyzed.

Structure (headings)

Often textbooks are divided into a structure like this:

```
Parts
 Chapters
  Sections
   Sub-sections
```

Parts either represent different major topics (e.g. conceptual vs. technical) or levels

Chapters contain a clearly identifiable major topic. In the US teaching university system, a textbook corresponds to a week's work, e.g. two classes and a homework assignment. This may be the reason why most textbooks are divided into 8-12 chapters. You need a least 8 if you want to sell the book to a "teaching professor" it seems.

Sections contain major subtopics, i.e. a independent unit of instruction. Sub-sections usually cover a concept or procedure to be learned. For a reason I do not understand, sections are generally not numbered in American textbooks. An exception is Deitel (2004).

Each heading that has subheadings must have at least two of its kind. E.g. a chapter should not just include a single section, but at least two. In most "hard-core" textbooks, everything is usually divided by three or four, plus openers and closers. Btw. this is also how military units are organized ...

Style of headings may be imposed by the publisher, e.g. capitalization and numbering scheme. Therefore, structuring is not only a pedagogical issue and you may have to give up pedagogical beliefs in order to comply with external constraints. E.g. I find it strange that navigation is so difficult in typical US textbooks and I suspect that this may be the result of "artistic" guidelines.

Good topical structure

Heading structure should have a function as *conceptual organizers*. The structure " reflects the amount of information you are providing, the amount of differentiation you are making within and between topics, and each topic's relative importance in you scheme of things" (Lepionka: 106).

Lepionka (2003:108) outlines a few characteristics of good topical structure that we reproduce here with different wording:

(1) Each major section (chapter, section and sub-section) should include a thesis statement, either typographically marked or in the introductory paragraph. E.g. in Alessi (2001:138) we find in the third paragraph of introduction to the "Hypermedia chapter":

Two components are necessary for a hypermedia program to be successful. First, it must have a clear and well-reasoned purpose. Second, it must be designed in accordance with that purpose ...

(2) Ideas or points are grouped into meaningful chunks of information.

(3) There should be a balance of topical development and including a reasonable amount of information. E.g. for smaller concept (a sub-section level) between 1/2 and 1 1/2 pages (figures not included).

(4) Topics (sections, subsections, etc.) should lead to each other. In other words, a textbook should not be written like an Encyclopedia. (This wiki is clearly not a textbook).

(5) These transitions should be clear, i.e. made explicit for the novices that your readers are.

(6) Each main concept should be supported, e.g. by data or examples.

(7) Each topic should only be treated once and you should avoid forward pointers.

Overview of textbook chapter elements

Most textbooks are written with a sort of direct instruction model in mind. However, this is not an obligation. Consider that teachers engaged in other pedagogical approaches do not necessarily use textbooks, but rather a combination of manuals and "normal" academic texts. I.e. a textbook that mainly targets research university students as opposed to teaching college students may implement very different design principles.

But in any case, chapters should include various functional elements that will at least help the reader to understand the text. These elements also may show visually. Lepionka (2003:117-118,123) distinguishes four major kinds of elements which we will summarize here, before a more detailed discussion later on.

1. Openers

    Express "subject, theme, aims, topics, and organization of a chapter [... readers should] know at the outset what they are reading and why or to what end" (Lepionka 2003:117). E.g. if you follow Gagné's nine events of instruction then you should include something to motivate and gain attention (step 1), something to help the frame and organize (step 2) and something to recall prior knowledge (step 3).

Typical openers are:

- overviews (previews)
- introductions
- outlines (text, bullets or graphics)

- focus questions (knowledge and comprehension questions)
- learning goals / objectives / outcomes / competences / skills
- A case problem
- In addition one may use the "special features" used inside chapters, e.g. vignettes, photos, quotations, ...

2. Closers

> Give students opportunities to review, reinforce, or extend their learning, i.e. help with transfer of learning (Lepionka 2003:118)

Typical closers are:

- conclusions and summaries (may include diagrams)
- list of definitions
- reference boxes (e.g. computer instructions)
- review questions
- self-assessment (usually simple quizzes)
- small exercises
- substantial exercises and problem cases
- fill-in tables (for "learning-in-action" books) to prepare a real world task
- ideas for projects (academic or real world)
- bibliographies and links (that can be annotated)

3. Integrated Pedagogical Devices

> These elements aid the learning process in several ways, e.g. by giving advice on how to understand / interpret or navigate, by engaging the learner in some reflection, by pointing out important elements, or to summarize key elements treated in previous text.

Typical elements are:

- Emphasis (bold face) of words
- Marginalia that summarize paragraphs
- Lists that highlight main points
- Summary tables and graphics
- Crossreferences that link backwards (or sometimes forwards) to important concepts
- Markers to identify embedded subjects (e.g. an "external" term used and that needs explanation)
- Study and review questions
- Pedagogical illustrations (concepts rendered graphically)
- Tips (to insure that the learner doesn't get caught in misconceptions or procedural errors)
- Reminders (e.g. make sure that something that was previously introduced is remembered)

4. Interior Feature Strands

> “Intext features, whether boxes or portions of text set off through design, function pedagogically to attract attention; arouse curiosity; increase motivation to read stimulate critical thinking; and provide opportunities for reflection, application, or problem solving” (Lepionka, 2003: 118).

Typical elements are:

- Case studies
- Problem descriptions
- Debates and reflections
- Profiles (case descriptions)
- Primary sources and data
- Models

Some of these four kinds of elements will be discussed in more details below

Chapter Openers

Chapter openers should be used consistently through the text, at least in form (in case chapter genres are different). Below we present a few techniques that can be use in combination or (as seen in some textbooks) alone.

Again, it is not always obvious to differentiate between function and structure. A well written introductory text labelled "introduction" may very well cover preview, introduction and outline without making a clear distinction. But its probably best to use a paragraph for each. E.g Alessi (2001:138) which is a highly regarded book since 1985 now in its third edition, structures the introduction to the "Hypermedia chapter" with three elements:

- Topic and definition of the concept
- A list of 5 topics (truncated below)
- A chapter preview (truncated below)

Quotation:

This chapter focuses on the *hypermedia* technology. Programs of this methodology consist of a database of information with multiple methods of navigation and features to facilitate learning. The chapter includes:

1. A brief description of hypermedia's history and origins
2. A description of the basic structure of hypermedia and its essential characteristics
3. Description of various hypermedia formats
4. ....

Two components are necessary for a hypermedia program to be successful. First, it must have a clear and well-reasoned purpose. Second, it must be designed in accordance with that purpose ...

Below we shall examine various chapter opener elements with some more examples.

Chapter Previews

Also called chapter overviews (but there might be a slight different), these elements summarize the "big picture" and frame the reader for acquiring the details.

Here is an example from Clark (2003:97) in the chapter "Applying the Redundancy Principle"

SOME e-LEARNING describe graphics using words in both onscreen text and audio narration in which the audio repeats the text. We call this technique *redundant onscreen text*. In this chapter, we summarize empirical evidence that graphics explained by *audio alone* rather that graphics explained by *audio and redundant onscreen text* gets better learning results. [...four lines cut ...]

Previews also act as self-monitoring device, i.e. it will you as an author whether you are able to understand what you wrote ...

Introductions

Introductions both at chapter and section level rather focus on the problem, i.e. try to convey to learner why the topic is important and in which context this knowledge is relevant. It also can link to previous chapters. E.g. the editors introduction to David Merrills' chapter on "First Principles of Instruction" (Reiser, 2006:62) starts like this:

In section 2 of this book, several of the authors point to differences in design practices between positivists (objectivists) and relativists (constructionists). In this chapter, David Merrril takes a different tack. Having spent several years studying a number of different instructional design theories and models, including a variety of positivist and constructivist approaches, he concludes that these different theories and models do share common instructional principles, which he labels *First Principles of Instruction*.

This text states a goals or an achievement, but it does not (like in a chapter preview) summarize these first principles of instruction

Here is another example from Deitel (2004:141). The Introduction is a numbered section and comes right after the outline (see below).

In Chapters 4 and 5, we introduced the Extensible HyperText Markup Language (XHTML) for marking up information. In this chapter, we shift our focus to formatting and presenting information. To do this, we use a W3C technology called **Cascading Style Sheets (CSS)** that allows document authors to specify the presentation of elements on a Web page (e.g., fonts, spacing, margins, etc.) separately from the structure of the document (section headers, body text, links, etc.). this **separation of structure from presentation** simplifies maintaining an modifying a document's layout.

Again, this introduction, makes a link and provides motivation for reading on.

Chapter outlines

Chapter outlines either support or integrate (replace) the function of Preview and Introduction. E.g. Morsund (2000:35) in the "the case for PBL" chapter uses a rather short multi-purpose introduction:

PBL is a versatile approach to instruction that can readily be used in conjunction with other approaches. A huge number of articles have been written about PBL. Most, however, are specific examples and testimonials rather than carefully conducted research studies.

This chapter discusses a number of different types of arguments that support the use of PBL and IT-assisted PBL in the classroom. In total, they present a strong case for increased use of PBL in K-12 education.

Driscoll (2005) starts chapter 6 "Simulations" with a quote from two researchers and then outlines the chapter as follows:

In This Chapter

In this chapter, we will

- Define the term simulation
- Discuss the factors that have been obstacles to the adoption of simulations as and instructional strategy
- Describe the benefits and limitations of simulations
- Describe nine types of simulations to add to your portfolio of simulation techniques and explain how these types of simulation differ
- Provide a portfolio of examples of simulation

In addition to an introductory text, one may also just display the chapter's internal table of content. It may replace the outline **'if'** the section titles are well chosen.

E.g. Deitel (2004: 141) after presenting Objectives and funny quotes on page one presents an outline of the 12 sections:

Outline

6.1 Introduction
6.2 Inline Styles
6.3 Embedded Style Sheets
...

This is followed by an introduction.

Learning objectives

Learning objectives can be interwoven with any of the above, but in a "hard-core" textbook they are usually stated in box à-part in list form.

E.g. Carey (2007:227) in the "Working with Cascading Style Sheets" Tutorial (chapter) defines *objectives* for each of the three Sessions (sections) in a sidebox next to the case problem that opens the chapter.

Session 5.1

- Understand the history and theory of CSS
- Write selectors for specific XML elements
- Set the display style for elements
- Size and position elements on a rendered page

...

Focus questions

Focus questions or in terms of Reiser (2007:viii) "knowledge and comprehension questions “at the start of each chapter require students to identify the key ideas presented and demonstrate their understanding of those ideas”

There are five focus questions attached to David Merrills' chapter on "First Principles of Instruction" (Reiser, 2006:62) and rendered in a smaller left-side column of the first chapter page. We list the two first ones:

1. In your own words, briefly describe each of the five first principles of instruction discussed in this chapter.
2. Merrill briefly indicates why each of the first principles is important. Briefly summarize his position regarding the importance of each principle and the indicate, for each principle, whether you agree or disagree with his point of view. Explain why you feel this way.

Case problems

Case problems have two functions:

- They motivate since the link topics to be covered to a real world problem
- They provide an example which can structure and/or exemplify the discourse

Clark (2003) use what the call a *Design dilemma* for each chapter. It is part of the chapter preview, i.e. follows a paragraph in the proper sense of *preview* as illustrated above. Design dilemmas are marked in a grey box and take up 1 or pages. In the chapter "Applying the Redundancy Principle", there is a 2-page dilemma of which we quote a few excepts (it also contains 2 figures).

Design Dilemma
In response to a request from the quality director of Madison Industries, you have created the perfect multimedia presentation for a company training program. As described in the previous chapter, your introductory lesson gives an overview of the quality control tools as part of the overall company quality process. As shown in figure 6.1, it contains a short animation and is consistent [...] In spite of your valiant efforts, the directory says "we need to accommodate different learning style ... [...] Although you have complied with the director's request, you are not convinced ...

Carey (2007:227) in his chapter design only uses a list of objectives and a case to open chapters. The case description usually takes a half a page (but specifics are introduced throughout the rest of the chapter). We quote a few excerpts:

Tour Nation Janet Schmidtt works in the Advertising Department of Tour Nation, a leading bicycle manufacturer. On of her responsibilities is to maintain an XML document that describes the various models offered by Tour Nation. Janet created a [...]
In its current form, the document is not very easy for other Tour Nation employees to read. Janet wants to format the

document [...]

Other elements

At chapter start one also may use typical features that are use as interior feature strands. See [#Special_features_strands|Special features strands]

Integrated pedagogical devices

(missing)

Special features strands

Case studies and scenarios

(missing)

Quotations and epigrams

(missing)

Pictures

(missing)

Summary and reference tables

(missing)

Chapter Closers

Conclusion

A conclusion should make a point. It may be seen as the "alter ego" of the the Chapter Introduction.

David Merrills' chapter "First Principles of Instruction" (Reiser, 2006:69) conclusion takes about 2/3s of a column and starts like this:

It would apprear from the limited sources quoted in this chapter that first principles are not only common to and prescribed by mny instructional design theories and models, but that they are also consistent with empirical research on instruction ...

Alessi (2001:173)'s conclusion takes up a bit more than a page and ismore of a summary. But it starts like this, i.e with a point:

There are many important factors in hypermedia design. It cannot be distilled into a specfific set of things to do and not do. However, some general and some specific principles, when applied intelligentyl (that is, in consideration of your context, content, and learner characteristics), ca help you make good design decisions.

Summary

The summary has a similar function as the chapter preview. It may be part of the conclusion or be labelled as a separate section or sub-section. It may for instance summarize essential points for each section. “A summary should be a content review, not a catalogue of what has been covered” (Lepionka 2003:141)

Alessi (2001:173)'s hypermedia chapter conclusion is mostly a summary of design principles, i.e. 2 paragraphs and a longer item list The first summary paragraph looks like this (see above for the conclusion opener):

First and most importantly, you should be clear about the *purpose* of your program and identify which of the eight hypermedia *formats* you will use to accomplish that purpose. Most other design decisions concerning the knowledge database, navigation, an support for learning follow logically from your purpose and chose format.

After stating an other second principle, the authors then list some morespecific recommendations as a list (see below)

Carey (2007:282)'s tutorial chapter summary is just a review of topics covered. In Daniel K. Schneider's this may be ok for a technical textbook. The summary starts like this:

This tutoraiil covered how to create a CSS style sheet and apply it to an XML document. The first session covered the history and theory behind the development of CSS. The session then explored [...] The second session [...]

Lists of principles

Alessi (2001:173) ends the conclusion of the hypermedia chapter with a list of specific recommendations that can apply to most hypermedia programes. We quote the first four (out of 21) here:

- Use multiple media, including both visual and autitory presentations.
- Make the structure of information visible to learners
- Provide cues, coaching, landmarks, section labels, and display consistency to facilitate learner orientation.
- Design for text readability and to encourage deep processing of text.

List of definitions or key terms

Carey (2007:283) ends a tutorial (a chapter) with a tutorial summary(a paragraph) and a list of "naked" key terms, followed by several "practice pages".

```
absolute position          CSS3        relative position
absolute unit              em unit     relative unit
....
```

This is IMHO rather useless, unless it is meant to challenge the student to make sure that he integrated definitions of these.

Review questions

Carey (2007) inserts review questions at the end of sessions (sections). E.g. the review (also marked with a marginalia title) of session 5.3 includes 7 questions and starts like this:

Session 5.3 Quick Check

1. What is the difference between a specific font and a generic font ?
2. What is a relative unit ? What are the two relative units supported by CSS?
3. How would you display the the Summary element in a boldface Arial font?

Review questions for Transfer

Driscoll's (2005) chapter 6 "Simulations" end includes as final element, a section labelled "Reflection and application": It starts like this:

To reflect on the material presented in this chapter and apply in in a real e-learning situation, consider how you would respond to the following challenges. (Each of these challenges is intentionally left vague. If you are unsure about a piece of information, make an assumption about it and list the assumption

On of the challenges starts and ends like this:

To vice president of human resources in your company has scheduled a mdeeting with you to talk about an initiative to improve customer service. Your company is in the hospitality business [...] You are considering recommending an online learning program that uses a simulation strategy. Outline the the benefits and limitations of this strategy before your meeting.

This is a short and open ended case problem for which the student is support to sketch out a design.

Transfer aids

Driscoll (2005) ends chapter 6 "Simulations" with a section labelled "Conclusion". The second paragraph looks like this:

Using the examples in this chapter, think about how you might use simulations in a blended mode. If you don't have the budget, time, or support to develop a pur simulation-based program, consider simulation as a post-training program. Use smaller programs with a focus on authentic and corrective feedback to re-inforce classroom lessons.

She then continues with a short annotated bibliography labelled "Learn More about it" an finally finally some review questions (see above)

Some authors also include planning aides (e.g. till-in tables) for reader who want to put theory into practise.

Self-assessment

(missing)

Exercises

(missing)

Projects

(missing)

Further reading

(missing)

Typographic Design

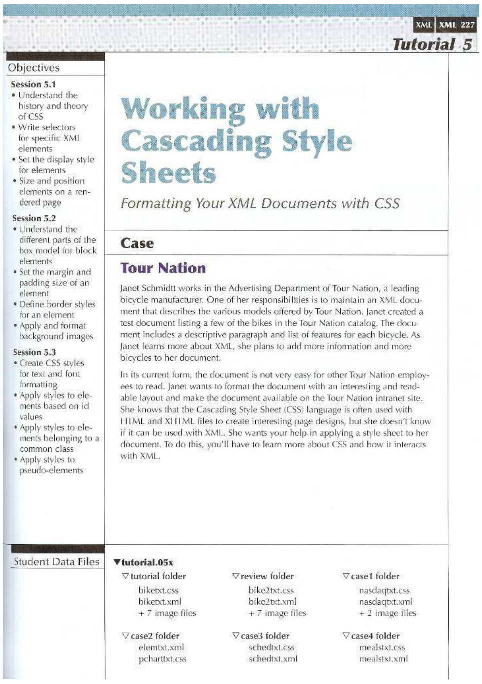
Overall style

Pedagogical discourse should be reflected in layout. However, as it is the general rule in educational technology, there is no single solution. Daniel K. Schneider believes that a lot of design decisions are rather based on intuition than on solide knowledge what works.

Globally speaking, there exist two extremes. Textbooks that relativeley "sober" with relatively few words per page and the opposite end textbooks that use wide pages, lots of color and graphical markup. Here are two examples from "real" textbooks:

Carey, Patrick (2006) New Perspectives on XML, Second Edition, Comprehensive.

This is the second page of the chapter (tutorial on CSS). The first page contains instructions dealing with code.



XML | XML 227

Tutorial 5

Objectives

Session 5.1
- Understand the history and theory of CSS
- Write selectors for specific XML elements
- Set the display style for elements
- Size and position elements on a rendered page

Session 5.2
- Understand the different parts of the box model for block elements
- Set the margin and padding size of an element
- Define border styles for an element
- Apply and format background images

Session 5.3
- Create CSS styles for text and font formatting
- Apply styles to elements based on id values
- Apply styles to elements belonging to a common class
- Apply styles to pseudo-elements

Working with Cascading Style Sheets

Formatting Your XML Documents with CSS

Case

Tour Nation

Janet Schmidtt works in the Advertising Department of Tour Nation, a leading bicycle manufacturer. One of her responsibilities is to maintain an XML document that describes the various models offered by Tour Nation. Janet created a test document listing a few of the bikes in the Tour Nation catalog. The document includes a descriptive paragraph and list of features for each bicycle. As Janet learns more about XML, she plans to add more information and more bicycles to her document.

In its current form, the document is not very easy for other Tour Nation employees to read. Janet wants to format the document with an interesting and readable layout and make the document available on the Tour Nation intranet site. She knows that the Cascading Style Sheet (CSS) language is often used with HTML and XHTML files to create interesting page designs, but she doesn't know if it can be used with XML. She wants your help in applying a style sheet to her document. To do this, you'll have to learn more about CSS and how it interacts with XML.

Student Data Files

▼**tutorial.05x**

▽tutorial folder
biketxt.css
biketxt.xml
+ 7 image files

▽review folder
bike2txt.css
bike2txt.xml
+ 7 image files

▽case1 folder
nasdaqtxt.css
nasdaqtxt.xml
+ 2 image files

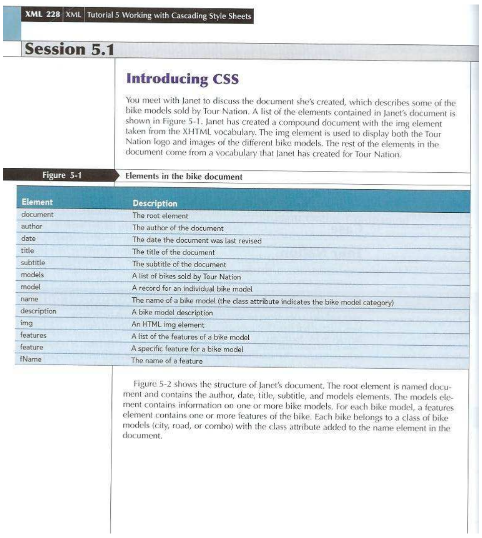
▽case2 folder
elemtxt.xml
pcharttxt.css

▽case3 folder
schedtxt.css
schedtxt.xml

▽case4 folder
mealstxt.css
mealstxt.xml

Carey, Patrick (2006) New Perspectives on XML

This is the third page of the same chapter



XML 228 | XML | Tutorial 5 Working with Cascading Style Sheets

Session 5.1

Introducing CSS

You meet with Janet to discuss the document she's created, which describes some of the bike models sold by Tour Nation. A list of the elements contained in Janet's document is shown in Figure 5-1. Janet has created a compound document with the img element taken from the XHTML vocabulary. The img element is used to display both the Tour Nation logo and images of the different bike models. The rest of the elements in the document come from a vocabulary that Janet has created for Tour Nation.

Figure 5-1 Elements in the bike document

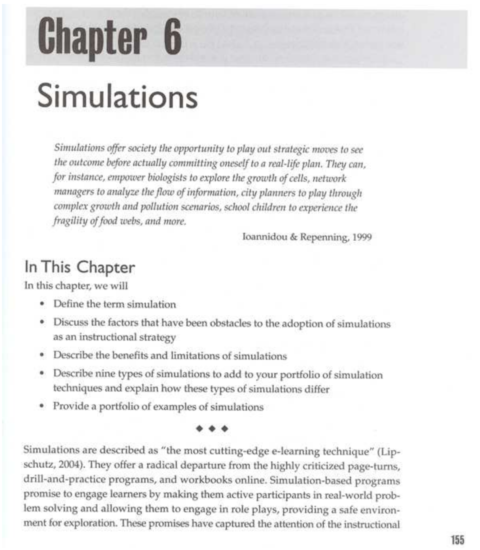
Element	Description
document	The root element
author	The author of the document
date	The date the document was last revised
title	The title of the document
subtitle	The subtitle of the document
models	A list of bikes sold by Tour Nation
model	A record for an individual bike model
name	The name of a bike model (the class attribute indicates the bike model category)
description	A bike model description
img	An HTML img element
features	A list of the features of a bike model
feature	A specific feature for a bike model
fName	The name of a feature

Figure 5-2 shows the structure of Janet's document. The root element is named document and contains the author, date, title, subtitle, and models elements. The models element contains information on one or more bike models. For each bike model, a features element contains one or more features of the bike. Each bike belongs to a class of bike models (city, road, or combo) with the class attribute added to the name element in the document.

Carey, Patrick (2006) New Perspectives on XM

Driscoll

This is the first page of the simulation chapter



Chapter 6

Simulations

Simulations offer society the opportunity to play out strategic moves to see the outcome before actually committing oneself to a real-life plan. They can, for instance, empower biologists to explore the growth of cells, network managers to analyze the flow of information, city planners to play through complex growth and pollution scenarios, school children to experience the fragility of food webs, and more.

Ioannidou & Repenning, 1999

In This Chapter

In this chapter, we will

- Define the term simulation
- Discuss the factors that have been obstacles to the adoption of simulations as an instructional strategy
- Describe the benefits and limitations of simulations
- Describe nine types of simulations to add to your portfolio of simulation techniques and explain how these types of simulations differ
- Provide a portfolio of examples of simulations

◆ ◆ ◆

Simulations are described as "the most cutting-edge e-learning technique" (Lipschutz, 2004). They offer a radical departure from the highly criticized page-turns, drill-and-practice programs, and workbooks online. Simulation-based programs promise to engage learners by making them active participants in real-world problem solving and allowing them to engage in role plays, providing a safe environment for exploration. These promises have captured the attention of the instructional

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Driscoll, M., Carliner, S. (2005) Advanced Web-Based Training - Real World Strategies in Your Online Learning

Titles

(missing)

Marginalia

(missing)

Strong text

(missing)

Crossreferences

(missing)

Figures

(missing)

Boxes

(missing)

Using a word processor

- See Microsoft Word if you must use it ...

Links

- Richard Felder [3]'s resources in science and engineering education.
- What I've Learned about Writing Economics [4] by Hal R. Varian, University of California, Berkeley
- Writing Guidelines for Engine (Eco)ering and Science Students [5] by Michael Alley
- Getting Started Creating A Textbook [6] by David Rees (goals and process). (also here [7]).

- Instructional literature [8], Development of Educational Material, CARNet, retrieved 19:57, 8 August 2007 (MEST)).
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- So You Want to Write a Book [9] (O'Reilly)

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For research-related questions, see textbook research

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Remark: My reason for writing in English is simple. That way I can find at least a few readers. I know that my unedited English is bad. Some things I could fix myself (like spelling, omission of words, too long sentences etc. if I had more time). Anyhow, there exist some manuals about style. However, Geoffrey K. Pullum in his piece *50 Years of Stupid Grammar Advice* [14] warns that " English syntax is a deep and interesting subject. It is much too important to be reduced to a bunch of trivial don't-do-this prescriptions by a pair of idiosyncratic bumblers who can't even tell when they've broken their own misbegotten rules.".

Instructional objectives

See also: instructional design and instructional design method in particular.

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Examples of textbooks

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- Clark, Ruth Colvin and Richard E. Mayer (2003). E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning, Pfeiffer, ISBN 0787960519
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- Morsund, David (2002) Project-based learning: Using Information Technology, 2nd edition, ISTE. ISBN 1-56484-196-0
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- Veer, E.A. Vander and Chris Grover (2007). Flash CS3: The Missing Manual. ISBN 0596510446

Learning design

Draft

Definitions

A **Learning Design** describes the educational process, not just courseware but the whole teaching/learning experience. It's a more or less formal description of a pedagogical scenario (also called educational script or storyboard) and that may or may not follow an instructional design model.

The process of learning design refers to the activity of designing units of learning, learning activities or learning environment.

Learning Designs are "pedagogically informed learning activities which make effective use of appropriate tools and resources" (Gráinne Conole and Karen Fill [1], creators of the DialogPlus Toolkit.)

"The basic idea of EML and LD [Learning Design] is in essence simple. It represents a vocabulary which users of any pedagogical approach understand, and into which existing designs can be translated. The core of LD can be summarised as the view that, when learning, people in specific groups and roles engage in activities using an environment with appropriate resources and services." (Rob Koper and Colin Tattersall [2], creators of EML/IMS Learning Design).

"The field of Learning Design seeks to describe the "process" of education - the sequences of activities facilitated by an educator that are often at the heart of small group teaching."(James Dalziel [3], creator of LAMS, retrieved 18:53, 4 June 2007 (MEST)).

See also:

- IMS Learning Design which is a related educational modeling language.
- CSCL script, an other type of learning design popular in collaborative learning.

Benefits of the learning design approach

Much of the work on Learning Design focuses on technology to automatically "run" the sequence of student activities (facilitated by the educator via computers), but an activity in a Learning Design could be conducted without technology. Hence, a particular Learning Design may be a mixture of online and face-to-face tasks ("blended learning") or it could be conducted entirely face-to-face with no computers (in this case, the particular Learning Design acts as a standardised written description of the educational process - like a K-12 lesson plan). One way to think of a Learning Design system is as a workflow engine for collaborative activities. A particular Learning Design is like an educational recipe for a teacher - it describes ingredients (content) and instructions (process). (James Dalziel [3], retrieved 18:53, 4 June 2007 (MEST)).

Learning Design theory is a new attempt to describe the foundational elements of the educational process. It provides conceptual and technical tools to describe who is involved in a learning activity, what resources are required for the activity, how the activity is conducted, and most importantly, how a collection of activities are structured into a Learning Design(also called a unit of learning, sequence of learning activities, digital lesson plan, etc). Two distinguishing features of recent work are (1) the description of Learning Designs in machine readable formats so that they can be run by software systems, and (2) the ability to store Learning Designs, and hence share them, search for them, re-use them, adapt them and so on. Taken together, these features of Learning Designs have the potential to transform teaching and learning through the sharing and implementation of good practice. More fundamentally, Learning Design theory may provide a new way to conceptualise the educational process via a shared vocabulary for describing learning activities and how they are combined.

(James Dalziel, ED-MEDIA 2006 Learning Design Keynote [4], retrieved 4 June 2007

The OU Learning Design Initiative [1] (retrieved jan 26, 2009) identified six main benefits to adopting a learning design approach:

* It acts as a means of eliciting designs from academics in a format that can be tested and reviewed by others involved in the design process, i.e. a common vocabulary and understanding of learning activities.

- It provides a method by which designs can be reused, as opposed to just sharing content.
- It can guide individuals through the process of creating new learning activities.
- It helps create an audit trail of academic (and production) design decisions.
- It can highlight policy implications for staff development, resource allocation, quality, etc.
- It has the potential to aids learners and tutors in complex activities by guiding them through the activity sequence.

Learning design can be seem as an attempt to grow the *troyan mouse*. “E-learning is often talked about as a ‘trojan mouse,’ which teachers let into their practice without realizing that it will require them to rethink not just how they use particular hardware or software, but all of what they do.” Sharpe & Oliver, 2007: 49. Once engaged in e-learning, reflective practitioners then might become interrested in more powerful tools for planning and enacting their teaching.

Learning Design and educational technologies

So far, typical source leaders rarely use tools to design courses. For example Masterman (2006) regarding the use of tools in designing for learning in postcompulsory education, reported that out of 69 respondents most respondents either rely on Pencil and Paper or very simple e-tools such as Word processors or presentation software: “On average, respondents used 2.5 different genres of e-tool, although this figure masks a wide variation. Only 13 used four or more genres, while 22 used only one genre, suggesting either lack of experience with other genres or that the tool they used appeared to satisfy their requirements. Where only one e-tool was used, that tool was Word in just over half of cases (12 out of 22)” (Masterman, 2006:13). Only 5.8% did use specialized learning design tools.

According to the LADIE framework (LADIE, 2005), we can distinguish two basic facts of learning design:

1. The design and construction of learning activities (LAA), including for example design of learning activities and learning conents.
2. The learning activity realization (LAR), i.e. the construction of the environment and the execution of the learning activities themselves.

Learning design tools can provide support for either one or both.

Here is an incomplete of some specialized learning design languages, tools and systems (follow up these links to find references) and also have a look at the category educational modeling languages

Standards, formalisms and modeling languages

- IMS Learning Design (An educational modeling language)
- coUML A UML-based design language.
- BPEL (Business Process Execution Language, used for Model-Driven Learning Design)
- Collaborative learning flow pattern (CLFP)

Visual modeling languages with a tool

- E2ML
- PALO
- IAMEL (Bottino et al. 2011)

Systems

- LAMS (Learning activity management software)
- CeLS

Learning design editors

- MISA (An instructional design method, includes the MOTD+ editor)
- Collage (CLFP editor)
- Compendium LD
- ASK Learning Designer Toolkit (ASK-LDT)

On-line repostitories for scenarios

- DialogPlus Toolkit (An online scenario builder).
- Cloudworks

Other initiatives (some are not called "learning design")

- Open University Learning Design Initiative [5] (ended 2012)
- CSCL scripts
- eLML (Pedagogical document markup
- Various more ambitious lesson planning tools, such as the London Pedagogy Planner [6] or the Phoebe pedagogic planner

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Learning management system

Definition

A Learning Management System (sometimes also called "Course Management System", "Pedagogical Platform", "E-Learning Platform") is a software system that delivers courseware plus e-tutoring over the Internet.

LMS should not be your starting point. Typically, when decision makers talk about E-Learning they want to know what system to install. First of all, so called LMS are not the only answer, you also can implement E-Learning with other tools (e.g. groupware, content management systems or even a wiki or other hypertext system, often in combination with a forum. Second, in any case you should start by thinking about an appropriate instructional design that uses appropriate teaching strategies for various learning types.

"“LMS” is a catchall term in SCORM. It refers to a suite of functionalities designed to deliver, track, report on and manage learning content, learner progress and learner interactions. “LMS” can apply to very simple course management systems, or highly complex enterprise-wide, distributed environments.” (SCORM 2004 3rd Edition Overview Version 1.0 [1])

See also:

- LAMS A good learning design system that we can recommend (for people with serious activity-based e-learning in mind)
- Rapid elearning (for mostly simple facts & skills training needs)
- LCMS (Learning content management systems)
- Student management system

Components of an LMS

Feature lists are getting quite long and it is not easy to decide which features are the most important unless you have a good background in various areas like instructional design, ergonomics and systems management.

Typical features are:

- Course Management, e.g. lists of courses, registration, credit information and syllabus, pre-requisites
- Teaching Materials, i.e. courseware
- Self-assessment quizzes
- Lessons tools: Authoring for contents (structured XML or HTML) and quizzing/testing (e.g. Java Script generators) or alternatively ability to import standard IMS or SCORM packages developed with an external tool (e.g. Dreamweaver).
- Asynchronous Communication: email, forums
- Synchronous Communication: chat, whiteboard, teleconferencing,
- Student tools: Home page, self tests, bookmarks, progress tracking, ...
- Student Management Tools: progress tracking, on-line grading (assessment), ...
- Learner feedback: course evaluation surveys, test evaluation surveys etc.

Usually LMS are closed circuit platforms (logins, restricted access to classes), so the idea of sharing contents and reusing products generated during classes does not exist in the world of "LMSs" (main-stream e-learning).

List of software

These lists **needs updating**, therefore, before looking our lists please check the links section at the end of this page. Others do a much better job than we do. In addition, it is very difficult to find truly independant reviews by real experts - Daniel K. Schneider (talk) 16:15, 9 October 2013 (CEST)

Free / Open Sourcource Portalware

Software to install on your own server,

- Amadeus [2] (the Brazilian Federal Government public software LMS)
- ATutor [3] (used at TECFA our student's to play with)
- Bodington [4]
- chamilo [5] (made by people who left the Dokeos development).
- Chamilo LCMS Connect [6]. Same team, but very different from Chamilo, Try it [7]
- Claroline [8] (Older sister of Dokos and Chamilo).
- Claroline Connect (Beta, ready in summer 2014?) - try it [9]
- DoceboLMS [10]
- Dokeos [11] (popular in french and spanish speaking countries)
- e-Learning XHTML Editor [12] (contents can then be imported to most LMSs).
- eFrontLearning [13] (fairly user friendly, not tested, there are commercial variants)
- Fle3 [14] (research system, maybe dead)
- GaneshaLMS [15]
- ILIAS [16]
- interact [17] (Dead link)
- KEWL.Nextgen [18] (Dead link)
- LRN [19]
- Moodle [20] (used at TECFA for several courses)
- OLAT [21]
- OpenUSS [22] and sourceforge site [23]
- Sakai [24], “a community source software development effort to design, build and deploy a new Collaboration and Learning Environment (CLE) for higher education.”
- Segue [25] (dead project)
- Stud.IP [26] (Studienbegleitender Internetsupport von Präsenzlehre). More like a portal, made for German higher education.
- TelEduc [27]
- WordPress LMS [28] (since summer 2012).

You can try out some of these system at http://www.opensourcecms.com/ [29] (in addition to **many** other portalware). You will have full administrator rights (all systems will be refreshed every hour).

Online services

(Most are commercial, basic services may be free)

- CCNet [30]
- Haiku LMS [31]
- Canevas [32], a popular recent cloud-based system. As of 2013, many sites seem to migrate from Blackboard to this. It does have a Auth2 / https / JSON [33] based API. Single teachers can sign up for free.
- FeatherCap [34] (trial version available)
- ProProfs [35] (free version available)
- KoolLearning [36], new in 2013. Offers good integration of resources.

Commercial

These are either available for self-hosting, as service or both.

- Blackboard Vista (former WebCT)
- Desire2Learn [37]
- Halogen eLearning Manager [38]
- iQpakk [39]
- TopYX [40], a service-based social LMS
- Rapid Intake [41] (several tools, both for corporate and school environments).
- Skilitix [42], a service-based LMS using the new Tin-CAN API (2013). At its core is a roleplay application.

See also rapid elearning, more popular in industry (low-level) training

Links

There are many sites that will give you advice on how to choose a standard, main-stream E-Learning System:

- elearningindustry.com [43] maintains several lists (search the site), e.g.
  - The Ultimate list of Open Source Learning Management Systems [44]
  - The Ultimate List of Cloud-Based Learning Management Systems [45]
- Course Management Systems [46] (formerly Landonline).
  - Probably the **best site** out there, if you are interested in criteria-based selection of an LMS
  - This site was built to assist higher education in using a more rational decision making process to review the many options for a course management system.
- LMS Talk [47] List of products, forum, etc.
- Elearning Platforms (Learning Management Systems) [48] by EduTech, the technological support for the Swiss Virtual Campus project. Much shorter list, but enough for most of us ....
- LernmanagementSysteme.DE [49] German blog about LMS, includes a large comparative table of LMS's (added oct. 2011).
- LMS comparison [50]
- UNESCO free software portal [51]
- The Re.ViCa wiki [52] has been set up to provide an inventory and to show the results of a systematic review of Virtual Campus initiatives of the past decade within higher education throughout the world.
- List of learning management systems [53] (Wikipedia)
  - See also Category:Learning management systems [54]
- What is an LMS [55] Free educational resource site with comprehensive articles explaining the different aspects of Learning Management Systems: features checklists, cost comparisons, support & technology, enterprise LMS

checklists, LMS vendor comparisons, LMS & LCMS comparisons, proprietary/open source & SaaS LMS comparisons and many more.

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- Jay Melton, The LMS moodle: A Usability Evaluation, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.124.7533&rep=rep1&type=pdf (ref to find/add)

Learning sequence

Draft

Definition

A **learning sequence** is an ordering of student's learning activities.

In the design literature one may find two basic sorts of instructional design models

- Those that focus on materials, i.e. resources arranged to form an organization of learning-flow content. Typically, they would use an instructional systems design method such as the Kemp design model.
- Those that focus on activities. In that case one rather talks about scenarization or storyboarding.

Learning sequences in Instructional Systems Design

“*Sequencing* is the efficient ordering of content in such a way as to help the learner achieve the objectives. For some objectives, the sequence is suggested by the procedure [...]. Other topics, however, have a less obious sequence. [...]” (Morrison, 2004: 136).

“The last step in the design phase is to determine program sequence and structure to ensure the learning objectives are met. A proper sequence provides the learners with a pattern of relationship so that each activity will have a definite purpose. The more meaningful the content, the easier it is to learn and, consequently, the more effective the instruction.” Instructional System Design - Design Phase [1], retrieved 20:57, 4 June 2007 (MEST).

Typically a learning sequence would use an instructional design model like Gagne's Nine events of instruction or Merril's component display theory.

Learning sequences in Learning Design

In IMS Learning Design sequences are implicitly defined as methods that contain a "play", i.e. a series of acts, in which roles are played by those taking part, for example learner, tutor, mentor, and so on.

Links

- Donald Clark, Developing Instruction or Instructional Design [5].
- Morrison, G. R., Ross, S. M., & Kemp, J. E. (2004). Designing effective instruction (4rd ed.). New York: John Wiley & Sons, Inc.

Learning to teach with technology model

Draft

Definition

The **Learning to teach with technology model** is a science teacher training model by Friederichsen et al. (2001).

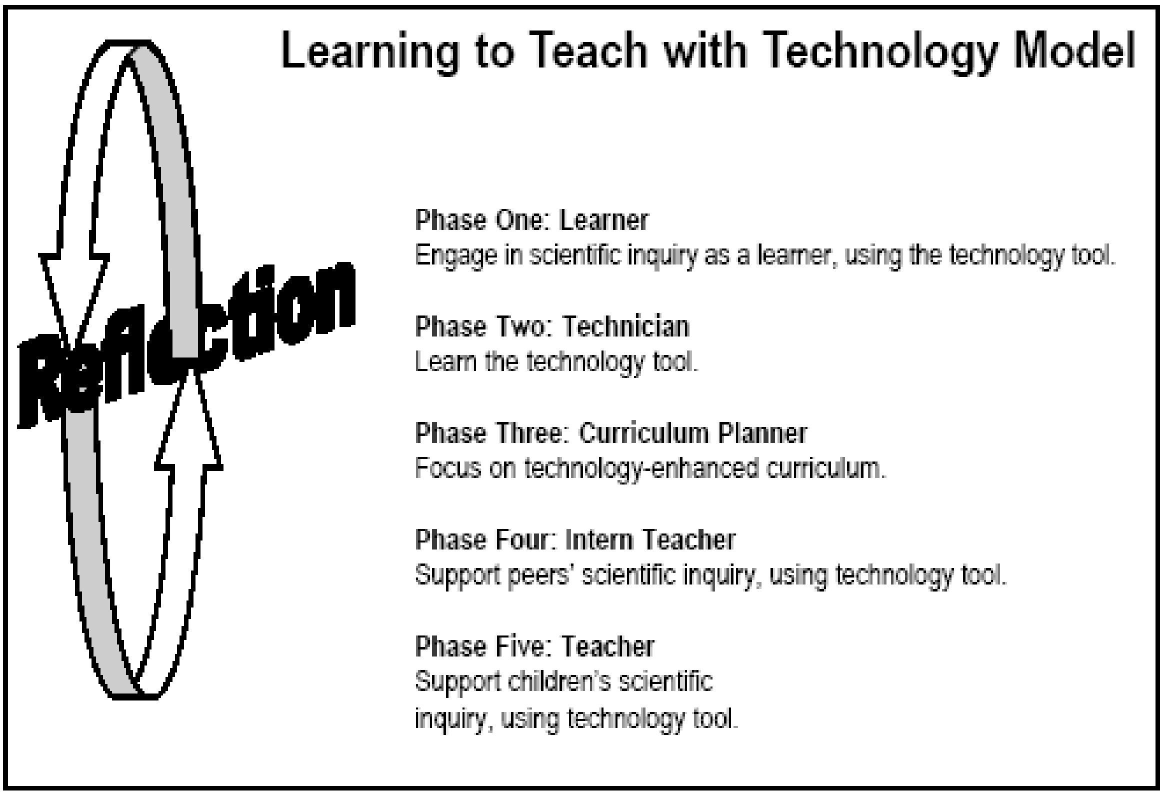
The model

This model is based on the idea that teachers first have to experience a technology before they can use it in teaching.

We quote from Friederichsen et al. (2001):

1. In the first phase of the model, students are viewed as science learners and engage in scientific inquiry using the specified technology tool. [...]
2. In the second phase of the model, the students focus explicitly on the technology tool. The students engage in additional scientific investigations using the technology tool, but in this stage of the model, some of the instructor support is removed. [...]
3. During the third phase of the model, Curriculum Planner, the students examine existing technology-enhanced science curricula and/or modify existing exemplary curricula to integrate the use of the technology tool. [...]
4. In the fourth phase of the model, the students move from the role of science learner to that of science teacher. In a mentored, small group setting, the students use the technology tool to support other students scientific inquiry. [...]
5. The final phase of the model, Teacher, occurs in a school setting as the students plan and teach technology-enhanced lessons for supporting childrens scientific inquiry. The students write lesson plans, teach using the technology tool, and write reflective papers on their experiences. [...]

This model is summarized by Friederichsen et al. (2001:384) with the following picture (reprinted without permission for the moment):



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Lesson planning

Draft

Definition

- A writing noting the method of delivery, and the specific goals and time-lines associated to the delivery of lesson content.
- It helps the teacher to know what to do in a class (prepared by themselves) with quite specific activities. EFL Teachers Jargon [1]

See also:

- curriculum planning
- the instructional design article that addresses very similar issue from a more "industrial" point of view, e.g. consider models like Gagne's nine events of instruction. If you are interested by more sophisticated models browse through the large list of instructional design models.

Lesson planning guide example

We provide a short summary of El-Tigi's Write a Lesson Plan Guide [2] with some modifications.

While planning a lesson, a teacher should think about each of the following categories:

1. Goals: Think about (1) broad objectives of the course, (2) goals of the particular lesson, (3) what students should be able to achieve after the lesson.
2. Objectives within the lesson: Define what your students will do to acquire further knowledge and skills and how they will be able to demonstrate that they have learned.
3. Prerequisites
4. Materials: What will be needed, e.g. what is available (make a list/bibliography) and what will have to be prepared.
5. Lesson Description: Describe the general focus of the lesson and include thoughts to share with other teachers. May include learning level.
6. Lesson Procedure
    1. Introduction: Describe how you introduce ideas and objectives, get student's attention and motivation, etc.
    2. Main activity: Define the sequence of activities, in particular pedagogic methods like presentation, demonstration, explanation, discussion.
    3. Closure/conclusion: Describe how you plan to draw ideas together and to provide feedback to students.
    4. Follow up Lessons / Activities:
7. Assessment / Evaluation: Define how you will assess student's learning. Also evaluate if students engaged in suggested practice.

Lesson planning tools

- Frequently these tools are also called **curriculum unit planners** (we use these as synonyms).
- Finally, we refer to curriculum planners (or **curricula planners** to describe instruments that either describe course contenents and objectives at a very high level or that allow students to select courses. But these distinctions are not always obvious it seems....

Lesson planning models and guides

For Lesson Plan Information [3] based on the Hunter Model

- Madeline Hunter method, a direct instruction model
- WIPPEA a backwards design method, based on Madeline Hunter.
- Lesson Planning self study guide [4] (58 steps).
- .... [more needed], see the references below

Lesson planners

Draft

Lesson planners also called lesson planning software help teachers to plan lessons. Sometimes, they also can be considered a policy tool, i.e. some tools specifically try to insure that teachers follow official guidelines.

Special purpose tools

- In some ways, authoring toolkits that implement an idea of learning design also can be considered to be lesson planners, see for example IMS Learning Design, Learning Activity Management System (LAMS), MOT, etc.

On-line tools

- The Dialog Plus Toolkit is an online toolkit to design activity-based learning designs

To sort out (applications and on-line tools)

Here are a few examples (not tested by the authors of this entry):

- LessonPlan101 [5] A wiki to share lesson plans and coming soon a lesson plan program for linux and windows.
- Lesson Planning Tool [6] assists elementary school teachers in making lesson plans that fulfill the Texas Education Agency (TEA) guidelines.
- PLANright [7]
- Lesson Plan Maker [8]
- NCRTEC Lesson Planner [9]
- DiscoverySchool Lesson Planner [10]
- CyberCampus ObjectivesBuilder [11] (On-line tool, Flash based).
- Ontario Curriculum Unit Planner [12] and Planificateur d'unités d'apprentissage [13]

Links

Lesson Planning

- Lesson planning [14], A teaching/learning module for teachers from the TILE [15] support tool from the Kite [16] project.
- Pedagogic Planner Summit [17] (workshop 8th of December 2008 at the University of Sydney) Includes slides about plans for LAMS

Lesson Plans

On the Internet one can find thousands of good lesson plans. Often through specialized portals some of which are sponsored by official school systems. The few links below are not at all complete and we absolutely don't vouch for any of them (no time for reviewing) ! We may at some point identify the ones that are particularly interesting with regarding technology integration.

- LessonPlanSearch.com [18] Lesson Plan Search engine.
- The Teacher's Corner - Lesson Plans [19]
- http://www.lessonplan101.com A lesson plan wiki - Share Your Lessons.
- http://memory.loc.gov/learn/(Library of Congress).
- http://www.eduref.org/Virtual/Lessons/
- http://www.readwritethink.org/index.asp
- http://www.kidzonline.org/LessonPlans/
- http://www.lessonplanspage.com/
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Introductions for teachers

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- El-Tigi, Manal (1999). Write a Lesson Plan Guide, The Educator's Reference Desk, HTML [2] retrieved 18:53, 27 June 2006 (MEST). This short guide also includes a library of examples and further pointers.
- Kizlik, Sandra, Lesson Plans The Easy Way, AdPrima, HTML [22]

Madeline Hunter method

Draft

Definition

The **Madeline Hunter method** is a kind of direct instruction model and method mostly applied to lesson planning.

This model is quite closely associated with typical general behaviorist/cognitivist instructional design models like Gagne'sNine events of instruction and it incorporates mastery learning concepts.

There are many variants of this models, e.g. the simple WIPPEA lesson planning method.

The model

Disclaimer: DSchneider did not read original work of M.Hunter. In the literature and web pages consulted, there are various variants of the typical "scenario steps". Usually it has either 7 or 8 steps.

From a preparation perspective

(1) Objectives and standards

- Fix them

(2) Prepare teaching materials

- Anticipation: Prepare materials to grab the student's attention and put him in "the right frame"
- Teaching: (input): Prepare "input" materials.
- Teaching (modeling): Prepare relevant examples that show what is expected
- Guide practice: Prepare exerices and other activities
- Closure: Rehearse a nice closing statement (that show what has been learnt, to point out important things, etc.)
- Independant practice: E.g. home work or group work. Should reinforce *and* engage learners in decontextualization (by have them work on examples from different context)

From a scenario perspective

(1) Anticipation

- A short wake-up activity that get's the student's attention *and* interest
- e.g. a simple question, an example problem,

(2) Objectives, purpose, standards

- Tell the students what he will learn
- And (if necessary) how this knowledge will be tested

(3) Input (teaching basic concepts and skills)

- Summarize definitions
- Demonstrate basic skills

(4) Modeling (show)

- Demonstrate application of concepts and skill with a worked through example.

(5) Guided practice

- have learners do exercises

(6) Monitoring

- This is not precisely a step in time, monitoring has to be done in different ways:

- During and after steps 3 and 4, the teacher has to *check for understanding* (this is often presented as step number 5 in fact).
- After steps 5 and 6 students have to be tested which is different sort of "checking for understanding", e.g. if guided practice shows misunderstanding or bad understanding, go back to step 3 and/or 4 and adapt.

(7) Independent practice

- Students practice on their own (either in or out of class).

(8) closure

- Wrap up

Jonathan Mueller [1] presents the Madeline Hunter Lesson Plan format in a way DSchneider likes better. His outline separates more clearly different phases:

Getting students set to learn

- Step 1: Review
- Step 2: Anticipatory Set
- Step 3: Objective

Instruction

- Step 4: Input and Modeling

Checking for understanding

- Step 5: Checking Understanding
- Step 6: Guided Practice

Independent practice

- Step 7: Independent Practice

Note: Mueller points out that " How are checking understanding and guided practice different? Checking understanding occurs in the process of instruction. Guided practice takes place just after instruction has occurred. Checking for understanding is often a whole-class process by observing body language or asking a simple question to the whole class. Guided practice may be done individually. Both involve quickly assessing whether students understand what has just been presented."

Links

- Some Basic Lesson Presentation Elements [8] (presents the Madeline Hunter Method).
- Madeline Hunter's Lesson Plan [2].
- A White Paper on Lesson Planning [3] by Cliff Schimmels.
- Formatting Lesson Plans: The Madeline Hunter Lesson Design Model [4]
- Hunter Method [5] by Christy Keeler. This includes an example.
- Madeline Hunter's Lesson Plan Format [1] by

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- Hunter, M. (1985). What's wrong with Madeline Hunter? Educational Leadership, 42(5), 57-60.
- Hunter, Robin (2004). Madeline Hunter's Mastery Teaching, Corwin Press. ISBN 076193930X (Seems to be the most popular modern M. Hunter method textbook)

Mastery learning

Definition

- **Mastery learning** refers to the idea that teaching should organize learning through ordered steps. In order to move to the next step, students have to master the prerequisite step. Mastery learning engages the learner in multiple instructional methods, learning levels and multiple cognitive thinking types.

According to Davis & Sorrel (1995): “ The mastery learning method divides subject matter into units that have predetermined objectives or unit expectations. Students, alone or in groups, work through each unit in an organized fashion. Students must demonstrate mastery on unit exams, typically 80%, before moving on to new material. Students who do not achieve mastery receive remediation through tutoring, peer monitoring, small group discussions, or additional homework. Additional time for learning is prescribed for those requiring remediation. Students continue the cycle of studying and testing until mastery is met. Block (1971) states that students with minimal prior knowledge of material have higher achievement through mastery learning than with traditional methods of instruction. ”

Cited from Davis & Sorrel (1995): “ In summary, mastery learning is not a new method of instruction. It is based on the concept that all students can learn when provided with conditions appropriate to their situation. The student must reach a predetermined level of mastery on one unit before they are allowed to progress to the next. In a mastery learning setting, students are given specific feedback about their learning progress at regular intervals throughout the instructional period. This feedback, helps students identify what they have learned well and what they have not learned well. Areas that were not learned well are allotted more time to achieve mastery. Only grades of "A" and "B" are permitted because these are the accepted standards of mastery. Traditional instruction holds time constant and allows mastery to vary while mastery learning or systematic instruction holds mastery constant and allows time to vary (Robinson, 1992).”

Typical design of a large learning unit

(e.g. a course)

1. Definition of clear objectives of what has to be taught/learnt
2. "Subject is divided into relatively small learning units. Each unit will have:
   - objectives (i.e. a clear definition of what has to be mastered");
   - a brief diagnostic test to be administered before the unit (they may lead to supplementary instruction);
   - learning materials and instructional strategies;
   - formative evaluation (that in turn should lead to remediation) and summative evaluation.
3. Time to learn is adjusted for each student in order to master at least 80% of the material
4. Assessment whether global objectives have been met.

See also similar instructional design models like Gagne's Nine events of instruction.

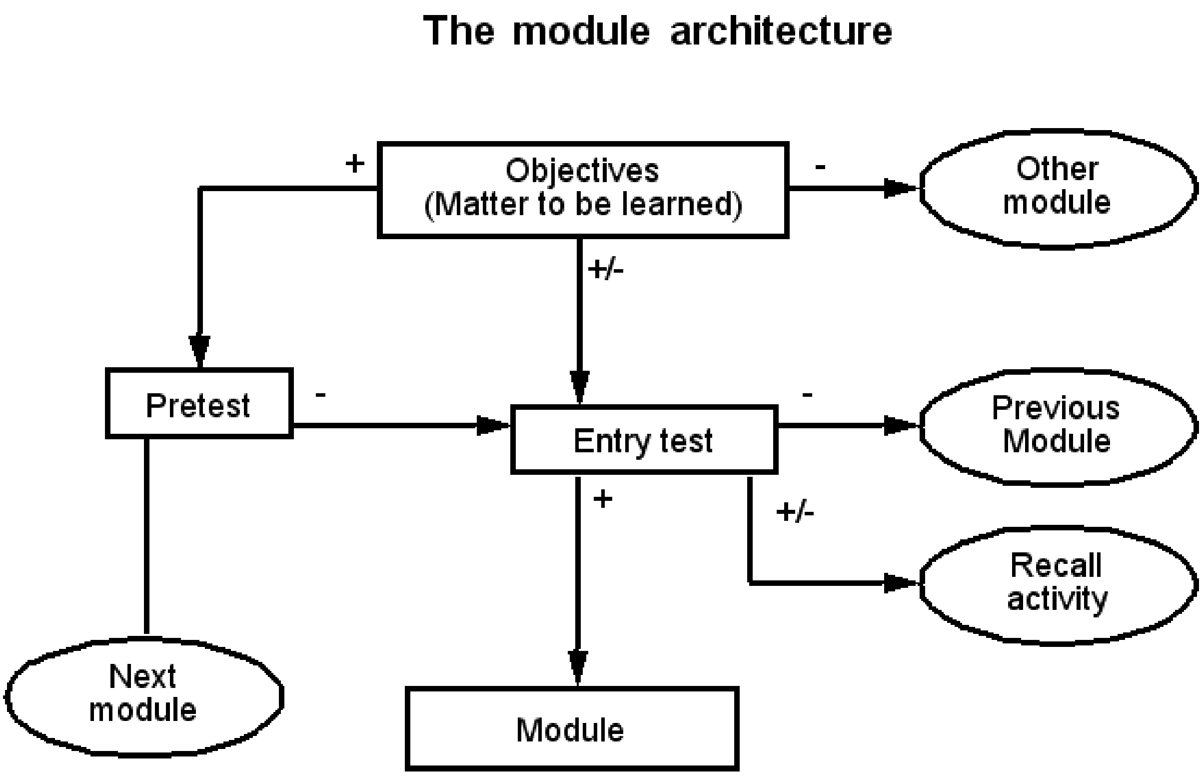
Mastery learning in practice

True mastery learning in the spirit of Bloom may not be very popular, mostly because it is very costly and difficult. This applies to both classroom teaching and electronic courseware.

However, a few key ideas can be found in many designs, e.g:

- course modularity
- definition of objectives for each module
- entry tests
- individual learning pace
- feedback after learning task with some remediation
- assessment

The following picture shows a typical design of a distance teaching module architecture (minus the assessment component).



Technologies

- **Mastery learning** at least at a superficial level of understanding and implementation is very popular in Computer-based training and e-learning. It also can be found in richer models of computer-based learning.
- Toolkits like Authorware have built-in facitilities to implement mastery learning.
- IMS Content Packaging plus IMS Simple Sequencing allows in principle to implement this kind of design (provided that the e_learning platform can fully deal with it.
- IMS Learning Design supports this instructional design model.

History

- According to Davis & Sorrel (1995), "The mastery learning concept was introduced in the American schools in the 1920's with the work of Washburne (1922, as cited in Block, 1971) and others in the format of the Winnetka Plan."
- It was revived in the late 1950' with programmed instruction
- According to TIP [1], Caroll in 1963 was the first to argue in favor of some kind of mastery learning. See the Carroll model of school learning article.
- Bloom in the 1960' defined the modern model and also was activly engaged in promulgation and evaluation.

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Medicine Blends Computers and PBL

Definition

This is an example case of problem-based learning.

Source: http://edweb.sdsu.edu/clrit/learningresource/PBL/PBLFacilitatingExample.html

The Medicine Blends Computers and PBL case

1. Students teams of five to six meet and are provided with a simulated patient's explanation of a medical complaint via a computer network. The computer will allow students access to history, physical examination, and diagnostic data for the case being presented. Students decide the learning issues involved in each case and how to go about solving these issues. The problem finding projections and analyzing are entered into the computer for record keeping and monitoring.
2. The classroom, whether virtual or face to face, is transformed into a tutorial where instruction takes the form of a process that evolves among students in a team and their coach. The instructor acts as a tutor/facilitator analyzing and guiding student's thinking strategies and modeling these processes for them. As a "meta-cognitive coach" the teaching role becomes one of questioning, probing, encouraging, critical appraisal, balancing emphasis, promoting interaction, and prompting students to become aware of the reasoning skills they are using (Gallagher, et. al., 1992). As different groups work through the problem, their progress is monitored by the instructor and feedback is delivered along with identified research topics for teams. Teams work out assignment among themselves and proceed to tackle them.
3. After one or two days students reconvene to reexamine the example problem and attempt a solution with regards to their research findings, again the computer is used to record and monitor progress as before.
4. Next all groups will meet together with the instructor. At this time students will assume the role of "expert" for the topic they explored and present findings. The instructor will give an expert description of the problem solution (instruction in basic science concepts associated with the problem) and provide each group with feedback concerning their efforts and findings. Faculty waits until students themselves have identified the need for specific information to solve their problem, then provides it.
5. This procedure will be repeated for a group of prototypical problems covering a unit of instruction. The spiral character of this curriculum consciously sequences projects so that each successive project draws on the knowledge and skills developed in the preceding projects. From the student's vantage point this provides repeated opportunities to repeat and refine their skills (Bridges, 1992).
6. After student teams have completed a unit of instruction the computer integration affords extended practice for individuals. Students will be able to use the computer to practice problems analogous to the problems presented in the unit and view the work of others. The computer will track the method by which the attempts are made and record the information in a database. The computer will compare the student's methodology to a standardized assessment form and record the differences. Feedback is available immediately, indicating the importance of immediate feedback to students after they have attempted to solve a problem.
7. Evaluation may be administered using the computer on the basis of student performance on a standardized simulation (Farnsworth, 1994).

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Mentoring

Draft

Definitions

Mentoring is a form of coaching in both formal and informal training. It can be an important strategy element to create or improve a community of practice.

- When the term mentor is used, an image of older, wiser individuals leading around young proteges and passing down age-old secrets comes to mind. In fact, the principals of mentoring and modeling have been around since ancient times (Murray and Owen, 1991) cited by Hull (20002).
- A mentor relationship is a deliberate pairing of a more skilled or experienced person with a lesser skilled or experienced person, with the agreed-upon goal of having the lesser skilled person grow and develop specific competencies (Murray & Owen, 1991).
- A mentoring relationship is characterized by an experienced faculty member (mentor) taking an active role in the development of the academic career of a less experienced faculty member (mentee) by offering guidance, support and advice. A mentor's guidance is rendered with an inside knowledge of the norms, values and procedures of the institution and from a depth of professional experience. (UTS [1])
- The word "mentor" reaches back to Greek mythology. When Odysseus went to war, he entrusted Mentor with his son's education and development. Mentor's wise counsel, teaching, parental concern and protection are evident in current interpretations of the mentoring process [2]

Mentoring components and conditions

According to Clark [3],

Facilitated mentoring is a process designed to create effective mentoring relationships, to guide the desired behavior change of those involved, and to evaluate the results for the protégés, the mentors,and those supervising the mentoring relationship. Facilitated mentoring includes the following components (Murray and Owen, 1991):

- A design that meets the perceived needs of the organization;
- Criteria and a process for the selection of protégés;
- Strategies and tools for diagnosing the developmental needs of protégés;
- Strategies and tools for diagnosing the developmental needs of protégés;
- Criteria and a process for qualifying mentors;
- Orientation to the responsibilities of the role for both mentors and protégés;* Strategies for matching mentors and protégés on the basis of skills to be developed and compatibility;
- A negotiated agreement between mentor, protégé, and other involved agencies;
- A coordinator responsible for maintaining the programs and supporting relationships;

- Formative evaluation to make necessary adjustments to the program;
- Summarative evaluation to determine outcomes for the organization, the mentors, and the protégés.

Clark also stresses the idea that facilitating mentoring programs and relationships is very important.... and this is not an easy task since it implies changes in organizational culture.

Maximal mentor roles

Below is a slighly modified (shortened) copy/paste from the Abreviated Mentoring guide [2].

- Trusted Counselor - Mentor listens and reflects the protégé's ideas and plans and shares his or her insights, practical experience and may recommend specific steps.
- Teacher or Tutor - Mentor instructs or guides the protégé to learn specific information or concepts. Can also provide useful sources of information.
- Coach - Mentor may go over the protégé's training and background, assess the experience level and where deficiencies are identified, teach these skills to the protégé.
- Motivator - Mentor encourages and pushes the protégé to assume additional responsibilities when the time appears right.
- Sponsor - Mentor supports and represents the protégé to the organization.
- Referral Agent - Mentor directs the protégé to proper sources to achieve his or her goal and introduces the protégé.
- Role Model - Mentor is a senior participant who demonstrates, by example, the traits, performance and contributions that spell success; someone the protégé wants to emulate.

This definition implicitly assigns a multiple and "heavy" role to a formal mentor in the Navy. On may add or remove roles.

An Implementation model

From some of the literature and resources we can derive a simple mentoring model that includes some minimal necessary conditions, a suggestion for setting it up, and an example for a mentoring contract.

Conditions

Mentoring works when:

- individuals are committed to it,
- when there is a goal (see the mentoring contract)
- a supportive environment.

Stages to set up a mentoring program

Here is a list of typical stages. Note that preparation (stages 1-4) is important.

1. Identify development needs of protégés
2. Identify and recruit mentors. This includes identification of their needs.
3. Prepare/train mentors
4. Mentor and protégé negociate a mentoring agreement
5. Implementation (can include meetings with a faciliator)
6. Evaluation

Typical contract

Mentors and proteges should agree on a formal contract. Here is an example from Training for trainers [4]

We agree to commit ourselves to the personal and professional development of the protegé by identifying his/her development objectives and supporting their achievement through a relationship based on trust and openness.

Development objectives: ______

Roles an expectations: ______

Ground rules: ______

Other comments: _____

Date and signatures: ____

Things to do and not to do

See: Training for trainers [4]

Models

Models for mentoring graduate students

This should be an important issue for many labs.

- An interesting model is the Campbell-Lom mentoring model which is a simple e-mail mechanism to enhance reflection, independence, and communication in young researchers
- At TECFA we ask our lab assistants to contribute to this wiki (or the french version on a weekly basis in order to help them doing their literature reviews. Their wiki home pages also can be used for planning and reflection. Results, so far, are not as good as they could be, probably for the lack of mentoring "structure" - 21:20, 10 February 2007 (MET). Confirmed: results are awful ;) - Daniel K. Schneider 17:12, 9 November 2007 (MET)

The Wikipedia model

Wikipedia's [Wikipedia:Adopt-a-User | Adopt-a-User] program was designed in the end of 1996 to help new and inexperienced users and to reduce vandalism as well as other bad edits like testing. Older editors can "adopt" newer users, helping to mentor them along the way as they learn about Wikipedia.

To be adopted, a user can either:

- add a template ({{subst:dated adoptme}}) to his homepage
- or directly try to find an adopter from the Adopt-a-User [5] list.

Links

- Peer Resources [6] A comprehensive source of information, research, documents, and papers on trends and issues associated with all types of mentoring
- Training for trainers [4]. Good introduction (workshop material).
- Abbreviated Mentoring Guide, prepared by US Navy Medical Corps, 1998 HTML [2]
- International Society for Performance Improvement [7]
- Mentorship [8] (Wikipedia)

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Microlearning

Draft

Definition

- “ Microlearning deals with relatively small learning units and short-term learning activities. Generally, the term 'microlearning' refers to micro-perspectives in the context of learning, education and training. More frequently, the term is used in the domain of E-learning and related fields in the sense of a new paradigmatic perspective on learning processes in mediated environments on micro levels.” (Wikipedia [1], retrieved 18:44, 24 July 2007 (MEST)).
- [Microlearning] “ is a term used in the e-learning context for a learner's short interaction with a learning matter broken down to very small bits of content. At present this term is not clearly defined. Learning processes that have been called "microlearning" can cover a span from some seconds (e.g. in mobile learning) to 15 minutes (learning objects sent as e-mails). There is some relation to older concepts like Microteaching. Of course the notion of microlearning rises the question of adequate Micropedagogy and Microdidactics, as well as the problem of learning itself.” (Microwiki [2]), retrieved 18:44, 24 July 2007 (MEST).)
- [Microlearning] “ in a wider sense is a term that can be used to describe the way more and more people are actually doing informal learning and gaining knowledge in Microcontent and Micromedia/Multitasking environments (see Microcosmos), especially those that become increasingly based on Web 2.0 and Wireless Web technologies. In this wider sense the borders between Microlearning and the complementary concept of Microknowledge are blurring.” (Microwiki [2]), retrieved 18:44, 24 July 2007 (MEST).

Related forms of learning are "just in time open learning" and "on the spot learning". Microlearning mostly happens in an informal learning and particularly in a life-long learning context, but not exclusively. museum learning for example is a form of microlearning.

Often microlearning is associated with mobile learning or more ambitious ubiquitous learning.

Forms of Microlearning

Theo Hug (2006:9) identifies various forms of microlearning and that can be identified through the following dimensions:

- Time: relatively short effort, operating expense, degree of time consumption, measurable time, subjective time, etc.
- Content: small or very small units, narrow topics, rather simplex issues, etc.
- Curriculum: part of curricular setting, parts of modules, elements of informal learning, etc.
- Form: fragments, facets, episodes, "knowledge nuggets", skill elements, etc.
- Process: separate, concomitant or actual, situated or integrated activities, iterative method, attention management, awareness (getting into or being in a process), etc.
- Mediality: face-to-face, mono-media vs. multi-media, (inter-)mediated, information objects or learning objects, symbolic value, cultural capital, etc.
- Learning type: repetitive, activist, reflective, pragmatist, conceptionalist, constructivist, connectivist, behaviourist, learning by example, task or exercise, goal- or problem-oriented, "along the way", action learning, classroom learning, corporate learning, conscious vs. unconscious, etc.

Tools and instructional designs

Firstly, a lot of social software, e.g. shared production portals like Skillsfeed [3] or simple wikis like this one provide bits of contents that can be used for learning.

To integrate microlearning activities, learners may use a personal learning environment.

The Kerres model

One important question is how to relate **microcontents** with some idea of instructional design. Kerres (2007:12) makes a point for personal learning environments and he argues that “the task of instructional design would imply to provide an arrangement of contents and tools that can be intrinsically interwoven with the personal workspace of the learner”.

Kerres (2007:12-14) defines a model that is somewhat compatible with more traditional instructional design models, but that is rather based on the German concept of "Bildung", that emphasizes the emergent and situated process of learning. It's in Daniel K. Schneider's opinion *not* a microlearning model, but a *use of microcontents model*.

Here is a summarized and probably slightly altered description version with some comments by Daniel K. Schneider.

1. An elearning environment should be perceived as a "gate" to the internet as a whole but may include specially prepared contents (in particular assignments given to the learner).
2. The learning portal aggregates (typically small) contents from the net and integrates them as an integral part of the learning environment. They are fetched by XML-feeds from other sites.
3. Complex materials can be integrated as learning objects that contain learning materials as well as metadata describing the content, e.g. a sequences for delivering the content.
4. Materials that are being produced within the learning environment should be offered as feeds for reuse at other sites on the net, e.g. for delivery on mobile devices.
5. Learners and teachers / authors use the same tools for working with contents of various kinds, for editing and sharing documents, like weblogs, wikis, forum, pictures, calendars (e.g. see the list of web 2.0 applications. Teachers and learners actively participate in developing the learning environment - with small differences regarding administrative rights to the learning environment.
6. Users (teachers and learners) use free tags or tags from a taxonomy to describe informations produced.
7. Users can use tools of their choice to produce and work on content. Learners are encouraged to arrange their own digital work space and to integrate existing tools.
8. There is a smooth transition between the personal learning environment and the environment people use for their work and other personal activities on the net. Teaching means observing, participating and evaluating the individual and social learning activities within the learning environment.
9. The environment supports social group processes by making visible what tools the users prefer and providing direct access to these tools.
10. The system supports community building by providing a full digital identity of its members (background, interests, competencies ..) including various workspace awareness tools reflecting personal engagements of each user.
11. It should be attractive to become a member of the community. Registered users and members of learning groups should enjoy certain privileges. They have access to more information and gain more rights, e.g. to promote information to the front page and to comment immediately).
12. The environment documents the learning activities and results automatically. Contributions become visible to other learners and the teacher, they can be included directly into an e-portfolio of the user (and the institution).
13. Learners are encouraged to reflect their learning activities (Did I set appropriate goals? Did I make a sufficient progress?), for example with a Weblog.
14. An elearning provider generates an added value to customers by supplying new and re-arranged (sequenced) (micro-) contents for the learning environment, assignments that structure the learning process and different

variants of tutorial support (including examination and certification).

15. Teachers provide a role model. They are actively engaged and show their presence in the learning environment, e.g. by using the tools the environment offers, by supplying personal information, by supplying materials and participating in discussions, by using a weblog and working on wikis. They react on feedback and error messages immediately.

Discussion

Daniel K. Schneider thinks that this model may make too many concession to traditional e-learning. I can see the relation to micro-contents, e.g. the personal learning environment is defined as along lines that can be compared to the Toronto's school's knowledge-building community model where users indeed operate within a common knowledge space, only that extends to the Internet. But I don't really see the needs of content aggregation (point 2), to work with learning objects (they are really not thought in terms of a living document system). What strikes me most is the absence of microlearning in this model. (*btw I may move this section to the personal learning environment article*).

Links

- Microlearning.org [4] (Through this website you can find various online publications, e.g. the 2005/6/7 electronic proceedings of the *Microlearning* conferences).
- Microlearning [1] (Wikipedia)

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MiniQuest

Draft

- MiniQuests are simple, well structured WebQuests according to Internet Innovations Inc. [1]
- MiniQuests vs. WebQuests: MiniQuests can be constructed in a few hours and can be completed in one to two 1-hour lessons. Therefore they can be quite easily be integrated in larger scenarios or "traditional" curricular sequences.

The Instructional design model

According to Internet Innovations:

1. The Scenario: Defined as a "use case" scenario, the learners are told to solve a problem formulated as a question. They have to play a given role.
2. The Task: Defined a set of precises questions designed to acquire factual information needed to asnwer the question.
3. The Product: Defined as a guideline on how the answer must look. It contains a synthesis of information including reflection to insure that the answer is constructed. If possible the answer should be an authentic product. E.g. a directive if students have been asked to play "manager".

Links

Please consult the WebSite for detailed discussion of this design model

- MiniQuest Home [2]
- MiniQuest Instructional Design [3], at BioPoint.com.

Minimalist instruction

Definition

- **Minimalist instruction** is based on the idea that one should minimize negative impact of instructional materials and favor self-directed learning with meaningful tasks.
- "The key idea in the minimalist approach is to present the smallest possible obstacle to learners' efforts, to accommodate, even to exploit, the learning strategies that cause problems for learners using systematic instructional materials. The goals is to let the learner get more out of the training experience by providing less overt training structure." (p. 77-78) (cited by Horn).

This approach developped by Caroll is based on studies on how people learn to use computers and how badly tutorials and manuals do the job. Therefore his message also is addressed to the "documentation people".

As Kearsley (1994d) explains, this theory suggests that:

1. All learning activities should be meaningful and self-contained.
2. Activities should exploit the learner's prior experience and knowledge.
3. Learners should be given realistic projects as quickly as possible.
4. Instruction should permit self-directed reasoning and improvising.
5. Training materials and activities should provide for error recognition and use errors as learning opportunities.
6. There should be a close linkage between training and the current task

Minimalist instructional design

In applying Carroll's Minimalist theory, Kearsley (1994d) recommends the following:

1. Allow learners to start immediately on meaningful tasks.
2. Minimize the amount of reading and other passive forms of training by allowing users to fill in the gaps themselves
3. Include error recognition and recovery activities in the instruction
4. Make all learning activities self-contained and independent of sequence.

Robert E. Horn [1] in his book review [2] (199?) summarizes the nine principles of the minimalist approach (shortened by DSchneider, read the original !):

1. Use real tasks for the training exercises and let users select their own tasks. It enables people to use their prerequisite competence and engages a "powerful source of motivation."
2. Get the learner started on real tasks fast by eliminating almost all front-end orientational material. Extensive preambles can "obstruct meaningful activity."
3. Guide learners' reasoning, exploring and improvising with questions and other hints. This includes incomplete training materials, so that learners have to explore. He also suggests presenting summaries in place of complete texts.
4. Design the materials so that they can be read in any order in so far as possible. This principle permits learners to "support their own goal-directed activities"
5. Help learners to coordinate training materials and software by providing landmarks for normal or error situations, e.g. illustrations which show what the screen should look like if everything is OK
6. Focus early attention in the training materials on enabling the learner to recognize and recover from errors. Learners make many kinds of errors in learning computer systems. "Training materials must therefore explicitly support the recognition of and recovery from error both to make the materials robust with respect to user error and to train error recovery skills." (p.10)

7. Engage the learner's prior knowledge in introducing novel concepts. Use familiar office tasks, language and metaphors. Highlight differences in operation of the system from what might be expected from the learner's background.
8. Consider using the learning situation, as opposed to practical on-the-job examples, for learning examples, exercises and explorations. Help the learner understand the "fine detail of the actual situations in order to create practical solutions." (p. 90)
9. Aim for optimizing learning designs by repeated testing and avoiding the temptation to systematize approaches into checklists. Carroll says, "There is no deductive theory of minimalist instruction; that is, given a set of minimalist principles, we cannot just crank out a training manual. Design never works this way." (p.91)

Now DSchneider wonders how we should write a "how to use this wiki" manual for beginners :)

References

- Carroll, J.M. (1990). The Nurnberg Funnel, Designing Minimalist Instruction for Practical Computer Skill. Cambridge, MA: MIT Press.
- van der Meij, H. & Carroll, J.M. (1995). Principles and heuristics for designing minimalist instruction. Technical Communications, 42(2), 243-261.
- Kearsley, Greg Minimalism (J. Carroll) [3]
- Horn, E. Book Review: The Nurnberg Funnel by John M. Carroll [2].
- Mary Beth Rosson, John M. Carroll, and Rachel K.E. Bellamy, Smalltalk Scaffolding: A Case Study of Minimalist Instruction, Proceedings of CH1'1990, pages 423-429, May 1990.

Model-based learning

Draft

Definition

Model-based teaching and learning (or *model-based teaching* or *model-based learning* refers to activities where students manipulate or build models.

- Note: *Model-based learning* also refers to a machine learning technology (artificial intelligence).

See also: microworlds and simulation

Examples

Approaches

Horwitz (2002) distinguishes 3 technical components: “ Basically, visualizations are what we choose to show users, simulations are what we let them do. And models are what link the two. In the case of educational software, the design of the visualizations, simulations, and models will depend critically on what is being taught, for what purpose, and to whom.”

- See Hypermodel

systems and technology

- WISE
- Pedagogica

References

- Paul Horwitz (2002), Simulations and Visualizations: Issues for REC, EHR/REC Principal Investigators meeting, HTML [2]
- Boulter, Carolyn; Buckley, Barbara; Walkington, Helen (2001) Model-Based Teaching and Learning during Ecological Inquiry. ERIC, Abstract/PDF [1]

Moursund project-based learning model

Draft

Definition

The Moursund project-based learning model as presented here has been published in one of the most popular textboooks, intitled "Project-based learning: Using Information Technology".

The model presented here draws from a summary of Moursund (2002: 57-64). We did not simply "pick out item headings", therefore it is **our** (DSchneider)'s reading of the model.

See also: project-oriented learning and project-based learning

Context

This model can be applied (or rather adapted) to a wide range of project-based learning at various levels of teaching.

Definition of goals

Typicially project-based learning involves definition of different kinds of goals, e.g.:

1. Gain knowledge and skills within a global (class-wide) subject area
2. Gain knowledge and skills in individual project-related subject areas
3. Improve IT skills (in particular improve ICT-enhanced "knowledge working" and "community of practice") skills
4. Improve general problem solving skills including metacognitive and other learning strategies.

Definition of the PBL Lesson(s) Topic(s)

under construction

The PBL lesson implementation Model

This is only a short summary, please refer to the book for details. Note that this is a generic outline that needs to adapted to each situation.

Getting started

1. Define the topic
2. Define timelines, milestones and assessment methods
3. Identify resources

4. Identify prequisites
5. Advance organization (introduce project-methodology, skills that will have to be acquired etc.)
6. Form teams

Initial Team Activity - Project Planning

1. Knowledge pooling by team members
2. Initial project specification, e.g. formulate objectives and questions. At university level, this should lead to a research design.
3. Planning, e.g. definition of workpackages, milestones and timelines
4. Formal teacher feedback
5. Revision of the project specification and plan (if need return to steps 2 and 3)

Project Implementation

1. Have students complete one task and milestone at a time. Make sure that students engage in regular meetings
2. Refining of project definition
3. Sharing between team members (make sure that there is collaboration and cooperation, you decide)
4. Provide feedback (this incluse peer-to-peer tutoring, global feedback to the class for all projects, etc.)
5. Move toward completion.
6. Repeat all steps until all milestones have been met

Completion

1. Students have to polish the final product and prepare associated presentations.
2. Assessment: The whole class should assist at the presentation of the results. Students may have the occasion to integrate a last feedback.
3. Closing session with the whole class discussing the experience

Discussion

DSchneider believes that this model is very representative for project-based learning. In his own practise he uses strong story-boarding with common milestones for all groups and strong usage of ICT, i.e. making sure that each production is reified, that collective exchange activities are organized at the class level at regular intervals, that students engage in reflective thinking etc. See the C3MS project-based learning model and the C3MS article.

It's a way to specialize the general Moursund model.

Links

- Dave Moursund, ICT-Assisted Project-Based Learning [6].
  - This is a Website designed to support a workshop, a short course, or self study. However, DSchneider also recommends to buy the book directly from ISTE [1]

About instructional design models and educational policy

Moursund's website also features a nice cartoon that we would like to share

Copyright: Jerry King [2] and From Now On [3]

References

- Moursund, David (2002) Project-based learning: Using Information Technology, 2nd edition, ISTE. ISBN 1-56484-196-0
  - Some chapters of prior edition are available online [4]

Nine events of instruction

Definition

"Nine events of instruction" is an instructional design model put together by Gagne. This is a behaviorist model that also draws from cognitivism.

The conditions of learning

“ Essential to Gagne's ideas of instruction are what he calls "conditions of learning." He breaks these down into internal and external conditions. The internal conditions deal with previously learned capabilities of the learner. Or in other words, what the learner knows prior to the instruction. The external conditions deal with the stimuli (a purely behaviorist term) that is presented externally to the learner. For example, what instruction is provided to the learner.” (Cory, 1996)

Gagné's most essential ingrediants of teaching are:

- presenting the knowledge or demonstrating the skill
- providing practice with feedback
- providing learner guidance

These elements have to be designed differently according to the type of learning level (learning goal) to be achieved. For Gagné, instructional design means to first identify the goal (a learning outcome) and then construct the learning hierarchy, i.e. do a task analysis of skills needed to perform a measurable activitiy that demonstrates a learning goal.

The nine events of instruction

Gagne's 9 general steps of instruction for learning are:

1. Gain attention:
   - e.g. present a good problem, a new situation, use a multimedia advertisement, ask questions.
   - This helps to ground the lesson, and to motivate
2. Describe the goal:
   - e.g. state what students will be able to accomplish and how they will be able to use the knowledge, give a demonstration if appropriate.
   - Allows students to frame information, i.e. treat it better.
3. Stimulate recall of prior knowledge
   - e.g. remind the student of prior knowledge relevant to the current lesson (facts, rules, procedures or skills). Show how knowledge is connected, provide the student with a framework that helps learning and remembering. Tests can be included.
4. Present the material to be learned
   - e.g. text, graphics, simulations, figures, pictures, sound, etc. Chunk information (avoid memory overload, recall information).
5. Provide guidance for learning
   - e.g. presentation of content is different from instructions on how to learn. Use of different channel (e.g. side-boxes)
6. Elicit performance "practice"
   - let the learner do something with the newly acquired behavior, practice skills or apply knowledge. At least use MCQ's.
7. Provide informative feedback ,
   - show correctness of the trainee's response, analyze learner's behavior, maybe present a good (step-by-step) solution of the problem
8. Assess performance test, if the lesson has been learned. Also give sometimes general progress information
9. Enhance retention and transfer :
   - e.g. inform the learner about similar problem situations, provide additional practice. Put the learner in a transfer situation. Maybe let the learner review the lesson.

“ The way Gagne's theory is put into practice is as follows. First of all, the instructor determines the objectives of the instruction. These objectives must then be categorized into one of the five domains of learning outcomes. Each of the objectives must be stated in performance terms using one of the standard verbs (i.e. states, discriminates, classifies, etc.) associated with the particular learning outcome. The instructor then uses the conditions of learning for the particular learning outcome to determine the conditions necessary for learning. And finally, the events of instruction necessary to promote the internal process of learning are chosen and put into the lesson plan. The events in essence become the framework for the lesson plan or steps of instruction.” (Corry, 1996)

See also instructional curriculum map for planning at larger scale.

Links

- http://www.my-ecoach.com/idtimeline/theory/gagne.html
- http://www.patsula.com/usefo/webbasedlearning/tutorial1/learning_theories_full_version.html

Links

- Robert Gagne [1] from my-ecoach.com. (Includes a table of learning outcomes with examples and associated learning conditions).

References

- Aronson, Dennis T., & Leslie J.Briggs, (1983). "Contributions of Gagné and Briggs to a Prescriptive Model of Instruction", in Reigeluth, C.M. (1983) (e.d). Instructional Design Theories and Models: An Overview of their Current Status. Hillsdale, NJ: Prentice-Hall.
- Corry, Michael, Gagne's Theory of Instruction, George Washington University, Webpage, HTML [2] retrieved 21:13, 3 October 2006 (MEST).
- Driscoll, M.(1991) Psychology of Learning for Instruction. Allyn and Bacon.
- Gagne, Robert M., Briggs, Leslie, J., Wager, Walter, F. (1985). Principles of Instructional Design, Wadsworth, ISBN 0030347572
- Killpatrick, L. (2001). Gagne's Nine Events of Instruction. In B. Hoffman (Ed.), Encyclopedia of Educational Technology. HTML [3] retrieved October 3, 2006.

OASIF

WARNING: Article could not be rendered - ouputting plain text.
Potential causes of the problem are: (a) a bug in the pdf-writer software (b) problematic Mediawiki markup (c) table is too wide

DraftDefinition OASIF is a free pedagogical scenario scenario editor for open and distance learning and that is used before the development process. It integrates with the Amarante platform.“ OASIF, Outil d'Aide à la Scénarisation pour l'Ingénierie de la Formation, s'adresse aux acteurs de la FOAD : concepteurs de dispositifs ou de formations à distance, enseignants, formateurs, ingénieurs de formation (IATOS).” (, retrieved 18:41, 18 October 2006 (MEST)) See also: MOT/MOTPlus the tools for the (MISA) design method. Architecture The OASIF software relies on a simple instructional design model and method that can be summarized by three hypothesis: Open and distance learning must be designed as a coherent, organized, flexible and regulated whole of learning activities; Design should be oriented by pedagogic actitivities and not contents; The system is organized at four levels (see below). Here is the original wording in french (, retrieved 18:41, 18 October 2006 (MEST)) Une conception basée sur la notion de dispositif de FOAD (ensemble cohérent, organisé, souple et régulé d'activités pédagogiques pour l'apprenant) ; Une conception orientée par l'activité pédagogique de l'apprenant (et non par les documents pédagogiques) ; Une organisation du dispositif par une structure en 4 niveaux 4 levels of the OASIS methodLinks OASIF homepage Download (Win/Mac/Linux, JRE 1.5 required) References Galisson Arnaud, Jean Sébastien Nouveau (2002), OASIF : un outil collaboratif d'aide à la scénarisation de modules de formation ouverte et à distance, TICE 2002. PDF Kraus Isabelle, & Christophe Serra, Le semi-présentiel pour la formation initiale d'élèves ingénieurs : Mise en oeuvre d'activités pédagogiques sur une plateforme de téléformation, PDF

PALO

Draft

Definition

PALO is an educational modeling language and a system.

PALO is a proposal of Educative Modelling Language to describe and design learning content and learning environments at a high level of abstraction using learning content ontologies and conceptual maps to search and retrieve small-granularity Learning Objects.

PALO is based on a reference framework to design educative content based in levels of abstraction. Each level identifies a certain group of related components or elements of a learning resource. The language allows to define teaching strategies by mean of the definition of specific DTD's called instructional templates . This templates are a general type of PALO document that specially suits for a given instructional or teaching purpose.

PALO has been designed to be a technology-independent representation of a learning reseource, thus allowing educative content interchange , interoperability, mantainability and reusability. A PALO description of a learning content (a *.palo file) can be turned into a variety of learning scenarios (each one built using an specific delivery format) via a compiling process.

(PALO language Home Page [16], retrieved 18:21, 29 May 2007 (MEST).

Structure

Google translation from Spanish of http:/ / sensei. ieec. uned. es/ %7Emiguel/ tesis/ node30. html ... almost understandable ;)

- Content: It is the knowledge that, modelizado in the surroundings, is study object during the education process. The content is modelizado of external and independent form of the structure of the surroundings. The references to these components can be direct or by means of the use of properties and didactic or instruccionales relations.
- Tasks: The tasks are the activities that the user of the surroundings makes to on approval practice or to put the knowledge assimilated in the study matter. They are basic educational elements that allow the knowledge acquisition, the pursuit, the evaluation of the student and the interaction with the professor.
- Structure: It defines the composition and the group of contents and tasks. It also determines the model of navigation by the material and provides an index of he himself.
- Planning: The planning includes/understands logistic associate to the use of the surroundings and the temporary requirements for its use.
- Management: It is the information that controls the accesses, the operation and the developed activity in the surroundings.

PALO can be described in terms of three components

- The DTD: An instructional template defining the tags and possible tag combinations for the given template. It is a SGML-based DTD
- The PALO File: An SGML file that contains declarative description of a learning environment according to the instructional template above (DTD).

- The resulting environment after the compilation process of the PALO File using the PALO Compiler. There are three kinds:
  1. A demo environment with no interactivity, but having all the content.
  2. An interactive environment using signed java applets. Students can install this environment, and work off-line. From time to time they can connect to our server and send the work done.
  3. An interactive environment to be used remotely.

SGML DTDs

“The PALO Language is defined by a set of DTD's that describe different documents, each one to be used for an specific instructional purpose. These DTD's describe a general template that can be instantiated into an SGML file. In the PALO system, the family of DTD's are known as instructional templates.” [1], retrieved 18:21, 29 May 2007 (MEST).

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Links

- PALO Home Page [16]. This page contains links to papers and talks, demoes and software.

References

PALO

Rodriguez-Artacho M. "Una Arquitectura Cognitiva para el Diseño de Entornos Telemáticos de Ensñanza y Aprendizaje", Ph. D. Thesis (In Spanish!), HTML [2]

- Overview of the PALO EML (IEEE Frontiers In Education FIE '99 Conference paper) HTML [3] PDF [4]
- Uses of PALO to build Educational Web-sites (IFIP 99) [HTML] (Building Electronic Educational Environments, Kluwer Ac. Publishers, 1999) HTML [5]
- Ontologies for learning content modeling and their use with PALO Language [PDF] (TET '99 conference, Norway) PDF [6]
- PALO Language uses for Higher Education (Computers and Ed. in the 21st Century. Kluwer Ac. publishers, 2000) PDF [7]
- Constructivism & PALO Language (IEEE Frontiers in Education FIE '01 Conference) PDF [36]
- Rodriguez-Artacho M. and Verdejo, M. F. "Modeling Educational Content: The Cognitive Approach of the PALO Language", *Journal of Educational Technology & Society* (Vol. 7 # 3, 2004) PDF Preprint [8]

Other

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POME

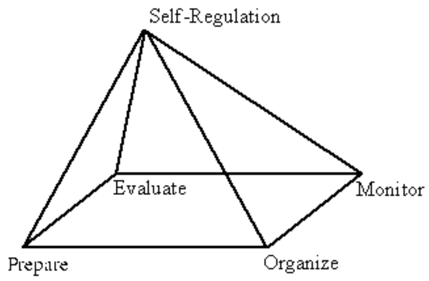
Draft

Definition

POME - "prepare - organize - monitor - evaluate" is a simple instructional design model that emphasis self-regulation.

The model

Ley and Young distinguish four kinds of self-regulation activity categories that a course designer has to look at. That means preparing self-regulation guidance activities for the learners.



Ley & Young POME model, modified and reprinted with permission by Kathryn Ley

Prepare (environmental structuring)

... the learning environment to concentrate and attend the learning process.

- E.g. provide checklists of study environments and strategies to cope with distraction and overload through multi-tasking.

Organize (organizing and transforming)

... the study material for studying or as part of the learning process.

- E.g. Advise students how to arrange or use learning materials, identify key points to learning, optimal learning path, have them complete partial outlines.

Monitor (keeping records, monitoring, reviewing tests)

... the learning process.

- E.g. Provide students with time needed for activities, detailed assignment tables (calendar), timely regular on-line feedback and assessment.

Evaluate (self evaluation)

... the learning outcomes.

- E.g. frequent ungraded quizzes, compare effort to learning, identify effective/ineffective learning strategies.

Discussion

The authors make the point that self-regulation can directly or indirectly be taught, i.e. by providing guidelines on how to plan, behave, etc. and also by engaging students into activities where they are brought to reflect.

Links

Self-regulation strategies - P.O.M.E model [1] Home page, including bibliography, copies of talks and other resources.

PDF Slides [2]

SRL for distance learning - PDF Slides [3]

References

- Ley, Kathryn., & Young, D. B. (2001). Instructional principles for self regulation. Educational Technology Research and Development, 49 (2), 93-103.pdf [4]

Peer-to-peer learning

Draft

There are several variants, e.g.

- (some forms of) collaborative writing
- Peer tutoring
- learning by teaching (reciprocal teaching)

See also:

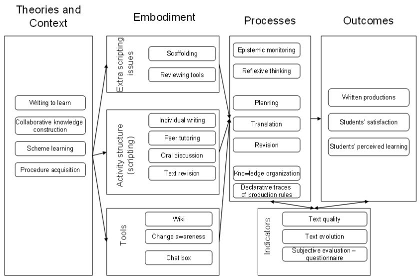
- Peer assessment
- When writing contributes to a larger collective body of knowledge whose elements can put in relation, we rather refer to a knowledge building community approach, as for example in the CSILE project.

Peer tutoring and collaborative writing

"Peer-tutoring" writing consists in assisting the revision process through the intervention of a peer, following the peer-tutoring assumption: Peer-tutoring is expected to enrich the production through the confrontation with other learners, and by fostering processes like metacognitive awareness on their own productions, particularly epistemic monitoring and reflexive thinking.

Peer tutoring is a process developed by Fantuzzo and his colleagues (Wolfe, Fantuzzo and Wolfe, 1986). It allows each student to play the role of tutor and tutored. Reciprocal peer tutoring allows each student to benefit from giving directions, evaluating and providing reinforcement for their partner. It creates mutual assistance and social support among participants (Fantuzzo, Riggio, Connelly and Dimeff, 1989; Pigott, Fantuzzo and Clement, 1986). Most of the time, research on peer tutoring provided evidence for its positive effects on performance, learning, reduction of stress and anxiety and an increase in satisfaction with the progress (Riggio, Fantuzzo, Connelly and Dimeff, 1991). Still, little research has investigated the effects of peer tutoring for "writing to learn" activities (Gielen, Dochy, Tops, Peeters, 2007).

Here is a conjecture map summarizing some elements and relationships that may constitute a little peer collaborative writing activity that took place in a wiki.



Peer tutoring in collaborative writing,
Bétrancourt, Schneider, Gavota, & Richle (2008)

Mazur Peer Instruction Model

According to Beth Simon and Quintin Cutts (2012) [1], "in Peer Instruction, students gain preparatory knowledge before class (for example, through textbook reading) and complete a pre-lecture quiz to both incentivize their preparation and to give them feedback on whether they are ready to learn in a lecture format. During class, lecture is interspersed with or largely replaced by multiple choice questions (MCQs) and discussion. MCQs are designed by instructors to engage students in thinking about deep conceptual issues or common misconceptions. This is instantiated via a four-part process: Students individually consider a question and select an answer (typically reporting it via use of a Classroom response systemclicker. Students discuss in preassigned groups. Students vote again on the same question. Classwide discussion follows led by student explanations and the instructor modeling their way of understanding the problem."

Links

- Web 2.0 and Emerging Learning Technologies/Learning Theory [2]
- Peer Tutoring [3] by the International Writing Centers Association (retrieved oct 2012). Includes a good *annotated* Bibliography

References

- Bétrancourt, Mireille, Daniel Schneider, Monica Gavota et Urs Richle (2008), Project 2, dental assistants, in P. Dillenbourg (ed.) (2008). DUAL-T: Technologies for Vocational Training, Rapport intermédiaire, Federal Office for Professional Education and Technology. document pdf [4]
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- Gielen, S., Filip Dochy, Liesje Tops, Elien Peeters (2007) Effects of formative peer-assessment on writing performance: What is the most beneficial role of the assessee in Proceedings of the 12th EARLI biennal conference on Research on Learning and Instruction, Aug. 28 - Sept. 1, Budapest (Hungary)
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- Simon, Beth and Quintin Cutts (2012). Peer Instruction: A Teaching Method to Foster Deep Understanding, Communications of the ACM, Vol. 55 No. 2, Pages 27-29, DOI: 10.1145/2076450.2076459

Phoebe pedagogic planner

Draft

Definition

“Phoebe is a web application designed to provide inspiration and practical support for learning design.” (phoebe application home page [1], retrieved 15:20, 29 January 2009 (UTC)

Looking at the phoebe welcome screen, it currently (jan 2009) has four functionalities:

1. Create or modify your learning designs: Build your own design or adapt an existing design.
2. View shared learning designs: Let Phoebe’s collection of shared designs inspire you.
3. Browse Phoebe’s teaching and technology guidance: Find out about different tools and the learning activities they support.
4. Manage your design templates: Create and modify the templates from which you build your learning designs.

Context

Phoebe has been developed by a team from the Technology-Assisted Lifelong Learning unit (TALL) at Oxford University and Oxford University Computing Services (OUCS) in partnership with Learning Technologies Group, and with funding from the JISC Design for Learning programme.

- Marion Manton: Project manager
- David Balch: Web developer
- Liz Masterman: researcher & evaluation specialist

Software

- Phoebe can be used through the online Phoebe Beta [1] system
- It also can be installed on your server (PHP/MySQL). Code is available [2] through tarballs or through a subversion system.

Links

- Phoebe Beta [1] (online system)
- Phoebe Wiki [3]. From this website you also can dowload presentations [4]
- Project member's Bookmarks on delicious [5]

Bibliography

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Acknowledgement: This article or part of this article has been written during a collaboration with the EducTice [7] group of INRP [8], which attributed a visiting grant to DKS in january 2009.

Problem-based learning

Draft

Introduction

Problem-based learning (PBL in this article) is defined by Finkle and Torp (1995) as, “a curriculum development and instructional system that simultaneously develops both problem solving strategies and disciplinary knowledge bases and skills by placing students in the active role of problem solvers confronted with an ill-structured problem that mirrors real-world problems”.

What is PBL?

Problem-based learning is an instructional design model and a variant of project-oriented learning. It is closely related to inquiry-based learning.

Real-life problems seldom parallel well-structured problems; hence, the ability to solve traditional school-based problems does little to increase relevant, critical thinking skills. Real-life problems present an ever-changing variety of goals, contexts, contents, obstacles, and unknowns which influence how each problem should be approached. To be successful, students need to practice solving ill-structured problems that reflect life beyond the classroom. These skills are the goal of PBL. With Problem-Based Learning, students engage in authentic experiences.

PBL is inherently social and collaborative in methodology and teaches students essential "soft skills" as well as domain specific content and skills. PBL is learner-centered and gives the learners progressively more responsibility and independence in their education. It encourages life-long learning. In PBL, it is the problem that drives the curriculum. It does not test a skill, it assists in the development of the skill itself. There is no one solution: the problem is solved in an iterative process where the perception of the problem can change as do the solutions found.

What Skills do Students learn?

Through PBL, students learn:

- **Solving real-life problems:** Learning to solve relevant and contextual problems congruent with workplace skills, develop initiative, performance ability and enthusiasm.
- **Efficient problem solving:** Develop the ability to find and use appropriate resources for problem solving
- **Independant learning:** Employ effective self-directed and self-motivated learning skills and proactive thinking to continue learning as a lifetime habit
- **Self-monitoring:** Continuously monitor and assess the adequacy of their own knowledge and of their problem-solving skills, practice critical thinking (see also cognitive tools)
- **Team work:** Efficient collaboration as a member of a group, communication and leadership skills, social and ethical skills.

From the problem based learning initiative [1] of the southern illinois university and the Stanford site on PBL [2]

Historical Background

Problem-Based Learning (PBL) has become popular because of its benefits to student learning.

PBL can be thought of as a combination of cognitive and social constructivist theories, as developed by Piaget and Vygotsky, respectively. The first application of PBL was in medical schools which rigorously test the knowledge base of graduates. According to García-Famoso (2005), "PBL was first applied in the 60s, in the Faculty of Health Sciences of McMaster University (Canada) and in the School of Medicine of Case Western Reserve University (United States). The main objective was twofold: to develop problem solving skills and bring learning closer to real medical problems." After these first experiences, many medical and professional schools started to use some form of PBL, for example, Harvard Medical School or, in Europe, Maastrich University. Many medical and professional schools, as well as undergraduate and graduate programs, use PBL in some form. Over 80% of medical schools use the PBL methodology to teach students about clinical cases, either real or hypothetical (Vernon & Blake, 1993, Bridges & Hallinger, 1991).

Models of PBL, Designing PBL curricula

Models of PBL

There are many problem-based learning models. E.g. Edwin Bridges (1992) suggests that there are two versions of PBL that have been implemented in the classroom, problem-stimulated PBL and Student Centered PBL.

Problem Stimulated PBL (PS PBL)

PS PBL uses role relevant problems in order to introduce and learn new knowledge.

PS PBL emphasizes 3 major goals:

- development of domain-specific skills
- development of problem-solving skills
- acquisition of domain-specific knowledge

Student Centered PBL (SC PBL)

SC PBL has the same goals as PS PBL, but includes one more: fostering life-long learning skills. Physicians are one group of professionals who are required to stay current with new developments in their fields. The skills of a life-long learner are particularly important for this group. Hence, several medical schools employ student centered PBL.

The major differences with PS PBL are in student responsibilities. In SC PBL:

- students themselves identify the learning issues they wish to explore
- students determine the content to be mastered
- students determine and locate the resources to be used

In short, students have self-defined learning issues. As is the case with PS PBL, students decide how to appropriately use the newly acquired information and knowledge in order to solve the problem at hand.

Case-based PBL See learning by design. The typical sequence of activities in a Learning-by-Design unit has students encountering a design challenge and attempting a solution using only prior knowledge. Students compare and contrast their ideas, identify what they need to learn to move forward in addressing the design challenge, choose a learning issue to focus on, and design and/or run a laboratory activity to examine that issue. Following this are cycles of exploratory and experimental work.Kolodner, Crismond, Gray, Holbrook & Puntembakar (1998)

Designing PBL

Integrating PBL into a Curriculum

Design Considerations:

- How should PBL be incorporated into the curriculum?
- What problems should be used and how should they be presented?
- What are the instructional goals?
- How should small groups be formed?
- How much should each problem be prestructured?
- How to evaluate the program and the students?
- What resources should be available?
- How to prepare students and faculty for PBL? (Bridges, 1992).

Creating appropriate Problems

PBL problems should be created with :

- introduction
- content
- learning objectives
- resources
- expected outcome
- guiding questions
- assessment exercises
- time frame

(Bridges, 1992)

The best format for problems is unorganized, unsynthesized, and open-ended because this allows for student processing. Students are motivated to use their reasoning skills and relate the content to their own context and previous knowledge. Focus problems on current events, student lives, or relationships to actual occurrences. Problems should be interdisciplinar and task oriented. It should not only focus on the large problem but also take students through the objectives. (Albanese & Mitchell, 1993)

Novice learners require more structure and cues while more experienced students are self-directed learners. Software can be used in the PBL curriculum, but avoid telling students when the solution is reached. This stops the learning process. Point out inappropriate strategies. Complex problems usually require learners to exhibit management, research, and thinking skills that help distinguish less expert from more expert performers. This differentiation can help serve as a grading standards in the class.(Albanese & Mitchell, 1993)

Getting Started

- Anticipate and manage anxiety (Bernstein, Tipping, Bercovitz, & Skinner, 1995).

- Explain to all involved what is happening and why.
- Tutors should receive training (Foley, Levy, Russinof, & Lemon, 1993).
- Students should be oriented to PBL.
- State the PBL goals.
- Randomly assign students to PBL (Mennin Friedman, Skipper, Kalishman, & Snyder, 1993).

According to Schmidt and Moust (1989), the student progresses through a series of steps, "The Seven Jump", during the PBL process.

1. Clarify unknown terms and concepts in the problem description.
2. Define the problem(s). List the phenomena or events to be explained.
3. Analyze the problem(s). Step 1. Brainstorm. Try to produce as many different explanations for the phenomena as you think of. Use prior knowledge and common sense. Student outcomes: activation of prior knowledge, elaboration, restructuring of information, organization of information, intrinsic motivation (see also Flow theory, Motivation).
4. Analyze the problem(s). Step 2. Discuss. Criticize the explanations proposed and try to produce a coherent description of the processes that, according to what you think, underlie the phenomena or events.
5. Formulate learning issues for self-directed learning.
6. Fill in gaps in your knowledge through self-study.
7. Share your findings with your group and try to integrate the knowledge acquired into a comprehensive explanation for the phenomena or events. Check whether you know enough now. Student outcomes: restructuring, applying, problem solving.

Evaluation

Because instruction and learning is different in problem based settings than traditional instruction, many instructors find student evaluation difficult.

PBL encourages development of meta-cognitive skills like group learning or research and communication skills and aims transferring knowledge to novel situations. With such multiple purposes for PBL, it is important to consider a variety of evaluation techniques:

- Written examinations: should be designed to ensure transference of skills to similar problems or subject domains.
- Practical examinations: used to ensure that students are able to apply skills learned during the course.
- Concept maps: much of the learning that goes on during PBL is more than just a compilation of facts. As such, written examinations may not be an adequate measure of student growth. Requiring students to generate concept maps, in which they depict their knowledge through the creation of identified nodes and links, may present another option to determine their cognitive growth.
- Peer assessment: because life outside the classroom usually requires working with others, peer assessment is a viable option to measure student growth. Providing students with an evaluation rubric often helps guide the peer evaluation process. This process also emphasizes the cooperative nature of the PBL environment.
- Self assessment: an important element of PBL is to help students identify gaps in their knowledge base in order for more meaningful learning to result. Self assessment allows students to think more carefully about what they know, what they do not know, and what they need to know to accomplish certain tasks.
- Facilitators/tutor assessment: the feedback provided by tutors should encourage the students to explore different ideas. It is important that facilitators do not dominate the group and facilitate learning and exploration. Tutor assessment may consist of how successful individuals interacted with their group and their cognitive growth.
- Oral Presentations: because so much of work life revolves around presenting ideas and results to peers, oral presentation in PBL provide students an opportunity to practice their communication skills. Presenting findings to their group, the class, or even a real-life audience can help strengthen these skills.
- Reports: Written communication is another skill important for students. Requiring written reports allows students to practice this form of communication.

Evaluation is an iterative process. Be prepared to make changes along the way based on experience (Bernstein, Tipping, Bercovitz, & Skinner, 1995).

Ressources

Ensure resources and time are available for self-study. "If students are to be genuinely empowered with their own learning, it is important to provide them with the necessary infrastructure." (Rangagachari, 1991). PBL students study in the library more than conventional students and study more during the day than the evening. Increasing the time spent instructing students decreases the time students spend in self-study (Williams, Saarinen-Rahikka, & Norman, 1995). If students must learn basic science or similar material for national standardized examinations, increase student access to self-assessment, provide practice examinations, allow additional examination preparation time (Mennin et al., 1993).

See also Problem-based learning and electronic games

Roles in PBL

Instructor's Role

Teaching in PBL normally occurs within small discussion groups of students facilitated by a faculty tutor (Aspy, Aspy, & Quimby, 1993, Bridges & Hallinger, 1991, Mayo, Donnelly, Nash, & Schwartz, 1993). Because the amount of direct instruction is reduced in PBL, students assume greater responsibility for their own learning. The instructor's role becomes one of subject matter expert, resource guide, and task group consultant. This arrangement promotes group processing of information rather than an imparting of information by faculty (Vernon & Blake, 1993). The tutor is most active in planning the PBL, the content and sequence of projects. He encourages student participation, provides appropriate information to keep students on track, gives immediate and appropriate feedback, and assumes the role of mentor, tutor or fellow learner (Aspy et al., 1993). The tutor acts as metacognitive coach, serving as model, thinking aloud with students and practicing behavior he wants his students to use (Stepien and Gallagher, 1993. He also evaluates the students.

Student's Role

The individual student in PBL

In PBL, students have responsibility for their own learning by identifying their learning issues and needs.

The students work with the following learning materials:

- the problem situation
- a list of objectives that the student is expected to master while working on the problem
- a reference list of materials that pertain to the basic objectives
- questions that focus on important concepts and applications of the knowledge base.

Time allotted to each project is fixed. Students work on the problem in project teams. Students are evaluated in multiple ways by instructors, peers, and self, using questionnaires, interviews, observation, and other assessment methods.

Groups in PBL

Students work in teams to complete the project, resolve the problem, and accomplish the learning objectives.

Groups usually consist of 5 to 7 students. Four roles are possible:

- project leader - proposes meeting agendas, suggests division of labor, and develops the overall project plan.
- facilitator - describes the process to be followed during the steps of the project plan, determines appropriate time to proceed in plan, and suggests adjustments to the plan as needed.
- recorder - takes group notes of each meeting.

- team member - takes individual notes, participates in discussion, and reviews resource materials.

Some PBL models include a mentor or tutor in the group (often a faculty member, or another student).

The team schedules its own activities and decides how to use the allotted time

See also Problem-based learning and social software

Discussion

Application of PBL: Advantages, Disadvantages

Advantages

Why is there an increase in scores resulting in PBL? Information theory links 3 conditions to subsequent improved retrieval and use. Bridges & Hallinger (1991) report that students improve their comprehension because they:

1. are better at activating prior knowledge,
2. learn in a setting resembling their future context, and
3. elaborate more fully on the information presented.

Increased elaboration promotes mental processing, understanding, and recall. Because content is learned in context, definitions, information, theories, correlations, and principles are learned and integrated with one another (Mandin, Harasym, & Watanabe, 1995).

See also the learning level article.

The Buck Institute fro Education (BIE) [3] sees PBL as a mean of developping what they call 21st century skills, meaning

- ICT literacy
- cognitive skills like critical thinking, creativeness
- Interpersonal skills
- Self- and task-managment skills
- personal charcteristics like ethical sensibility, civic responsibility, accountability

Disadvantages

Introducing PBL means

- changing the Curriculum
- introducing higher costs
- higher time demands: PBL takes more time to teach the same content
- change of roles: Students have to change attitude and go from memorization of facts to an active searching for information(Reithlingshoefer, 1992). Teachers have to shift from dissemination of information to a tutor's and guide role.
- formulation of appropriate problems that encompass both a large goal and specific objectives
- setting up appropriate assessment
- facing a lack of extrinsic rewards for PBL teaching

Is PBL better?

When determining the value of PBL curriculum, the literature has focused on 4 components :

- Attitudes: Students enrolled in PBL courses appear to have a more favorable attitude toward their course than students schooled in traditional instruction. Improved attitudes contribute to a variety of factors including increased course enrollment, enhanced interest in major course of study, and positive feedback from faculty and employers (Pincus, 1995); a reduced dropout rate (Bridges & Hallinger, 1991; Pincus, 1995); and an increase in student comments concerning the advantages of PBL after their learning experience (Bernstein, Tipping, Bercovitz, & Skinner, 1995). Schmidt, Henny, and de Vries (1992) conclude that "problem based curricula do appear to provide a friendlier and more inviting educational climate."

- Basic knowledge: Test results seem split on basic knowledge comprehension. In the medical field, although it was sometimes found that students schooled with PBL performed worse on standardized tests, they performed better on clinical tests and equal on essay tests to conventionally-schooled students (Albanese, 1993). Not all studies are favorable to PBL, but Albanese found that PBL knowledge is more deeply ingrained and less likely to be forgotten.
- Problem solving ability: Reasoning and problem solving skills: The evidence appears supportive in finding PBL students better than conventional students in analyzing atypical medical cases (Albanese, 1993), and in having stronger problem solving skills (Gallagher, Stepien, & Rosenthal, 1992).
- Study habits: Team work Most PBL is done in small groups. Therefore it is not surprising to find that students who learn in this context tend to be more oriented toward collaborative learning.

Examples and links

Examples

- Medicine Blends Computers and PBL
- Ace Training Ltd. A complete Case Study of Problem-based learning
- Examples [4] of PBL from the Stanford Learning Laboratory.(find examples of PBL at university Level, in biology, environmental sciences, high School level, economics, environmental sciences, history, ancient worlds and english).

University level

- Biology [5]
- Teacher Training in Science [6]

Sherman Rosenfeld and Yehuda Ben-Hur, PBL in Science and Technology: A Case Study of Professional Development, Department of Science Teaching, Wizmann Institute of Science

- Problem-Based Learning [7] at McMaster University (Canada).

High School Level

- History [8]
- Ancient World [9]

Commercial PBL example cases

- Ace Training Ltd. A complete Case Study of Problem-based learning

Various links

- Problem-based learning and electronic games
- Problem-based learning and social software
- Problem-based Learning resources [10] page with a comprehensive list of links of the technology for learning consortium.
- Problem-Based Learning [11] comprehensive site of the Illinois maths and science academy with description of pbl, rersources, examples and more.
- Problem-based learning pages [12] in the archives of the center for teaching, learning and scholarship from the samford university, alabama, previously center for problem-based learning
- Problem-Based Learning [13] pages of the learning-theories.com site: knowledge base and webliography.
- pennsylvania state university and nasa wiki-like page on pbl [14]

- very complete pbl site [15] of the university of delaware.
- PBL pages [16] of the maricopa center for learning and instruction MCLI, arizona with a searchable archive.
- resources site [17] from the queensland university

Journals:

- The Interdisciplinary Journal of Problem-based Learning (IJPBL) [18] is an open access journal that publishes relevant, interesting, and challenging articles of research, analysis, or promising practice related to all aspects of implementing problem-based learning (PBL).

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Programmed instruction

Draft

Definitions

- Although Skinners initial programmed instruction format has undergone many transformations, most adaptations retain three essential features: (1) an ordered sequence of items, either questions or statements to which the student is asked to respond; (2) the student's response, which may be in the form of filling in a blank, recalling the answer to a question, selecting from among a series of answers, or solving a problem; and (3) provision for immediate response confirmation, somtimes within the program frame itself but usually in a different location, as on the next page in a programmed textbook or in a separate window in the teaching machine. (Joyce, Weil & Calhoun, 2000:332)
- **Programmed instruction** is a method of presenting new subject matters to students in a graded sequence of controlled steps. Students work through the programmed material by themselves at their own speed and after each step test their comprehension by answering an examination question or filling in a diagram. They are then immediately shown the correct answer or given additional information. Computers and other types of teaching machines are often used to present the material, although books may also be used. (The Columbia Encyclopedia, Sixth Edition. 2001-05 [1], retrieved 16:22, 16 August 2007 (MEST)).
- **Programmed instruction** consists of a **network** of statements and tests, which direct the student to new statements depending on his pattern of errors. It is based on a particular tool which is called **teaching machine**. (Cited from Encyclopedia.com ???).

Sometimes a distinction is made between programmed instructions and programmed learning. See also: Mastery learning

Theory and history

There are various origins and flavors of programmed instruction. The most important to subcategories are:

- linear programs (in the Skinner tradition)
- branched programs (in the Crowder tradition)

Skinner's operant conditioning

See behaviorism for the theory.

- Programmed instruction is based on Skinner's "operant conditioning", a (behaviorist theory stating that learning is change in behavior, i.e. the individual's response to events (stimuli). Behavior can be conditioned by rewarding the right stimulus-response patterns.

According to Greg Kearsley [2]:

1. Behavior that is positively reinforced will reoccur; intermittent reinforcement is particularly effective
2. Information should be presented in small amounts so that responses can be reinforced ("shaping")
3. Reinforcements will generalize across similar stimuli ("stimulus generalization") producing secondary conditioning

Skinner argued strongly against teaching that is based on punishment. According to Kristinsdóttir [3], “In a chapter of his book 1968 *Why teachers fail* he argued that formal education is usually based on 'aversive control'. Teaching rests on punishment and ridicule for unsuitable behavior rather than showing a consideration for the shaping and reinforcement of responses to be learned. He also said that lessons and examinations are designed to show what pupils do not know and cannot do, rather than to expose and build upon what they do know and are able to learn.

Therefore, he argued, teachers fail to *shape* their children's behavior sufficiently, leading to inappropriate learning or to learned responses that are quickly forgotten (Skinner, 1968).”E. (Markle, S. (1969). Good Frames and Bad (2nd ed.). New York: Wiley.)

The teaching machine

The first teaching machine was invented by **Sydney L. Pressey** in the 1920's,

Skinner in the 1950's introduced a concept of "teaching machine" that differed from Pressey's in some ways. “The teaching machine is composed of mainly a program, which is a system of combined teaching and test items that carries the student gradually through the material to be learned. The "machine" is composed by a fill-in-the-blank method on either a workbook or in a computer. If the subject is correct, he/she gets reinforcement and moves on to the next question. If the answer is incorrect, the subject studies the correct answer to increase the chance of getting reinforced next time.” (learning technologies timeline [4], retrieved 16:22, 16 August 2007 (MEST))

Romiszowski (1997:16) cited by Kristinsdóttir defined the "core" of Skinner's stimulus-response model as “that learning has occurred when a specific response is elicited by specific situation or stimulus with a high degree of probability. The more likely and predictable the response, the more efficient the learning has been. These attempt to shape human behavior by presenting a gradual progression of small units of information and related tasks to the learner. At each stage the learner must actively participate by performing the set task. He is then immediately supplied with feedback in the form of correct answer”

Skinner stated that the student should compose his response on his own, rather than choose it among a large range of possibilities, because the responses should not be recognized but recalled. Moreover, according to Skinner, the machine should present information in a designed sequence of steps. In programmed instruction, **the subject is the student itself**, the aim is his/her understanding of the material and the **reinforcement** or **punishment** refers to satisfaction or disappointment, resulting from the comparison of the student's answers with the E.answers given by the computer.

Teaching machines did not allow students to proceed in their tasks unless they understood the materials. The machines helped students to give the correct answer by "a logical presentation of material" (Skinner on Programmed Instruction [5]) and by *"hinting, prompting, suggesting, and so on, derived from an analysis of verbal behavior"* (Skinner, 1958).

Crowder's intrinsic or branching program

Norman Crowder, a contemporary of Skinner, was working independently for the armed services on programmed instruction. He felt that a program was a form of communication between a programmer and a user. Like any communication, the program must be directed to the individual. Unlike Skinner, Crowder was not working from a psychological perspective, but from a communications point of view. In an intrinsic or branching program, each frame presents more text than the average linear frame. After reading, the user responds to an adjunct question, usually in a multiple-option format. Unlike Pressey's auto-instructional approach, which provides only confirmation of the correctness or incorrectness of that response, branching style optional choices lead users to optional forms of feedback, most of which is corrective. If the user makes a correct response, the program asserts the reasons why she or he was correct and moves on to new material. If an incorrect response is made, the program, at the very least, informs the user that an error was made and then branches the user back to the previous frame for another try.

The primary purpose of feedback" is to determine whether the communication was successful, in order that corrective steps be taken." (Crowder 288) Depending upon the complexity of the error committed, the programE. may initiate a remedial sequence of instruction, a practice designed to eliminate the learning deficiency. Branching instruction adapts the sequence of the program to a limited degree to fit the prior learning and processing capabilities of the user. The term intrinsic refers to the fact that all program options are intrinsic to the program and, therefore, not dependent on any external programming device. This approach is especially adapted to machine presentation, which provides for greater levels of adaptability. Branching texts tend to be large and confusing, especially when users try to access them in a manual way.

The primary difference between Skinner's conception of programming and Crowder's is in the function of the response. To Skinner, learning results from making the correct response. Contrary to this response orientation, Crowder believed that learning results from the realignment of the user's knowledge structure, and that the response is simply a means for controlling the program or machine. The larger chunks of information need to be assimilated and integrated with what the user already knows. The response, he believed, tests the level of integration. This type of programming benefits the higher-ability user, who is more capable of higher-level integration of ideas, more than it does the lower-ability user.

Portia Diaz-Martin [6] (2001, retrieved 15:56, 14 August 2007 (MEST)).

Mastery learning

According to Davis & Sorrel (1995), "The mastery learning concept was introduced in the American schools in the 1920's with the work of Washburne (1922, as cited in Block, 1971) and others in the format of the Winnetka Plan." It then was revived in the late 1950' with programmed instruction and brought to perfection by Caroll and Bloom's work.

The architectures of programmed instruction

Programmed instruction has the following core elements:

- Contents are broken down into pieces of instructions called **frames**. A frame contains statements and questions.
- Learners then read the frame and immediately answer a question about the frame
- There is an immediate feedback about the correctness of the frame (usually in a different place)
- Instruction is self-paced and learners are active (in the sense of reactive)

Skinner variant

- Contents are very small, i.e. simple statements plus a question or direct questions
- Answers are usually filling in blanks
- Feedback is in the form of the correct answer

“Programmed instruction (PI) involved breaking content down into small pieces of information called frames. A PI textbook might contain several thousand frames of information. Students would read a frame, then answer a question about the frame. Then they would check their answer (get "feedback") and proceed to the next frame. When PI was delivered by a "teaching machine" the possibilities for effective teaching seemed unlimited to many. PI-style software is linear. Skinner argued that PI was more effective than traditional teaching methods, ” (Programmed Instruction [7], retrieved 16:22, 16 August 2007 (MEST)) ... since learners have to receive thousands of reinforcements, something a teacher can do.

Here is an example on programmed English (M.W Sullivan) presented by Joyce, Weil & Calhoun (2000:333):

```
1. Words are divided into classes. We
   call the largest class nouns. Nouns are
   a class of ________________________.                         words
```

```
2. In English the class of words called
   nouns is larger than all the other
   __________________ of words combined                         classes
```

Questions only

Daniel K. Schneider doesn't know where this comes from, but I can show an example. On my bookshelf I found a book (Daniel P. Friedman,Matthias Felleisen, *The Little LISPer*, MIT Press ISBN 0-262-56099-2.) It teaches a programming language and is only composed of questions in increasingly difficult order.

```
Is it true that this is an atom?          Yes,
 atom                                     because atom is a string of characters
                                                beginning with the letter a.

Is it true that this is an atom?          Yes,
 turkey                                   because turkey is a string of characters
                                                beginning with a letter.

Is it true that this is an atom?          Yes,
 1942                                     because 1942 is a string of characters
                                                beginning with a digit
```

This strategy looks very Skinnerian, since the learner is supposed to learn from good answers.

Branching style

Branching is used with the idea that slower learners can be presented with additional information if they can't respond well enough to a sequence of frames and that more advanced students can be exposed to more challenging materials.

- Each frame usually presents more text than the average linear frame.
- After reading, the user responds to a question, usually in a multiple-option format (since this allows for easy electronic treatment)
- Feedback then, can be corrective i.e. branch the user into a sequence that attempts to remediate the learner's misconceptions or gaps in understanding.

Some versions of this model (i.e. Crowder's original) are more based on a (corrective) theory of communication than a behaviorist learning theory.

Special forms of this model are so-called **drill and practise** programs where learners are supposed to develop basic skills like arithmetics and keyboard operations by many repetitions. The program adjusts drill sequences according to answers.

Mastery learning

Mastery learning refers to the idea that teaching should organize learning through ordered steps. In order to move to the next step, students have to master at least 80% of the prerequisite step.

Additional topics

The role of the teachers in Skinner's thoughts

Even if in a chapter of his book “Why teachers fail”, Skinner argued that teachers fail to shape their students’ behaviour sufficiently, he stated (1954) that: *“If the teacher is to take advantage of recent advances in the study of learning, she must have the help of mechanical devices.”* Concluding his analysis he also argued that mechanized instruction should be integrated into all schools, not as a replacement for, but as an adjunct to the teacher. By saying so, he did not deny the importance of the teacher in the learning process.

Many objections to Skinner's programs have been raised during these years. The most important is that people think that the answers given by the machine are only "indicators of success" which do not constitute a complete learning program. However, students are obliged to determine on their own the success of their research and problem-solving efforts. All this is considered to be minimal and the starting point of any problem. So, maybe, the real benefit of programmed instruction is precisely the **effort** made by the student which can be seen as a sort of **grounding** for developing the **ability** to think and to learn on his own. Ability that will be achieved only thanks to the involvement of the teacher in class.

At the beginning, programmed instruction was thought for students particularly gifted, in order to prevent them to waste their time by listening things they already knew, and that could be useless for their learning process. Those who think (and are still thinking) that programmed instruction isolate students, must consider that the machine brings them into contact with the people who composed the material and with a large number of other students. Besides, computers prevent students from repeating the same material and facilitate the review of previous lessons, so, each student can learn in accordance with his own level. But all this is only feasible in **class**, where the role of teachers is once more important for stimulating discussion and improving the quality of education itself. Moreover, the fact that the student is among his friends avoids the risk of socially isolating him as homeschooling does.

Technological progress

It is important to bear in mind that "teaching machines" were much more similar to a mechanical tool than a computer as we know it. If education accepted with great interest Skinner's suggestions, it was not like that for industry because companies thought that this machine could get out of production soon. For these reasons, the materials concerning programmed instructions were mainly books, detracting the value of Skinner as a forerunner of (behaviorist) e-learning.

Some time later, the programmed instruction movement presented the concept of interactive text and extended this kind of instruction to all school subjects. So, computer-assisted instruction could assist students, by allowing them to test their abilities and to mark their improvements, supplementing the activities in class and helping to develop new skills independently. But, it was still economically difficult to put a system like that into place. As a consequence, programmed instruction as a whole seemed to sink into oblivion. Of course, another reason was a change in the understanding of learning (not discussed here).

Nowadays, the situation has changed a lot: thanks to technological progress, in particular Internet and various learning platforms like learning management systems, one could implement Skinner's theories and projects more economically.

Open-contents and programmed instructional texts

One could use the technology of wikis that succeeded in creating Wikipedia. Wikitechnology offers a great deal of opportunities based on the work of an increasing number of volunteers. In addition, the learning material can be translated in many languages in order to let people consult it for free and at home.

The success of wikis and other open source softwares gave rise to several communities of learning, made up of people who just want to *'share knowledge*E.' at all levels. The range of subjects has developed a lot, concerning spelling, reading, arithmetic, foreign languages, psychology, physics and much more. Some programs enable advancement only in a fixed order, others give additional information at the appropriate level whether a correct or incorrect answer is given, providing an immediate feedback.(See [8])

See open educational resources.

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- Programmed instruction [7]
- Behavioral Theories: Programmed Instruction [21] (includes screendumps of earlier PC programs).
- Programmed Instruction [22] (WikiEd, CTER programme, Department of Educational Psychology, University of Illinois at Urbana-Champaign..

Progressive project assignment

Definition

- Progressive project assignment is Leeper's (1989) instructional design model or method of designing projects that are challenging and attainable for each student in a class.

This design for projects in computer courses can be applied to other contexts. It “ tends to enable all students in the class to achieve their maximum potential. Each project is structured at three progressive levels of difficulty corresponding to three prospective grades A, B, and C. The B-level is an extension of the C-level and the Alevel is an extension of the B-level. Each student starts at the C-level and progresses as far as possible and is scored accordingly” (Leeper, 1989, 88).

Architecture

Each assignment has three parts:

- Each project has a core part that includes all the principles the project intents to convey and each student is expected to complete this part. A correct project gets a 'C' (US grading)
- A second part extens the project and requires a significant effort from students who elect to aim higher than 'C'. Students who correctly finish this 'B' part and the 'C' part will get a 'B'.
- Same principle for a third 'A' part

It is important that projects are progressive. Otherwise, some weaker students may select 'A' and then get stuck, which will lead to an 'F' (failure).

Evaluation

There are two steps:

1. Evaluation of each project type (A,B,C) is made with an appropriate grid.
2. The result is then multiplied with a "level factor".

E.g. on a scale from 0 to 20 points:

```
18-20 = A
16-17 = B
14-15 = C
12-13 = D
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Level factors:

```
A = 20/20
B = 17/20
C = 15/20
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Evaluation example

Here is an example presented by Leeper (1989: 90) for teaching a computer class.

The grading system is patterened after Linda Rising (1987):

- Correctness
- Design
- Style
- Documentation
- Efficiency

“ A project is assigned a score of 0-4 points for each of these factors. These scores are totalled (maximum is 20) then multiplied by the level factor that corresponds to the number of steps completed by the student for this project. This result is rounded then converted to a letter grade. For example, suppose a student submits a B-level project and the scores are as follows:” (Leeper, 1989:90):

- Correctness 3
- Design 4
- Style 4
- Documentation 3
- Efficiency 4

Total = 18

The level factor for project level B is 17/20. Multiplying the total score by this factor

```
18 x 17/20 = 15.3 (Rounded to 15)
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Therefore, the final grade falls in the C range.

Discussion

Leeper resports that this method resulted in significantly fewer "A" and "F" grades and significantly more "B", "C" and "D" grades.

This result should interest many teachers since the idea is to leave as few students as possible behind but also to set high challenges for the best.

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Project-based learning

Draft

This article provides a short introduction to *project-based learning* in the framework of more open-ended projects that are typical of socio-constructivist approaches (based on Synteta, 2002). Please, see project-oriented learning for a short general overview of all project-oriented approaches.

If you are interested in the history of project-based teaching, read Michael Knoll's The Project Method: Its Vocational Education Origin and International Development [1].

Introduction

The notion of **project** is central to socio-constructivism and other related activity-based approaches. A project allows learners to identify and formulate their own problems. The goals they set as well as the unexpected discoveries they will make during their interaction with the environment serve as guides (Collins et al, 1989). It is therefore important to divide scenarios into sequences and to divide problems into sub-problems so that learners perform only one task at a time and that these tasks are flexible enough in order for learners to be able achieve them whatever their basic level. Project-based learning is a model which distinguishes from traditional teaching since the focus is put on the learner and his project. Learners have the opportunity to work more autonomously and build their knowledge.

Projects as a methodology are not a new concept; in the United States pioneers were John Dewey (Dewey, 1966) and William H. Kilpatrick (Kilpatrick, 1918).

The project method is a genuine product of the American progressive education movement. It was described in detail and definitively delimited for the first time by William Heard Kilpatrick in his essay, "The Project Method," which became known worldwide (Church & Sedlak, 1976; Cremin, 1961; Kilpatrick, 1918; Röhrs, 1977).

[....]

Recently, however, historical research has made great progress in answering the question of when and where the term "project"-"progetto" in Italian, "projet" in French, "projekt" in German, and "proekt" in Russian-was used in the past to denote an educational and learning device. According to recent studies, the "project" as a method of institutionalized instruction is not a child of the industrial and progressive education movement that arose in the United States at the end of the 19th century. Rather it grew out of the architectural and engineering education movement that began in Italy during the late 16th century (Knoll 1991a, 1991b, 1991c; Schöller, 1993; Weiss, 1982). The long and distinguished history of the project method can be divided into five phases:

1590-1765: The beginnings of project work at architectural schools in Europe.

1765-1880: The project as a regular teaching method and its transplantation to America.

1880-1915: Work on projects in manual training and in general public schools.

1915-1965: Redefinition of the project method and its transplantation from America back to Europe.

1965-today: Rediscovery of the project idea and the third wave of its international dissemination.

(Knoll, 1997 [1])

For over 100 years, educators such as John Dewey have reported on the benefits of experiential, hands-on, student-directed learning. Most teachers, knowing the value of engaging, challenging projects for students, have planned field trips, laboratory investigations, and interdisciplinary activities that enrich and extend the curriculum. "Doing projects" is a long-standing tradition in American education. (Markham et al. 2003, 3).

In Europe, some of the known researchers are Makarenko (1888-1939), Freinet (1896-1966) and the (Groupe Français d'Education Nouvelle, 1982)). In the 1990's with the rapid growth of telematics, PBL is being revised and redefined as it is an approach that supports many of the tasks that teachers face today such as incorporating authentic assessment, infusing higher-order thinking skills, guiding students in life choices, and providing experiences that tap individual student interests and abilities.

The context

These design ideas are based on various socio-constructivist schools of thought (Bruner, 1973), but can also be found in other modern instructional theories (Ausubel, Novak and Hanesian, 1978 ; Reigeluth, 1999). We consider socio-constructivism as an understanding of learning that stresses the importance of constructing knowledge based on previous knowledge and interaction with the social environment, e.g. theories that have followed from constructivism (Piaget), socio-culturalism (Vygotsky, 1962) and situated learning (Lave and Wenger, 1991). Secondly, we perceive socio-constructivism as a set of pedagogies that use strategies like project-based learning (Thomas, Mergendoller and Michaelson, 1999), problem-based learning, inquiry-based learning, case-based learning or action learning. We call these new pedagogies « activity-based », since the students learn with interactive technology (instead of from) and since the teacher has to design, to facilitate and to monitor student activities. While each of these designs has different pedagogical objectives, we believe that all good pedagogical designs should include somewhat structured pedagogical scenarios and that the teacher's role is crucial. In this perspective, the modern teacher has to fulfill a triple role of facilitator, manager and « orchestrator » and he needs adequate supporting environments since such designs can become very complex and costly.

"The reason that Dewey, Papert, and others have advocated learning from projects rather than from isolated problems is, in part, so that students can face the task of formulating their own problems, guided on the one hand by the general goals they set, and on the other hand by the 'interesting' phenomena and difficulties they discover through their interaction with the environment" (Collins, Brown and Newman, 1989, p. 487). Powerful pedagogical designs that aim at the development of general problem skills, deeper conceptual understanding and more applicable knowledge include, according to van Merriënboer and Pass (2003, p. 3), the following characteristics : "(1) the use of complex, realistic and challenging problems that elicit in learners active and constructive processes of knowledge and skill acquisition ; (2) the inclusion of small group, collaborative work and ample opportunities for interaction, communication and co-operation ; and (3) the encouragement of learners to set their own goals and provision of guidance for students in taking more responsibility for their own learning activities an processes.". See also combined complex instructional design models like 4C/ID.

Definition

Project Based Learning is a teaching and learning model (curriculum development and instructional approach) that emphasizes student-centered instruction by assigning projects. It allows students to work more autonomously to construct their own learning, and culminates in realistic, student-generated products. More specifically, project-based learning can be defined as follows :

1. Focuses on the central concepts of a discipline
2. Engaging learning experiences that involve students in complex, real-world projects through which they develop and apply skills and knowledge
3. Learning that requires students to draw from many information sources and disciplines in order to solve problems
4. Learning in which curricular outcomes can be identified up-front, but in which the outcomes of the student's learning process are neither predetermined nor fully predictable
5. Experiences through which students learn to manage and allocate resources such as time and materials

(Moursund, 2002; J. W. Thomas et al., 1999)

Rooted (at least it's design of the curriculum, instruction and assessment) in various constructivist schools of thought (Perkins, 1991; Piaget, 1969; Vygotsky, 1978), constructionism (Harel & Papert, 1991; Kafai & Resnick, 1996), cooperative or collaborative learning (Dillenbourg, 1999), and generally active learning, has strong theoretical support for successful achievement. Still, we have to note that PBL is not a pure constructivist model but uses also multiple methods of instruction, among them direct, explicit, (didactic) instruction (Moursund, 1999). PBL can be found under the name of project method, project approach, knowledge in action, learning or education by project, intentional learning (Scardamalia, Bereiter, McLearn, Swallow, & Woodruff, 1989), learning by doing, design experiments (Brown, 1992), to name a few.

Main features

Although PBL is popular as an approach, it lacks from a universally accepted model or theory and one can find in literature a diversity of defining features (W. J. Thomas, 2000a). In order to capture the uniqueness of PBL and to screen out non examples of it, Synteta (2001) made the synthesis of the features described in literature (Reginald & Laferrière, 1999; W. J. Thomas, 2000b), and ended in the following: PBL emphasizes activities that

- are central to curriculum,
- long-term (more than a couple of class days and up to semester),
- interdisciplinary,
- have a driving question that is challenging and constructive,
- are student-centered and
- are based on collaborative or cooperative group learning,
- are integrated with real world issues and practices,
- have productive outcomes,
- have an impact on “life skills” like self-management, group process, and problem-solving skills,
- and use cognitive tools, usually technology-based (Krajcik, Blumenfeld, Marx, & Soloway, 1994; Marx et al., 1994).

According to these criteria, there are not PBL instances (Synteta, 2002):

- the projects that are not central to curriculum but serve as a complementary practice,
- projects that don't have an intellectually challenging driving question,
- projects that can be carried out with already-learned information or skills,
- projects that are scripted (P. Dillenbourg, 2002),
- projects that focus on simulated and not realistic questions.

Project vs Problem Based Learning

We have to clarify here, that with the abbreviation of PBL, we refer to Project-Based Learning and not to Problem-Based Learning. They both have roots in constructivism, as they engage students in authentic student-centered tasks to enhance learning, and the line between them is frequently blurred, as they can be used in combination and play complementary roles, but they are not identical approaches (Camille Esch, 1998 cited in (Schneiderman, Borkowski, Alavi, & Norman, 1998)).

Project-based learning focuses mostly on a production model. Students start by defining the purpose of creating the end-product, identify their audience, they research the topic, design the product, do the project management, solve the problems that arise and finish the product followed by a self-evaluation and reflection (Crawford, Bellnet website, Autodesk website, Blumenfeld et al. cited in (Schneiderman et al., 1998)). So, the driving force is the end-product, but the key to success is the skills acquired during it’s production.

Problem-based learning uses an inquiry model. Students start with a given problem, make a plan for gathering information, pose new questions and summarize their research by presenting their conclusions (Duch, Delisle, Hoffman and Ritchie, Stepian and Gallacher cited in (Schneiderman et al., 1998)). In this case, the driving force is the problem given and the success is the solution of it (Vu, Van der Vleuten, & Lacombe, 1998).

In that sense, Project-Based Learning is a broader category than the Problem-based one (Moursund, 1999), as the first includes always inquiry and might in cases address a specific problem but not the other way around.

Actors

Roles of actors are also particular in PBL. Project-based learning is a structure that transforms teaching from **"teachers telling"** to **"students doing"**. Students become active problem-solvers, decision and meaning-makers rather than passive listeners, they collaborate or cooperate forming groups, organize their activities, conduct research, solve problems, synthesize information, organize time and resources and reflect on their learning. Teachers change their role **“from sage on the stage to guide on the side”** and assume the role of cognitive and meta-cognitive coach (by asking, monitoring, probing, managing, group regulating, keeping moving) rather than knowledge-holder and disseminator. Project serves as the initial challenge and motivation (appealing to be explored, setting up the context of learning).

Identity

In addition, the concept of identity is essential to pbl. This means that the learner has the opportunity to try out various identities while engaged in a project. The learner is also surrounded by other identities, those of the other participants. Identities will vary by expertise which supports the learner's progress. The interaction of identities of varying expertise in part comprises legitimate peripheral participation, as is found in communities of practice(Lave & Wenger, 1991).

Assessment

Generally, with its innovative approach to learning, PBL also requires an innovative approach to assessment, which is challenging. It requires varied and frequent assessment, including teacher assessment, peer assessment, self-assessment and reflection. Using technology as a tool and constructivist learning as the methodology, assessment of learning is not a separate process after learning has occurred, but rather learning and assessment are coterminous (H. D. Jonassen, Peck, & Wilson, 1999).

Implementation Levels

Activity-based, collaborative, and construction-based pedagogies can be implemented at three levels: (1) the micro-level, i.e. smaller pedagogical scenarios or projects which can be components for larger projects, (2) long term projects, i.e. project-based classes and (3) the general study environment favoring student initiative and community building on which we will come back later.While micro activities (lasting only over a single or a few lessons) can not reach the same goals as true project-based teaching, they nicely can complement traditional instruction and are often the only realistic alternative in today's organization of the school and university system.We now will examine particular instructional design issues, first at the level of smaller scenarios and then for larger project-oriented classes.

See also: project-oriented learning for a wider discussion of different frameworks.

Efficiency, effectiveness and affordability

Researchers have investigated the impact of project-based learning (and related instructional approaches) in a wide variety of educational contexts ranging from early childhood education to medical and legal education. They have generally been shown to be effective in increasing student motivation by engaging them in their own learning, in improving student problem-solving and higher order thinking skills (Stites, 1998). It promotes meta-cognition and self-regulated learning by asking students to generate their own strategies for problem definition, information gathering, data-analysis, and hypothesis-building and testing, comparing these strategies against and sharing them with other students' and mentors' strategies. Teaching with the project-based method enables students to work cooperatively with peers and mentors in a student-centered environment where learners are encouraged to explore various topics of interest. "The collaborative nature of the investigation enhances all of these valuable experiences ... as well as promotes a greater appreciation for social responsibility (Scott, 1994)". Hence, it also provides opportunities for interdisciplinary learning by engaging students in applying the content of different subject areas during the various phases of the project. PBL helps students develop real world skills like the ability to collaborate well with others, make decisions and take initiative, and face complex problems. After completing a project, if students are asked to create a self-evaluation of the project, like writing a meta-report, this enables the students to focus on their learning process and allows them to see their progress. Self-evaluation gives students a sense of accomplishment and further instills responsibility for learning. And by documenting the learning process it also makes it easy to distribute results to bigger audiences, with all the obvious advantages.

The most complete research on PBL effectiveness has been done from (W. J. Thomas, 2000b)) in the framework of his dissertation that concludes that: a) PBL is challenging to plan and enact, b) PBL depends a lot on the scaffolding provided to students to learn how to learn, c) there is indirect and direct evidence that PBL is a more popular method than other instructional strategies, as both students and teachers believe that is beneficial and effective, d) there is some evidence that PBL compared to other learning methods, enhances the quality of students’ learning, increasing their capability for applying what is learned in novel problems, e) finally, there is ample evidence that PBL is effective for teaching students complex processes like planning, communicating, problem solving and decision-making, but there is no comparison with other methods.

Unfortunately, there is only evidence for most of the advantages mentioned above, given the complexity of PBL coupled with the diversity of defining features and the lack of a universally accepted model or theory. In addition, it is difficult to isolate the effects of it. Some of the reasons are, that it is applied most of the time with other strategies, limits with other similar approaches are blurred (like problem-based learning), it is implemented differently in different contexts and most of all, standard achievement tests cannot measure the higher order thinking skills developed (Stites, 1998).

Difficulties

Although PBL is considered to be a profitable learning strategy, its implementation faces several challenges (Kehoe, Guzdial, & Turns, 1998; Means & Olson, 1995; Synteta, 2001; W. J. Thomas, 2000b; Synteta, 2003) as projects are complex endeavours involving many different activities. In particular,

Students have difficulty to:

- Initiate inquiry; have coherent research questions,
- Define a research project; good research design and appropriate methodology,
- Direct investigations; find resources,
- Manage complexity and time; keep deadlines, estimate time needed to do a task,
- Collaborate and give feedback; articulating the work of others and give regular feedback. Known problems concern planning, operationalisation and monitoring (J. van der Veen, B. Collis, & Jones, 2001),
- Follow-up the project; revise products, thing that requires critical thinking skills and cognitive self-awareness (Schneiderman et al., 1998).

In addition to the difficulty of setting clear goals for various phases, students have trouble relating data, concept and theory. A teacher should orchestrate a project into several more or less sequential scenarios who in turn can be broken down to smaller phases. This will insure that learners will focus on smaller sub-problems, will do things in the right order (e.g define research goals in the beginning of the project and not in the middle).

On the other hand, teachers have difficulty to:

- Design a PBL course; design projects that support learning of specific concepts and skills and sustain such highly demanding pedagogical approaches like PBL,
- Follow-up several projects; monitor progress, give feedback and support where and when is needed and generally classroom management,
- Use technology especially as a cognitive tool; incorporating technology is challenging,
- Design assessment; assessment that require students to demonstrate their understanding.

Interventions and the role of technology

Many researchers believe that PBL is a beneficial learning model and in order to remediate it's pitfalls have run intervention research proposing various strategies to support and improve it.

(Krajcik et al., 1998) and (M Guzdial, 1998) use the term “**scaffolding**” and (Scardamalia et al., 1989)) the term “**procedural facilitation**” to refer to their intervention strategies.

(Barron et al., 1998)), propose to introduce explicit design requirements within the project that prompt students to generate and pursue productive questions. (Blumenfeld, 1991)), propose to help teachers develop “**driving questions**” that will ensure that student will encounter with complex concepts and principles and develop CSILE, a computer-supported intentional learning environment to provide temporary support for young learners who were observed to face difficulties asking questions and directing their inquiries.

(Hmelo, 1998)), focuses on providing scaffolds for collaborative group work and (Barron et al., 1998) on providing scaffolds for student self-assessment. (W. J. Thomas, 2000b)) in the conclusions of his dissertation, says that there is evidence that PBL is relatively challenging to plan and enact so teachers will benefit from a supportive context for it’s administration. According to (Kehoe et al., 1998)), the combination of supporting learning and doing is critical to successful PBL.

Among the intervention strategies that have been proposed, the use of technology was central :

(Blumenfeld, 1991; Means & Olson, 1995). Evaluations of K-12 instruction have shown strong evidence of learning gains associated with PBL plus technology (Cognition and Technology Group at Vanderbilt (CTGV), 1992). (Kehoe et al., 1998) also clearly state that “… technology can play an important role in structuring and supporting effective project-based learning …” after long experience with “**Team Facilitator**” (team planning through web), **CaMILE**

(Collaborative and Multimedia Interactive Learning Environment), **Reflective Learner** (web environment that supports students in writing learning essays using prompts) and **STABLE** (SmallTalk Apprenticeship-Based Learning Environment, a web-based case library of exemplary projects). (Brown & Campione, 1996), say that technology has also the value of making the knowledge construction process explicit, thereby helping learners to become aware of that process. (H. D. Jonassen et al., 1999), state in their manifesto that tools that meaningfully engage the learners should support constructivist environments and that technology-based environments can effectively support these activities. (Krajcik et al., 1994), state that technology makes the environment more authentic to students, because among others the computer provides access to data and information and expands interaction and collaboration with others via networks. A long technical report (USA department of education, 1995) concludes that: "… some aspects of the model (PBL) maybe directly stimulated by technology – notably an increased level of collaboration, heterogeneity of roles, and greater complexity and authenticity in assigned tasks. Other tasks …are often reinforced by technology use. …".

But technology-based learning environments can and should support advanced knowledge acquisition. And that can be done by providing environments and thinking tools that engage constructivist conceptions of learning (Kommers, Jonassen, & Mayes, 1992). Thinking tools are technology systems or applications that extend the intellectual functionality of the learner by engaging the learner to tasks that facilitate knowledge construction (e.g. semantic network software, expert systems, databases and microworlds). Even simpler Internet tools add critical and valuable dimensions to a PBL experience. The management issues, for a start, that a teacher can face as the classroom-learning manager of a networked project can be dealt with easier than the ones on an "old-fashioned, low-tech" project (in case that teachers cannot meet the students frequently). Another advantage is that the dissemination of the projects is open to bigger and different audiences. More specifically, students have the opportunity to peer, review and browse other similar projects, motivating them and supporting them in the accomplishment of their own project. Most important, the web can be used as a communications and collaboration medium to build ongoing dialogs between the project authors and their audience, especially their teachers. These "author-mentor" dialogs can be planned and organized to motivate students and establish increasingly high standards. A networked project typically involves students in distant locations cooperating to research, exchange information, and learn from one another, although the distant partners may include experts. Students may conduct research, perform experiments in their own community, and report their findings. They may pose questions to experts or exchange information with their peers. (J. van der Veen et al., 2001) focuses also on the important support that telematics (as they call them) can provide to group-based learning. All the above advantages of a networked project are not without cost. We shouldn't forget the disadvantage of it's distant nature compared to face-to-face communication. To remedy, teachers have to put special attention on details such as meeting deadlines (e.g., using reminders), regular animating the course, and finally, being ready to help and being flexible. Students on the other hand, in order to conclude their projects and enhance their learning, it is important to be able to share project results, to be able to reflect on their work, and stay in touch. In the directions of (W. J. Thomas, 2000b) for future research in PBL, we distinguished two needs, a new theory of learning and instruction that will provide principles for guiding authentic inquiry, knowledge construction and autonomous learning and models for designing efficient and productive projects. In conclusion, for PBL success we have to focus on the following points: careful management and orchestration of instruction, multiple scaffolds during students inquiries, careful and continuous monitoring. Technology can help, as it supports very well features that are important in PBL, like student-autonomy, group work, scaffolding on-demand, and many others.

Scenarization

Effectiveness is not guaranteed if the teacher simply asks students to do projects, to engage in writing activities, to learn together or at least to profit from each other's ideas. We assume that the risk is quite high to observe that students cannot start, get lost or are otherwise unproductive. We therefore suggest to create semi-structured pedagogical scenarios that define an orchestrated sequence of learning activities. Such a scenario is often called a « script » in the literature, and in particular, in the field of Computer-supported collaborative learning (CSCL) that Dillenbourg, Schneider and Synteta (2002) define as a story or scenario that the students and tutors have to play just in the same way as actors play a movie script. Such pedagogical scripts can become very sophisticated : for each phase, the script specifies the tasks that students have to perform, the composition of the group, the way that the task is distributed within and among the groups, the mode of interaction and the timing of phase. Phases are ordered and connected, i.e. outputs of one phase become inputs of the next phase.

Pedagogical scripts are mostly sequential, at least from the student's perspective. However, it does not mean that these are merely instructions that the learners have to follow. Tasks can and should often be defined as mere goals, e.g. that at some point the teacher can ask students to hunt out and to formulate definitions of the objects they will have to study although the way they do it is left open. In other words, when designing and executing pedagogical scenarios the teacher has to respect a harmonious equilibrium between the freedom left to students that is necessary for intellectual development and motivation on one hand, and certain guiding principles on the other hand.

Scenarization of project components

Structured activity-based teaching involves sequencing scenarios and therefore breaking the « problem » into parts so that the students are challenged to master as many tasks as they are ready to handle. From a more abstract perspective, scenarios evolve in cycles, e.g. a typical teaching/learning phase has more or less the following elements (in whatever order) :

1. Do
2. Deposit
3. Look
4. Discuss

Resources, tools and products play an important role. Each time a student does something, there should be a product (even as small as a little message) that is deposited somewhere and that can be looked at and discussed. Below is an alternative but very similar loop showing that there are variants of the same principle: Things are looked at, things are produced and discussion happens. It is the principle of information seeking, production and interaction that counts.

1. Look (discovery)
2. Discuss (interaction)
3. Do (production)
4. Deposit (sharing)
5. Feedback (discussion of results)

The teacher's manager role is to make sure that such loops are productive, e.g. that the students produce something, that it is task related, that they engage themselves in meta-reflection (look critically at their own work) and that they discuss and share with others. The teacher's facilitator role is to help students with their tasks, e.g. help them to select resources and tools, explain difficult concepts and procedures, "debug" when they are stuck etc. The teacher's orchestrator role is to implement (or most frequently also to create) the scenarios or scripts as they are also called. This means basically to define a scenario as a sequence of clearly identifiable phases in a way that learners focus on a smaller amount of tasks at the same time and that these tasks are not too difficult to be solved at some point.

Let's have a look at a simple example. Imagine that for a given purpose, students need references for a project. We can turn this into a pedagogical activity with a scenario that includes the following steps:

1. The teacher introduces the theme, gives clues and asks students to consider the different aspects of the subject (Discuss).
2. Students search the web with various search engines and bookmark the links they find interesting (Look, Deposit).
3. Students then try to work out a certain amount of categories and sub-categories for this theme (Look, Do, Deposit).
4. The results are put in common and a hierarchy is worked out (Look, Do, Discuss).
5. The approved categories are entered in a common space (e.g. the classroom wall, a sheet of paper or an electronic links management system) (Deposit).
6. Students classify, enter and describe their links (Do, Deposit).
7. Teacher provides an evaluation (Discuss).

More such scenarios are suggested for example in the TECFA SEED Catalog in terms of scenarios (activities), its constituant elementary activities and supporting technology. As we said before, scenarios should not be "over-scripted", the student should in general be its own master of the tasks and tasks should have some flavor of authenticity. Along similar lines, the teacher should not directly interfere with student's products, but only give feedback and evaluation and let the student fix things himself. Defining a scenario therefore is a workflow design problem, but with the idea that pedagogical workflows are different from the ones in industry. In industry the goal is the product, in education the goal is apprenticeship, i.e. what the student has learnt from performing a set of activities

Global Story-boards

Global story boards are quite different according to level of education, field, total time, duration, etc.

Here is one possible blueprint of the scenario the students are confronted with:

1. Familiarization with the project(s) content
2. Familiarization with pedagogical goals (including content area(s), methodology-related know-how, higher-order skills, ...)
3. Familiarization with (rough) timeline (i.e. deadlines for audits, sharing activities)
4. Exploration/discussion of subjects and team-building
    - At the same time the working environment is introduced.
5. Definition of individual (or group) projects including planning.
    - This usually requires at least 3 iterations
6. Audits and sharing activities, for example:
    - students have to present literature reviews at the start and exchange links
    - constitution of a common dictionary
    - make comments to other projects
7. Presentation of results
8. Evaluation

Global problem-based learning models:

- C3MS project-based learning model
- Moursund project-based learning model

The role of Tools

As the above example shows, most activity-based, constructive and collaborative pedagogies do not necessarily need any special tools, but work can be made more efficient (after some adaptation period) and certainly more powerful by adopting some support technology. Walls in a classroom run out of space, paper is lost and collaboration within the classroom is under heavy time constraints and "home work" lacks the sort of support that classroom activities have. Content needs to managed, knowledge exchange must be organized, discussion tools must favor exchange of arguments, projects must run, and generated knowledge must be managed.

What kinds of productions could typically happen in such a workflow approach?

1. Gathering and distribution of information : teachers and learners share resources and the activities are designed to help them gather information and make it available to all.
2. Creation of collaborative documents : here the students can write definitions, analyze cases, solve problems, write documents and create illustrated documents together around specific themes.
3. Discussion and comments about the productions : learners identify together facts, principles and concepts and clarify complex ideas. They formulate hypotheses and plan solutions, make links between ideas, compare different points of view, argue, evaluate... ?
4. Project management related activities : learners can decide work plans, share tasks and form groups, decide a schedule and so forth. Teachers can distribute and regulate tasks.

Internet technology supports most open-ended, creative and active pedagogies, as long as students can also be producers (not just readers and exercise button pushers). While there is an interesting number of enabling software and while activity-based (e.g. project or problem-based) scenarios are quite popular (Reigeluth, 1999 ; Wilson and Lowry 2001), they are not supported by the same number of technologies as the scenarios inspired by more traditional instructional design are. Exceptions like the Knowledge Forum System are rare. Besides commonly used tools like HTML pages and forums, there exist quite a number of interesting tools like participatory content management systems (e.g. Weblogs), and collaborative hypertexts in various forms (e.g. Wikis). However, we like to push one step further, i.e. provide teachers with a fairly integrated configurable platform of tools. Technical requirements for active and rich pedagogies are not extremely demanding, but interesting results could already be obtained by providing the following sort of functionalities :

1. Access to rich information sources (not just stream-lined e-learning blocks) by various means, e.g. browsing, searching by categories or popularity, searching by keywords.
2. Affordable interaction with various types of information contents (including annotation).
3. Rich interactions between actors, that are facilitated by awareness mechanisms (who did what, what is new, etc.)
4. Simple integration of these activities through a « place ».

Activity-based pedagogies assign a better diverse role to documents used. Learners generally select by themselves the documents they need from a larger choice (which includes the whole Internet). More importantly, they actively participate in the production of documents, some of which can be reused later on. Ideally, they also should be allowed to annotate documents, i.e. enrich them by their own experience. Writing in this perspective concerns producing short texts in various genres (questions, arguments, links, definitions, etc.). These learner productions plus interactions are meant to provoke various meta-cognitive mechanisms beneficial to learning e.g. conceptual change and deeper understanding (Klein 1999). In general terms, activity-based teaching needs mainly a computer as a facilitating structure, a thinking, working and communication tool instead of a content transmission device. Accordingly, most student and teacher activities should be supported by computational tools and lead to new « contents ». Within this perspective we can see that activities and roles are defined in a collaborative expressive digital media framework.

- See: C3MS as a way to implement this sort of design. We advocate either Portals (of the C3MS kind) or a combination of web 2.0 applications (see the list of web 2.0 applications, personal learning environments, webtops etc.)

Other tools:

- NoteStar [2] Assist students with collecting group notes and citations for papers.
- PBL CheckList [3]
- Think Tank [4] is designed to help students (grades 3-8) develop a Research Organizer (a list of topics and subtopics) for reports and projects
- Project Foundry [5] A project-based learning management tool for students and teachers

The general study environment

The community factor is particularly important in open and distance learning situations. As formulated by e-learning practitioner Gilroy (2001) « E-learning should be first and foremost about creating a social space that must be managed for the teaching and learning needs of the particular group of people inhabiting that space ». While a large part of our knowledge comes indeed from formally planned learning scenarios, people learn a lot from informal exchange with fellow learners, with professors, experts, i.e. from exchange within tightly or loosely defined communities (Lave and Wenger, 1991).

It is very important that teaching should generate enthusiasm, enhance concentration and favor creativity, which are very distinct, but somehow interconnected phenomena. Rieber Smith and Noah (1998) convincingly argue that learning process itself -and not just the result- should be interesting, if one seeks higher motivation among learners. « Serious play » or « hard fun » are intense learning situations where learners are investing a lot of « energy » and time, that provide equally intensive pleasure at certain moments which have been identified as « flow » or « optimal experience » by Csikszentmihalyi

According to Feldman, Csikszentmihalyi and Gardner (1994), creativity should be studied and therefore facilitated by the teacher at three different levels : (1) the social field, e.g. a network of people who provide cognitive and affective support, instruction, evaluation, recognition, etc. ; (2) the domain (symbol systems of knowledge) ; and (3) the individual, i.e. intellectual traits, personal traits and cognitive structures. It is clear that education cannot influence all variables, but pedagogical design certainly can have a positive influence on individual dispositions that already exist. It can act upon conditions, i.e. on educational tasks and the general learning environment like the « class spirit » with the help of specially designed technology that we will introduce later on. By exposing students to open-ended, challenging, authentic and partly self-defined projects on one hand and by providing scaffolding and support on the other hand, the teacher does create situations where individual traits can be exposed and developed.

By taking into accout input from community of practice, flow theory, creativity theory etc. we can define a few desiderata for the design of portals as holistic learning environments:

First, the portal should be a rich information space for « domain support » and it should encourage students to add their own contribution. Such a space also encourages exploration. The typical tools used are links managers, Wikis, news engines and RSS feed that keep users up-to-date about articles posted to other interesting portals or individual Weblogs. Intellectual support is provided via forums, annotations and articles. Student productions are always accessible to all (including visitors) and therefore provide for recognition. In our experience, it has been shown that students are more likely to contribute to an environment if they own an identity. In the student's partly automatically generated home page on the portal one can see their contributions, read public parts of their personal Weblog and conversely each production in the portal is signed with a clickable link to the author. In addition, we developed a tool that allows to list and display in detail all student productions throughout the various tools. A successful teaching by projects pedagogy needs to provide strong emotional support and it is therefore important to encourage spontaneous, playful interaction and corners for humor that will augment quality of on-line life and contribute to class spirit. Tools like the shoutbox or a little quotation box can do wonders. Last, but not least, a personal Weblog (diary) can stimulate meta-reflection, in particular if the teacher requires that students write an entry after the completion of each activity.

Our observations lead us to conclude that pedagogical portals should also be designed in the spirit of true virtual environments that have drawn a lot of attention in the last decade. A pedagogical virtual environment (VE) consists in a constructed virtual information space built with the appropriate tools as outlined above. A virtual environment (VE) is also a social space, where pedagogical interactions take place.

Example cases of project-based learning

- High school project
- Junior High school project
- Elementary school project

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Notes

This is more or less copy/paste text from Schneider & Synteta (2005 and our TecfaSeed Catalog. A better version will be written once we are done with describing other project-oriented / activity-based designs. DSchneider 12:45, 13 May 2006 (MEST)

Project-based science model

Draft

The **project-based science (PBS) model** is a project-oriented instructional design model from the Project-Based Science (PBS) project, an effort that began in 1991 at the University of Michigan School of Education.

According to Lin & Fishman (2006), " the five design principles for PBS curriculum units (Singer, Marx, Krajcik, & Chambers, 2000) are: (1) establish meaningful context; (2) engage in scientific inquiry; (3) collaborate to share/refine understandings; (4) utilize learning tools; and (5) create class/individual artifacts."

See the PIViT software (also a PBS project).

The model

The design principles of project-based science curricula are according to Lin & Fishman (2006)'s interpretation of Singer et. al 2000):

Name	Description	Examples
Establish meaningful context	Meaningful, defined problem space that provides intellectual challenge for the learner.	Driving question and sub-questions Anchoring event
Engage in scientific inquiry	A set of interrelated processes by which scientists and students pose questions about the natural world and investigate phenomena	Asking questions Data collection and analysis Communicating data
Collaborate to share/refine understandings	Interaction among students, teachers, and community members to share information and negotiate meaning	Small-group design meetings Think-pair-share learning strategy Group presentations
Utilize learning tools	Tools that support students in intellectually challenging task	Data collection Communication Modeling
Create class/individual artifacts	Representations of ideas or concepts that can be shared, critiqued, and revised to enhance learning	Concept maps Scientific models Lab reports

In an earlier publication Soloway, Krajcik and Finkel (1995) link the model to learning theoretical issues. Below we reproduced the original table with minor modifications and annotated with some annotations in the column to the right.

Learning Theory	Project-based Science Feature
Authentic Problems: Investigations should concern non-trivial problems that involve activities like asking and refining questions, debating ideas, making predictions, designing plans and/or experiments, collecting and analyzing data and/or information, drawing conclusions, making inferences,communicating their ideas and findings to others, and asking newquestions. Contextualized Important Complex Meaningful (interesting, valuable, ...)	**Driving Questions** that serve to organize and drive activities. Students or teachers can create questions and activities. In any case, students must have enough room to develop their own approach to answer questions. Real-world Nontrivial Worthwhile Science content feasible
Understanding Active construction Multiple representations Applying information Situated Using strategic thinking	Investigation **Artifact development**: Activities should lead to artifacts or products that represent student's solutions and implicitly represent their emergent state of knowledge. In addition these artifacts allow actors to share and to reflect.
Community of learners Collaboration Social context Negotiated meaning Distributed expertise	[Collaborative learning]] Students, teachers, society members as a community. Establish norms Sustain focus Hold students accountable
Cognitive tools	Technology: based on user-centered design principles. Teachers/students use: to collaborate, to investigate, and to develop artifacts

Soloway, Krajcik and Finkel Framework of Project-based Science

Tools

- Collaborative hypertexts, such as wikis
- Inquiry learning environments like WISE or BGuILE and other kinds of microworlds.
- Any sort of CMC tools
- Concept maps

Example

According to Timmerman et al. (2006:11), such instructional design models are appropriate for more abstract topics and/or those where students tend to have well-developed prior ideas (misconceptions): “ Thus, when faced with limited time or resources for curriculum reform, we agree with Wandersee et al. (1994) that conventional teaching is sometimes sufficient and our data suggest that more "high-powered" methods such as inquiry-based curriculum reform should focus on more abstract topics or those known to be resistant to conceptual change. Indeed, we would hypothesize that it is nearly impossible to change students' conceptions of abstract topics such as evolution using only didactic methods and that inquiry-based methods which allow students to confront their prior conceptions are required for meaningful learning to occur in these areas.”

Timmerman et al (2006: 12) provided comparison of inquiry and "didactic curricula" regarding "evolution" that we slightly modified.

Elements	Design Principle Reformed inquiry-based curriculum	Traditional, didactic curriculum
Content Topics	Evolution Biodiversity	Plant and Animal Anatomy and Physiology
Context	Emphasizes scientific inquiry skills and application of knowledge	Emphasizes reiteration or verification of ideas
Inquiry	Science inquiry skills explicitly a goal Explicit use of primary literature Explicit, formalized peer review (emphasized as an inquiry skill, not just a process)	Focused on factual content knowledge No primary literature No peer review.
Collaboration	Mostly collaborative; group work common	Mostly individual
Assessments	Summative assessments based on open-ended projects and authentic performances (oral presentation, written reports) - Multi-week assignments - Formative feedback provided	Weekly quizzes, factually oriented (multiple choice or fill-in-blanks) with a practical exam at end of term. Single lab activities with the exception of the rat dissection No formative feedback
Learning Technologies	Beguile-like environments	Interactive dissection video and images

Links

- BGuiILE Website [1], Biology GUided Inquiry Learning Environments], Brian J. Reiser et al., Northwestern University. Includes software like the Galapogos Finches [2].
- http://www.biol.sc.edu/~timmerman/misconceptions.pdf
- Science Diverse Learners Research Reviews [3].The purpose of the Content Network's review tables is to organize the review teams' information regarding science research studies.

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To move elswhere

(e.g. either inquiry learning, change management, teacher development)

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Project-methodology-based learning

Draft

Definition

- We define **Project-methodology-based learning** as designs were students have to use a specific project methodology (or set of). This is typically the case in engineering curricula.

Technology

- Project management software
- Simpler CMC tools like:
  - Wikis
  - Groupware (that include at least file upload/download and a forum).

Examples

- See Instructional design methods, e.g. MISA
- Todo: Software engineering methods like IBM's RUP and some UML-based things.

R2D2

Draft

Definition

- **R2D2** (Recursive Reflective Design and Development) is a constructivist instructional design model and Instructional design method developed by Willis.

The model

According to Willis (1995) defines the following characteristics of a typical constructivist-interpretivist instructional design model

1. The ID process is recursive, non-linear, and sometimes chaotic.
2. Planning is organic, developmental, reflective, and collaborative.
3. Objectives emerge from design and development work.
4. General ID experts don't exist.
5. Instruction emphasizes learning in meaningful contexts.
6. Formative evaluation is critical.
7. Subjective data may be the most valuable

In contrast to many instructional systems design models, Willis claims in particular that objectives do not guide lesson development, rather that they emerge during development. The main components of his development method are:

- Define
- Design
- Develop
- Disseminate

Botturi et al. summarize the R2D2 overarching principles as follows:

1. Recursion: the steps/elements are revisited at different times and decisions can be made anew.
2. Reflection based on feedback and ideas from many sources, which is contrasted with the linear design rationality of linear models.
3. Non-linearity, focal points instead of steps (e.g. a bit like the Kemp design model.
4. Participatory design: the whole idea behind this model is that the ID process is not only the designer's job, but rather team work, in which different people collaborate. Communication and negotiation acquire a primary role here.

Links

- Summary of Willis (1995) [1] by K. Song and L. Brunner.

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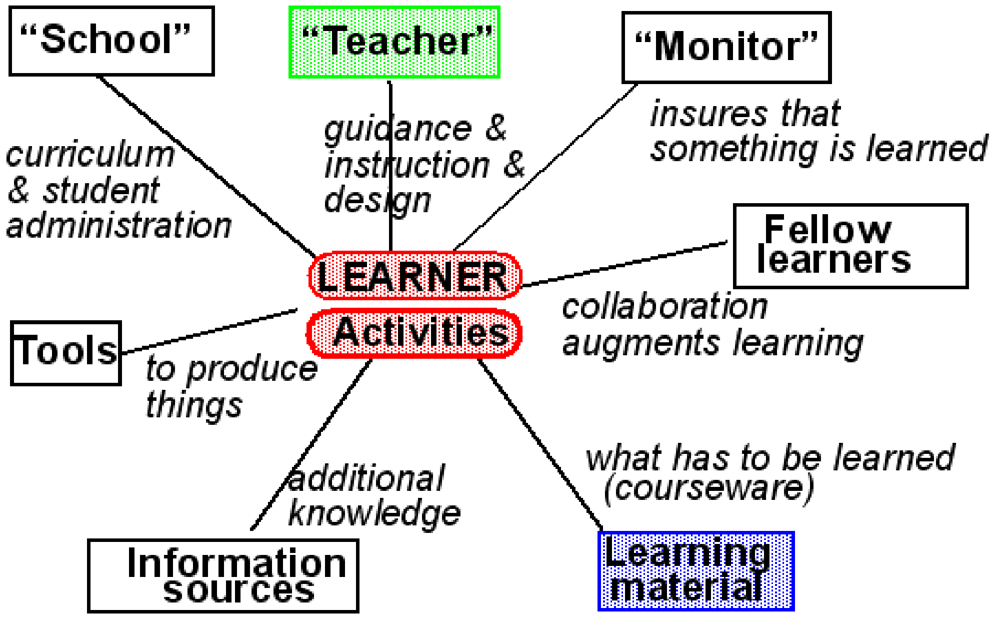
Sandberg learning environment functions

Draft

In discussing the role of technological support in education, [Sandberg, 1994, 225,] identifies the components of a (technologically rich) learning environment. These components must all be there in order to optimize learning. However, they can be ``implemented *in many different ways. Each component has functionalities that we should insure:*

1. Teacher component: Its role is to provide something between loose guidance and direct instruction. It can be a human agent (present or distant), an intelligent agent, instructions like some text books provide, etc. This component provides information from the syllabus to the task level.
2. Monitor component: Ensures that something is learned. A role taken by either the human teacher, the learner (self-control) or by some program.
3. Fellow learners component: Improves the learning process by collaborative learning principle
4. Learning material: Contains what has to be learned in a very broad sense (knowing what, knowing how). It can be computational in various ways (exploratory hypertext, lesson and task oriented hypertext, simulation software, task solving environments, etc.).
5. External information sources: All kinds of information which is not directly stored in the learning material (e.g. the Internet as a whole, a web site, additional materials, handbooks, manuals, etc.).
6. Tools: Everything which may help the learning process other then the learning material (e.g. calculators, communication software, etc.)
7. School [a category we added]: Something that provides a curriculum.



modified from Sandberg

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Scaffolded knowledge integration

Draft

Introduction

- Scaffolded knowledge integration (SKI) or *scaffolded knowledge integration framework* is an instructional design model to enhance science teaching in school classrooms. It was developped by Marcia C. Linn [1] (and collaborators) at University of California, Berkely.

" In the SKI framework, learners are viewed as adding to their repertoire of ideas and reorganising their knowledgeweb about science. Students sort out their ideas as a result of instruction, experience, observation, and reflection (Linn & Hsi, 2000). The framework is organised around four principles to promote knowledge integration: (a) making science accessible for students, (b) making thinking visible for students, (c) providing social supports for students, and (d) promoting lifelong science learning." (Williams & Linn, 2002: 416).

"The Scaffolded Knowledge Integration framework offers guidelines to help designers create materials that promote integration. Scaffolded Knowledge Integration builds on results from related research (Linn and Hsi 2000, Hawkins and Pea 1987, Mokros and Tinker 1987, Bransford et al.1990, Hawkins 1991, Pea and Gomez 1992, Pea and Gomez 1993, Gordin et al.1994, Means et al. 1996, Means and Coleman,).To promote knowledge integration, Scaffolded Knowledge Integration has four main tenets: making science accessible for all students; making thinking visible so students understand the process of knowledge integration; helping students to listen from each other; and promoting life long science learning." (Linn, 2000: 784)

See also: socio-constructivism, inquiry-based learning, Project-based science model, project-oriented learning, ...

The model

(1) Instruction should connect science to personally relevant problems and prior knowledge, i.e. to make a link between instructed and spontaneous concepts.

(2) Students and teachers are encouraged to “ make their thinking visible, describing how they recognise new ideas, and reorganise and connect new and prior ideas. Students explore events and phenomena first hand and develop from those observations important concepts and ideas. Technological supports such as visualisations, films, models, and simulations can also make thinking visible.We ask students to make predictions, drawinferences, and construct generalisations” ((Williams & Linn, 2002: 417)

(3) Based on Vygotsky's concept zone of proximal development - a foundation of most socio-constructivist designs, the SKI “ [...] emphasises that providing students with social supports in a science classroom can promote knowledge integration. Collaborative learning situations such as discussions and debates can be designed so students offer explanations, interpretations, and resolutions supported by a peer or a scientist.” (Williams & Linn, 2002: 418)

(4) Promote autonomy for lifelong science learning: “ To prepare students to integrate the ideas they learn in science and revisit them once they have completed a science course, WISE software supports questioning, analysing, and reflecting. [...] Students are asked to identify weaknesses in arguments and question the validity of the scientific information presented. These activities allow students to link their real world experiences with scientific concepts taught in school and prompt students to make the links between spontaneous and instructed ideas. [...] In addition, the WISE software features "Amanda the Panda", an electronic guidance tool that supplies students with hints regarding salient aspects of Internet evidence and also reminds students of the purpose of a project activity. These forms of guidance make the computer a learning partner in the classroom, encouraging students to link their real world experiences with scientific concepts.” (Williams & Linn, 2002: 418)

Examples

- See the article about the WISE project

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Science writing heuristic

Definition

- The **science writing heuristic** (SWH) is a writing-to-learn model for learning from laboratory activities in secondary science and can be used by teachers as a framework from which to design classroom activities.
- "The science writing heuristic (SWH) is a tool to guide both teachers and students in productive activities for negotiating meaning about laboratory investigations." (Keys et al., 1999: 1067).

The science writing heuristic

The **Science Writing Heuristic** has been developed by Carolyn Keys, Brian Hand, Vaughan Prain and Susan Collins (Keys et al, 1999). This " ... heuristic is intended to help students construct understanding during practical work. Students are required to produce written explanations of the processes involved in the activity through completion of a template, with particular emphasis placed on claims, evidence and reflection" (Hand et al. 2002: 20).

"There is evidence that use of the science writing heuristic facilitated students to generate meaning from data, make connections among procedures, data, evidence, and claims, and engage in metacognition. Students' vague understandings of the nature of science at the beginning of the study were modified to more complex, rich, and specific understandings." (Keys 1999:1065).

The heuristic is a instructional design model consisting of 2 parts: one for the teacher actions and for student activities. Keys et. al, (1999:1067-1069) and also Hand, Prain and Wallace (2003:20-22) provide the following definitions (from which the lists are quoted entirely).

Teacher template component

(The Science Writing Heuristic, Part I)

This template contains a series of suggested activities to involve students in meaninful learning activitivies. More precisely, we can defined it as socio-constructivist pedagogical scenario to promote laboratory understanding. Teacher's are of course encouraged to adapt it to their local context.

1. Exploration of pre-instruction understanding through individual or group concept mapping.
2. Pre-laboratory activities, including informal writing, making observations, brainstorming, and posing questions.
3. Participation in laboratory activity.
4. Negotiation phase I - writing personal meanings for laboratory activity. (For example, writing journals.)
5. Negotiation phase II - sharing and comparing data interpretations in small groups. (For example, making group charts.)

6. Negotiation phase III - comparing science ideas to textbooks for other printed resources. (For example, writing group notes in response to focus questions.)
7. Negotiation phase IV - individual reflection and writing. (For example, creating a presentation such as a poster or report for a larger audience.)
8. Exploration of post-instruction understanding through concept mapping.

Hand, Prain and Wallace (2003:20)

The student compontent

(The Science Writing Heuristic, Part II)

In order to scaffold student's knowledge construction process, they are asked to complete a number of questions within a template format including the focus of their question, their claims and their evidence. These written explanations are also based on peer discussion and text reviews. Therefore students can use the templates as individuals but also in small groups. Again, the heuristic may be used as is or be tailored by the teacher to specific investigations.

1. Beginning ideas - What are my questions?
2. Tests - What did I do?
3. Observations - What did I see?
4. Claims - What can I claim?
5. Evidence - How do I know?Why am I making these claims?
6. Reading - How do my ideas compare with other ideas?
7. Reflection - How have my ideas changed?0

Hand, Prain and Wallace (2003:21)

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Self-regulated strategy development model

Draft

Definition

The Self-Regulated Strategy Development Model (SRSD) is an implementation model for Cognitive strategy instruction.

The model is based on research work by Graham, Harris, Read, Ryan, Short et al. According to Read (2005) " The goal of SRSD is to make the use of strategies habitual, flexible, and automatic. This can take a lot of time, practice, and effort.The SRSD model is very comprehensive. This ensures that crucial steps are not overlooked."

The model

Stage 1: Develop and Activate Background Knowledge

Stage 2: Discuss the Strategy

Stage 3: Model the Strategy

Stage 4: Memorize the Strategy

Stage 5: Support the Strategy

Stage 6: Independent Performance

Example

See the [Story grammar (PDF) [1]] (according to Short and Ryan, 1984),

Links

- Resources from the Cognitive Strategy Instruction Web Site:
  - http://www.unl.edu/csi/Pdfs/sgrammar.pdf [Story Grammar]
  - http://www.unl.edu/csi/Pdfs/scrolcsi.pdf [SCROL]
  - http://www.unl.edu/csi/Pdfs/lplan.pdf [Lesson plan guide, PDF]
  - http://www.unl.edu/csi/srsdworksheet.rtf [Lesson plan guide, RTF]

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Shuell model of learning functions

Draft

“According to Thomas Shuell "meaningful learning" is a cognitive, metacognitive & affective activity, which is typified by five characteristics: active, cumulative, goal-oriented, constructive and self-regulated (Shuell 1992: 23-5.). The characteristics mentioned above are triggered when the learner engages certain ‘psychological processes’, called ‘learning functions’2. The functions are in turn activated by learning tasks, which can be learner- or tutor-initiated.” (Grogan, 2005 [1]).

This view can be compared to other constructivist models, e.g. Jonassen's meaningful learning.

The list of learning functions

Source: Casey & Brosnan (2004:27-28). I have no clue of this is the "true" list. Have to get myself a copy of the original at some point, rewrite the list and tie it to the five characteristics - Daniel K. Schneider 16:58, 27 February 2009 (UTC).

Define Learning Expectations

the learner has some idea of what he or she is trying to accomplish

Motivation

willingness to persist and contribute effort to the task in which he or she is engaged

Prior Knowledge Activation

ensure that both cognitive and affective prerequisites (including the needs, goals, and everyday experiences of the learner) are available for use by the learner

Attention

important for the leamer to pay attention to important features of the instructional task and to ignore features that are irrelevant

Encoding

the process by which information is prepared so that it can be manipulated in short-term or working memory

Comparison

in order to acquire a body of knowledge involves understanding rather than rote memorization, the learner must compare facts and concepts in a search for similarities and differences that permit the formation of those higher-order relationships that comprise understanding

Hypothesis Generation

the active, constructive nature of meaningful learning requires the learner to generate various hypotheses as he or she seeks a more adequate understanding of the material being learned

Repetition

it takes time, and multiple exposures, to find meaningful ways of relating the various parts of a complex body of knowledge

Feedback

for the learner to determine if he or she is on the right track, feedback must be received on the accuracy and/or appropriateness of what was done â either overtly or covertly

Monitoring

an effective learner keeps track of the progress being made toward achieving the instructional goal

Evaluation

simply receiving appropriate feedback is not sufficient; the learner must interpret and evaluate the feedback and determine how it can best be used in the learning process

Combination, Integration, Synthesis (CIS)

As information is acquired, the more-or-less isolated pieces must be combined in ways that permit the learner to integrate and synthesize information from several sources. Meaningful learning,

Links

- Thomas J. Shuell [2] Home page.

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Simulation

Draft

Definition

- A simulation is an imitation of some real device, state of affairs or process. Simulation attempts to represent certain features of the behavior of a physical or abstract system by the behavior of another system (Wikipedia:Simulation)
- Most often, simulations are fully or partially implemented with a software program that allows the user to learn something about a given object of interest by "playing" with parameters of a model ("What happens if I do this" ? ... and later, "why did this happen ?").

According to Mergendoller et al. (2004): Randel, Morris, Wetzel, and Whitehill (1992) examined 68 studies on the effectiveness of simulations and found that students engaged in simulations and games show greater content retention over time compared to students engaged in conventional classroom instruction.

Simulation types:

- Computer simulations
- Computer games, e.g. serious games
- Microworlds, e.g. systems like AgentSheets
- Simulation and gaming (including role play simulation and computer supported simulation and gaming)

In some pedagogical scenarios, learners have to build their own simulation with modeling software. Of course, some microworlds also have students model.

Links

- Textbooks and General References [1]. Good bibliography, contains on-line papers.
- Resources for Higher Education [2]. Includes Virtual Worlds large scale resources that will challenge first year economics undergraduates. The Virtual Learning Arcade encompasses a series of simulations, such as the inter-relationships between markets, and the Virtual Farm game, where students can run a business over a ten year period. (not test - DKS).

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Super motivation

Draft

Definition

Super motivation (here) refers to an instructional design model defined by Dean R. Spitzer (1996).

The model

According to Sonvilla-Weiss (2004), the Spitzer model can be summarized as:

- **Action:** Active participation in the learning process. Activity can be both physical and mental nature.
- **Fun:** Humorous and surprising elements as part of the learning system can evoke a playful and encouraging way of using learning systems.
- **Variety:** Use of different media, resources and activities. Choice Learners should be able to do their own selection of media, contexts and learning paths.
- **Social interaction:** group-discussion, work in teams or consultation by instructors play an important motivational function.
- **Error tolerance:** Learners do mistakes, and this is an important factor when learning.
- **Measurement:** The focus is on personal improvement.
- **Feedback:** should be positively formulated. Spitzer recommends suggestions on improvement instead of pointing out the errors.
- **Challenge:** Tasks that can be mastered should not be trivial, but represent a sufficient challenge. Particularly recommended are learning goals by the learner themselves.
- **Recognition:** The motivation can be increased, if the learning progress is recognized by the system, other learners or teachers.

According to Spitzer's super motivation most effective in complex multimedia learning environments is Challenge, Choice, Action and also Fun, since most interactive media bear a highly explorative potential of learning goals.

Here is another summary in German by Tellenbach et al. (someday both should be merged ...- DKS)

- **Action (Aktion)** Dieser Aspekt wird vor allem auch durch die Interaktivität unterstützt, da sie den Lernenden zu aktiver Mitarbeit ermuntert, was eine Grundvoraussetzung für einen Lernerfolg ist.
- **Fun (Spaß)** Oftmals wird diese Komponente als Motivation missverstanden. Tatsächlich kann Spaß am Lernen tatsächlich die Motivation verstärken, es besteht jedoch die Gefahr, dass vermeintlich humoristische Elemente nicht so wirken wie es der Autor beabsichtigte, daher sollte man damit sorgfältig und sparsam umgehen.

- **Variety (Abwechslung)** Dies soll vor allem durch eine abwechslungsreiche Verwendung der verschiedenen Medien erreicht werden, so dass die Aufgabe nicht allzu monoton erscheint.
- **Choice (Auswahl)** Da nicht alle Lernenden die gleichen individuellen Lernstile haben, empfiehlt es sich, dem Lernenden die Wahl zumindest teilweise zu überlassen, welche Medien er bevorzugt. Um der Gefahr der sozialen Isolation zu begegnen - ein Vorwurf, der
- **Social Interaction (Soziale Interaktion)** elektronischen Lernsystemen immer wieder gemacht wird - ist es wichtig, Kommunikationswerkzeuge in die Lernumgebung zu integrieren, hier sind einerseits Werkzeuge zur Gruppenunterstützung denkbar, wie auch solche, die die Kommunikation und Betreuung durch den Dozenten ermöglichen. Da es zum Lernen gehört, Fehler zu machen, ist es wichtig, das Lernsystem so
- **Error Tolerance (Fehlertoleranz)** zu konstruieren, dass der Lernende keine Angst und damit Scheu vor Tests und verbundenen Bestrafungen entwickelt. Die Erfolgsmessung sollte hier vorzugsweise positiv erfolgen, sprich nicht die
- **Measurement (Erfolgsmessung)** Fehler sollen bewertet werden, sondern der tatsächliche Lernfortschritt. Ähnlich wie die Erfolgsmessung sollte auch das Feedback positiv orientiert
- **Feedback (Rückmeldung)** sein, also nicht nur auf Fehler hinweisen, sondern hilfreiche Tipps geben und Vorschläge liefern. Allzu leichte Aufgaben wirken auf den Lernenden nicht motivierend, da das
- **Challenge (Herausforderung)** betrachtete Problem allzu schnell als trivial angesehen wird. Da jedoch nicht alle Lernenden die gleichen Fähigkeiten mitbringen, müssen die Aufgaben/Ziele an den jeweiligen Fähigkeiten ausgerichtet werden. Dies kann zum Beispiel anhand eines Eingangstests erfolgen. Erkennt der Lernende, dass seine Fortschritte durch das System, den
- **Recognition (Anerkennung)** Lehrenden oder Mitlerner bemerkt werden, so kann dies auch weitere Motivation schaffen

Other application areas

Spitzer (1990) also developed a model for motivation in the workplace (and that is better known). He also analyzed de-motivators.

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Links

- Super Motivation: Dean Spitzer [3]

Taba teaching strategy model

Draft

Definition

The **Taba teaching strategy model** (our name) was defined in the sixties by Hilda Taba and aims to help designing courses down to lessons in areas where students are supposed to learn how to think.

Background assumptions

According to Joyce and Weil (2000:131), Taba built her approach around three assumptions:

1. Thinking can be taught (through engaging students in practice, in particular inductive reasoning).
2. Thinking is an active transaction between the individual and data. This relies on earlier theories, e.g. Bruner's concept attainment, an important component of concept learning
3. Processes of thought evolve by a sequence that is "lawful", somewhat in the sense of mastery learning.

Taba identified three inductive thinking skills:

- concept formation (concept learning)
- interpretation of data
- application of principles

The model

According to Joyce and Weil (2000), think inductively [1], Handbook to Elementary Social Studies [2] we made a provisional summary of the model (have to get the original at some point - Daniel K. Schneider).

Concept Formation

This stage includes three major steps: listing items (exemplars of concepts), group similar items together, label these (with a concept name).

- **Phase 1:** Identifying and listing
  - What do you know about .... ?
  - For lessons in your own classroom, you might ask the following: What did you see? What did you hear? What do you know about...?
- **Phase 2:** Grouping according to common attributes
  - Do any of these go together? Why?
- **Phase 3:** Categorizing (labeling of the categories above)
  - How would you name these groups?

Interpretation of Data

This stage includes interpreting, inferring, and generalization and leads to concept attainment (i.e. students develop deductive capabilities).

- **Phase 4:** Identifying critical relationships (differentiation)
  - What do you notice about the data ? What did you see ?
- **Phase 5:** Exploring relationships (cause-effect)
  - Why did this or that happen? What do you think this means?
  - Do you notice any connections within the records or across the data?
- **Phase 6:** Making inferences
  - What makes you think about this?
  - What can you conclude?

Note: At some point phases 1/2/3 can be repeated or revised.

Application of Principles

- **Phase 7:** Predicting consequences
  - What if?
- **Phase 8:** Explaining and/or supporting predictions
  - Why do you think this or that would happen?
  - Based on the data, would these conditions be logical?
- **Phase 9:** Testing and generalization
  - What would it take to make this generally true ?

Links

Summaries

- Concept Formation or Concept Development Model by Hilda Taba (1966) [3] by Janet Bosnick
- Summary of Taba's ch 5. Teacher's Handbook [2] an other version is Concept Attainment [4] (not clear who copied from whom).
- Outline of framework for instruction and learning [5]

Examples

- The Database Project [6]
- [http://imet.csus.edu/classic/imet1/dave/periodictable/

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TeachML

Draft

Definition

TeachML is an educational modelling language for contents. The code can be run in the Targeteam software.

This project may be dead since the homepage [8] of the project is dead. See ELML, a very similar (and alive) project.

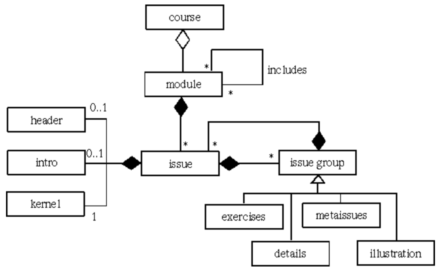
TeachML has been created in the TArgeted Reuse and GEneration of TEAching Materials (Targeteam) project). " Targeteam is a system for supporting the preparation, use, and reuse of teaching materials. It is centered around the XML based language TeachML which can be classified as an "educational modelling language"." ([8], retrieved 15:50, 29 May 2007 (MEST)).

The Targeteam project is a joint development effort of the group of Prof. Gunnar Teege, University of the Armed Forces, and Prof. Johann Schlichter, Technical University, both at faculty of Informatics, in Munich, Germany. The Targeteam System is an Open Source development, implemented completely in Java. The System and all documentation can be downloaded from the Targeteam homepage [8] and can freely be used and distributed.

TeachML architecture

The most important element of TeachML is the **issue**: "Targeteam [...] provides an abstract structure in the form of a homogeneous hierarchy of issues . Content chunks are not identified as "chapter", "section", "paragraph", "list entry", "exercise", "slide", "course unit" etc. Instead, the actual structure is generated automatically from the homogeneous hierarchy when the delivery format is produced. The abstract structure makes it possible, to reuse Targeteam content chunks in differently structured contexts. The same issue can be used in one context as a subsection where the subissues become list entries, and in another context as a separate chapter where the subissues become sections " (Teege, 2002 [1])

The main structure of TeachML can be formalized with a UML class diagram



UML diagram of the main structure in TeachML (Teege, 2002 [1])

TeachML 1.2 Integrated Materials Language

```
<?xml version="1.0" encoding="ISO-8859-1"?>

<!-- .................................. -->
<!-- TeachML 1.2 Integrated Materials Language -->
<!-- file: TeachML-Int.dtd

   This is the TeachML language for complete integrated
   TeachML materials. It consists of all TeachML language
   modules but TeachML Integration.

   Note, that this is not the real DTD, as it is used in the
   Targeteam system. The real DTD is modularized into several files,
   according to DTD modularization in XHTML, and it makes heavy use of
   parameter enities. This file contains all DTD modules and
   most parameter entities have been eliminated for better
   readability. This file is provided for getting a first quick
   impression of the Targeteam DTD.

   More information about the elements, their semantics, their use and
   examples can be found in the Targeteam documentation, available at
   the Targeteam homepage:
     http://www11.in.tum.de/forschung/projekte/targeteam/

   .................................. -->

<!-- The document element is teachml. -->

<!-- TeachML document element .................... -->
<!ELEMENT teachml ( module ) >

<!-- Next, all sublanguages for content are integrated. Each
     sublanguage XXX contributes the elements in ContentXXX.mix
     to the elements which may be used anywhere in content. -->

<!-- Language Core -->
<!-- content contribution elements: -->
<!ENTITY % ContentCore.mix
  "note | definition | code | defined | emph | quote | ref | whatsit |
xor"
 >

<!-- complete element set: -->
<!ENTITY % ElementsCore.mix
  "%ContentCore.mix; | header | intro | kernel
   | details | illustration | exercises | metaissues | summary
   | module | issue " >
```

```
<!-- Sublanguage Box -->
<!-- complete element set: -->
<!ENTITY % ElementsBox.mix "vbox | hbox | cbox | ivbox | ihbox" >

<!-- content contribution elements: all -->
<!ENTITY % ContentBox.mix "%ElementsBox.mix;" >

<!-- Sublanguage Tup -->
<!-- complete element set: -->
<!ENTITY % ElementsTup.mix "tuples | metatuple | tuple | ten" >

<!-- content contribution element: tuples -->
<!ENTITY % ContentTup.mix "tuples" >

<!-- Sublanguage Astep -->
<!-- complete element set: -->
<!ENTITY % ElementsAstep.mix "atom-stepping | atoms | step | nosteps" >

<!-- content contribution elements: all -->
<!ENTITY % ContentAstep.mix "%ElementsAstep.mix;" >

<!-- Additionally, content elements which are only present
     after integration (this is the atom element) -->
<!-- complete element set: -->
<!ENTITY % ElementsIntegrated.mix "atom" >

<!-- content contribution elements: all -->
<!ENTITY % ContentIntegrated.mix
  "%ElementsIntegrated.mix;"
 >

<!ENTITY % Content.mix
  "| %ContentCore.mix; | %ContentBox.mix; | %ContentTup.mix; |
   %ContentAstep.mix; | %ContentIntegrated.mix;" >

<!ENTITY % Elements.mix
  "| %ElementsCore.mix; | %ElementsBox.mix; | %ElementsTup.mix; |
   %ElementsAstep.mix; | %ElementsIntegrated.mix;" >

<!-- Now we define the language modules. They only
     interact via the Content.mix parameter. -->

<!-- TeachML core language ..................... -->
<!-- Parameter defaults: -->
<!ENTITY % Inissue.class
  "header | intro | kernel
```

```
  | details | illustration | exercises | metaissues | summary"
 >

<!-- The Root Element: module.  -->

<!ELEMENT module ( issue )+ >
<!ATTLIST module
    id ID #IMPLIED >

<!-- ********************************* -->
<!-- The sublanguage for structuring   -->

<!ELEMENT issue ( %Inissue.class; )* >
<!ATTLIST issue
     id ID #IMPLIED
     kind CDATA #IMPLIED
     author CDATA #IMPLIED
     affiliation CDATA #IMPLIED >

<!ELEMENT header ( #PCDATA %Content.mix; )* >

<!ELEMENT intro ( #PCDATA %Content.mix; )*" >
<!ATTLIST intro id ID #IMPLIED>

<!ELEMENT kernel ( #PCDATA %Content.mix; )* >
<!ATTLIST kernel id ID #IMPLIED>

<!ELEMENT summary ( #PCDATA %Content.mix;  )* >
<!ATTLIST summary id ID #IMPLIED>

<!ELEMENT xor ( alt  )* >

<!ELEMENT alt ( #PCDATA | issue %Content.mix;  )* >
<!ATTLIST alt types NMTOKENS "standard">

<!-- Issue groups: -->

<!ENTITY % [http://www.eurodl.org/materials/contrib/2002/7teege/teege.htm Teege, 2002]Issuegroup.attrib "
  id ID #IMPLIED
  header CDATA #IMPLIED
  labels (numbers | letters | capletters | dots) #IMPLIED
  first-label CDATA #IMPLIED
  label-pre CDATA #IMPLIED
  label-post CDATA #IMPLIED
" >

<!ELEMENT details ( issue | xor )* >
```

```
<!ATTLIST details %Issuegroup.attrib; >

<!ELEMENT illustration ( issue | xor )* >
<!ATTLIST illustration %Issuegroup.attrib; >

<!ELEMENT metaissues ( issue | xor )* >
<!ATTLIST metaissues %Issuegroup.attrib; >

<!ELEMENT exercises ( issue | xor )* >
<!ATTLIST exercises %Issuegroup.attrib; >

<!-- *********************************** -->
<!-- The sublanguage for textual content -->

<!ELEMENT definition ( #PCDATA %Content.mix;  )* >
<!ATTLIST definition id ID #IMPLIED>

<!ELEMENT note ( #PCDATA %Content.mix;  )* >
<!ATTLIST note id ID #IMPLIED>

<!ELEMENT code ( #PCDATA %Content.mix;  )* >

<!ELEMENT defined ( #PCDATA %Content.mix;  )* >

<!ELEMENT emph ( #PCDATA %Content.mix;  )* >

<!ELEMENT quote ( #PCDATA %Content.mix;  )* >

<!ELEMENT whatsit ( #PCDATA %Content.mix;  )* >
<!ATTLIST whatsit kind CDATA #REQUIRED>

<!-- ************************************ -->
<!-- The sublanguage for cross references -->

<!ELEMENT ref ( #PCDATA %Content.mix;  )* >
<!ATTLIST ref target-module NMTOKEN #IMPLIED
              target-atom NMTOKEN #IMPLIED
              target NMTOKEN #IMPLIED
              url CDATA #IMPLIED>

<!-- ************************************ -->
<!-- The sublanguage for simple includes  -->

<!ELEMENT include EMPTY >
<!ATTLIST include select CDATA #REQUIRED>

<!-- TeachML Box .................. .................... -->
```

```
<!ELEMENT vbox ( %ElementsBox.mix;  )+ >
<!ATTLIST vbox
    width CDATA #IMPLIED
    id ID #IMPLIED >

<!ELEMENT hbox ( %ElementsBox.mix;  )+ >
<!ATTLIST hbox
    width CDATA #IMPLIED
    id ID #IMPLIED >

<!ELEMENT cbox ( #PCDATA %Content.mix;  )* >
<!ATTLIST cbox
    width CDATA #IMPLIED
    id ID #IMPLIED >

<!ELEMENT ivbox ( %ElementsBox.mix;  )+ >
<!ATTLIST ivbox
    width CDATA #IMPLIED
    id ID #IMPLIED >

<!ELEMENT ihbox ( %ElementsBox.mix;  )+ >
<!ATTLIST ihbox
    width CDATA #IMPLIED
    id ID #IMPLIED >

<!-- TeachML Tup .................. ..................... -->

<!ELEMENT tuples ( metatuple?, tuple+ ) >
<!ATTLIST tuples
    arity CDATA #IMPLIED
    id ID #IMPLIED >

<!ELEMENT metatuple ( ten+ ) >

<!ELEMENT tuple ( ten+ ) >

<!-- "ten" is the abbreviation of Tuple ENtry -->
<!ELEMENT ten ( #PCDATA %Content.mix;  )* >

<!-- TeachML Astep .................. ..................... -->

<!ELEMENT atom-stepping ( #PCDATA %Content.mix;  )* >
<!ATTLIST atom-stepping
    id ID #IMPLIED  >

<!ELEMENT atoms ( atom )+ >
```

```
<!ELEMENT step ( #PCDATA %Content.mix;  )* >
<!ATTLIST step
    atom CDATA #REQUIRED
    initial (true|false) "false" >

<!ELEMENT nosteps EMPTY >
<!ATTLIST nosteps
    atom CDATA #REQUIRED >

<!-- TeachML Integration extensions  .................... -->
<!ELEMENT atom ( alternative )+ >
<!ATTLIST atom
    id ID #IMPLIED >

<!ELEMENT alternative EMPTY >
<!ATTLIST alternative
    name         CDATA #REQUIRED
    extension    CDATA #REQUIRED
    type         CDATA #REQUIRED
    derived-from CDATA #IMPLIED
    derived-by   CDATA #IMPLIED>
```

Discussion

The following text is copy/paste from http://www.targeteam.net/(!), , retrieved 15:50, 29 May 2007 (MEST).

Learner's Experience

The feedback from learners was positive about the rich offer of different delivery formats which can be selected according to the learning situation and personal preferences. The main delivery formats offered where a fulltext script in PDF, a fulltext online script as structured HTML, and a short "slide" version in HTML used during the lectures.

Authors Experience

After a period of accomodation the abstract structure and the separation from layout of the Targeteam content was perceived by authors as making the development of teaching materials substantially easier. However, this is only true for the development of new content or the reuse of Targeteam content. The reuse of "legacy content", such as content in LaTeX, Powerpoint or Word format, is rather difficult.

Links

- TArgeted Reuse and GEneration of TEAching Materials [8] (TargeTeam Homepage - **dead** link June 2009)
- Targeteam Documentation [2]

Bibliography

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Team learning

Draft

Definition

Team learning is a popular design element in various project-oriented learning models.

Team building

According to the Building Blocks for Teams [1] Web Site there are a few recommendations on which most practitioners would agree:

Number of students

- In engineering education, a team is usually composed by 4-5 people, because that is small enough for everyone to communicate, but large enough to have genuine team dynamics. 7-8 participants seems to be maximum, pairs (2) the minimum.

Mix of students

- Most experts agree that students should not form teams by themselves, since within the team clique-building increases and conversely exclusions of some.

Different strategies:

1. Heterogeneous Groups: Selection of students according to several criteria, e.g. according to background in subject matters, or geographic / ethnic / gender, or learning styles. However, make sure not to have a sole "minority person" in a group.
2. Random assignment.
3. By interest, e.g. topics, future career plans, etc.
4. By expertise, see shared expertise.

“ Teams which have similar membership often function more quickly and efficiently than heterogeneous groups, but heterogeneous teams can be more innovative in the long run.” ([2], retrieved, 17:17, 15 September 2006 (MEST))

Team stability

As a general rule, teams should remain stable throughout a project. However there are exceptions:

- “ One exception could be if your class does relatively short projects with pairs or small teams. In that case, it could be advantageous to rotate members so students are exposed to more viewpoints.” ([2] retrieved, 17:17, 15 September 2006 (MEST))
- Some CSCL models like Busser and Ninck's (2004) *BrainSpace* may include rotation schemes where students are assigned different roles in differents groups so that knowledge can spread through a whole class.

The role of technology

Technology is of course very prominent in scenarios that explicitly include within-group collaboration scripts, e.g. this is the case in computer-supported collaborative learning.

However, even if teamwork organization is left open to team members and students are enrolled in presential teaching, technology plays an increasingly important role.

> *needs to be completed, see entries like project-oriented learning and technology-enhanced classroom for conceptual issues and entries like project management software for very technical issues.*

Research Issues

Can team skills be taught ?

According to Okudan (2001) “ it was proposed that the high performing team skills training and education could improve the performance of student design teams.”. Half of an engineering class received three two-hour training, but globally the results have not been found significant and the authors call for more research that also try out different more in depth-training.

Links

- Student Teams in Engineering [3] This Web page from the engineering education Foundation Coalition [4] has several interesting documents for teachers.
- Building Blocks for Teams [1], Teaching and Learning with Technology, PennState. Good site with practical advice.
- Frequently Asked Questions [5] of the Wharton Leadership Program. Addresses some team forming/management issues.
- BESTTEAMS [6], (Building Engineering Student Team Effectiveness and Management Systems project) at University of Maryland. This site has teaching materials for download.

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Teleteaching

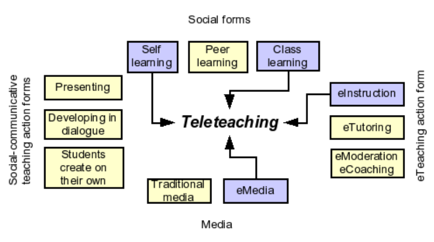
Draft

Definition

- Teleteaching can be considered as a form of e-learning or distance teaching. Most often, it implements a sort of direct instruction approach.
- Sometimes it also is used as synonym for educational videoconferencing, i.e. as a component of a design, not a design by itself.

Teleteaching designs

A key feature of a teleteaching instructional design model is e-instruction. Teleteaching is most often done in a class context (i.e. learners connect at the same time and can interact with the instructor). But they also may choose to look at archived sessions they can download. In addition, each learner will have to work on his own.



Teleteaching according to the SCIL eLearning compontents framework

Of course, such a instructional framework can be combined with others. I.e. it is possible to engage learners of a distance teaching class in other activities, e.g. collaborative work through a wiki. Modern instructional design models like 4C/ID or First principles of instruction advocate the use of different strategies.

Technology

For Videoconferencing

- Videoconferencing and archives of sessions, e.g. Mpeg4, quicktime, breeze/flash formats
- Screencasting software (slides + voice over).

In addition

- Various courseware (eMedia)
- Learning platforms, such as LMSs or groupware

Trialogical learning

Stub

Trialogical Learning refers to “Those forms of learning where learners are collaboratively developing, transforming, or creating shared objects of activity (such as conceptual artefacts, practices, products) in a systematic fashion. Trialogical learning concentrates on the interaction through developing these common, concrete objects (or artefacts) of activity, not just between people ("dialogical approach"), or within one's mind ("monological" approach)” (Trialogical Learning [1], retrieved 17:16, 13 June 2008 (UTC)).

Trialogic learning can be defined with respect to monologic and dialogic learning:

Trialogic learning, Retrieved June 2008 from http://escalate.org.il/construction_knowledge/papers/andriessen.html

See also: Cognitive artifact, Cognitive tool, Knowledge-building community model, expansive learning, Transformative pedagogy.

Tools

- See cognitive tools, in particular environments like CSILE.
- Simple software like wikis (e.g. some articles in our edutech wikis may be the trace of some trialogical learning
- The KP-LAB [2] Project attemps to build software. The European Community's Knowledge-Practices Laboratory (KP-Lab) project is coordinated by Hakkarainen's research centre at the University of Helsinki. It is a large integrated European project (11.2 million euro, Information Society Technologies program, Technology Enhanced learning call) that involves 15 European countries and 22 organizations (2005-2010). The project will produce a modular, flexible and extensible system consisting of a cluster of inter-operable applications (i.e., shared collaborative spaces, semantic web knowledge services, communication platforms, ubiquitous user agents, inter-institutional access) which organize participants' collaborative activity around shared knowledge artefacts.

Links

- Trialogical Glossary [3]
  - Trialogical Learning [1]
  - Trialogical Technology [4]

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Universal design for learning

Draft

Definition

Universal Design for Learning (UDL) is an instructional design model for designing curricula that engable all individuals to gain knowledge, skills, and enthousiasm for learning.

Principle

UDL relies on the idea that there exist three primary brain networks playing different roles in learning. According to UDL Homepage [1] at CAST:

- Recognition networks: Gathering facts. How we identify and categorize what we see, hear, and read. Identifying letters, words, or an author's style are recognition tasks- the "what" of learning.
- Strategic networks: Planning and performing tasks. How we organize and express our ideas. Writing an essay or solving a math problem are strategic tasks - the "how" of learning.
- Affective networks: How students are engaged and motivated. How they are challenged, excited, or interested. These are affective dimensions- the "why" of learning.

Therefore, an universally-designed currulum should offer the following:

- Multiple means of representation to give learners various ways of acquiring information and knowledge
- Multiple means of expression to provide learners alternatives for demonstrating what they know, and
- Multiple means of engagement to tap into learners' interests, challenge them appropriately, and motivate them to learn

More details in executive format can be found in a table in the FORMATEX 2006 paper: Supporting post secondary learners with psychiatric disabilities in online environments [2]. The most detailed model we found is in Grabinger et al., 2008.

Links

Center for applied special technology (CAST)

- CAST [3] Homepage
- CAST Universal design for learning [1]
- Teaching Every Student (TES) [4]

Other

- Universal Design for Learning - Improved Access for All [5], by Nancy Firchow.

References

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WIPPEA

Draft

Definition

- **WIPPEA** is a lesson planning method.
- The acronym WIPPEA represents the first letter of each stage in the lesson planning model: Warm-up, Introduction, Presentation, Practice, Evaluation, Application.

The design method

According to Writing lesson plans [1], the desing principles are the following.

Each learning concept builds on the previous one

- This becomes the instructional roadmap for teachers

Teachers plan lessons with the result in mind, according to the backwards design method. Teachers defines:

- The lesson's objective
- The evaluation of mastery of the objective. E.g. he asks himself “ How will I expect students to demonstrate understanding or mastery of this objective? What type of evaluation activity will best assess students' ability to learn and apply their new knowledge?”

Then, the teachers designs the lesson activities according to the WIPPEA stages:

1. Warm-up
2. Introduction
3. Presentation

4. Practice
5. Evaluation, Application

Links

- Writing lesson plans [1] from OTAN Online Lesson Plan Builder for adult educators

Templates

- Word blank template [2]

WebLabs model

Definition

We refer to **WebLabs** as an instructional design model: " The **model of learning** in *WebLab*s is that children design, model, reflect, share and comment on each others' evolving knowledge of mathematical and scientific ideas. **The pedagogic approach** in WebLabs is to motivate and foster model building, collaboration and critique." (Pedagogical Model [1], retrieved 20:19, 21 July 2006 (MEST))

The model

This model draws from various socio-constructivist thoughts and insists on well defined scenarios (activity sequences).

Its main components are according to the pedagogical model [1] page:

- Motivation: Teacher leads an introduction into the activity sequence.
- Group discussion: Teacher-led sharing of ideas about
- Group web report: Teacher-led writing of an initial group web report
- Designing: Small group discussion about how to model the situation (build from scratch, use preparred tools or models from another site).
- Modelling: Work with the computer
- Group Sharing: Teacher-led sharing of products, comparison. Also debugging and setting of new challenges. Back to modelling if needed.
- Group Reflection: Teacher-led discussion of what has been done
- Group web report: Teacher-led writing of a report (including working models).

It is is noteworthy that each group activity takes place in different sites (web labs created within the WebReports system) and can feed into each other.

Software

- ToonTalk is the authoring environment used to build models.
- Models build with ToonTalk
- WebReports is the web-based collaborative workspace.

Links

- WebLabs [2] home page.

References

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Matos, J.F & Santos, M., Global view of WebLabs from a Communities of Practice's point of view, PDF [4]

WebQuest

Definition

A WebQuest is an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web, optionally supplemented with videoconferencing. WebQuests are designed to use learner's time well, to focus on using information rather than looking for it, and to support learner's thinking at the levels of analysis, synthesis and evaluation. The model was developed in 1995 at San Diego State University by B.Dodge with T.March. There are at least two levels of WebQuests:

(a) Short Term WebQuests: designed to be completed in 1 to 3 class periods. The instructional goal is knowledge acquisition and integration, described as Dimension 2 in Marzano's (1992) Dimensions of Thinking model. At the end of a short term WebQuest, a learner will have grappled with a significant amount of new information and made sense of it.

(b) Longer Term WebQuest: will typically take between one week and a month in a classroom setting. The instructional goal is extending and refining knowledge (Marzano's Dimension 3). After completing a longer term WebQuest, a learner would have analyzed a body of knowledge deeply, transformed it in some way, and demonstrated an understanding of the material by creating something that others can respond to, on-line or off-.

The forms that a longer term WebQuest might take are open to the imagination. Some ideas:

- A searchable database in which the categories in each field were created by the learners.
- A microworld that users can navigate through that represents a physical space.
- An interactive story or case study created by learners.
- A document that describes an analysis of a controversial situation, takes a stand, and invites users to add to or disagree with that stand.
- A simulated person who can be interviewed on-line. The questions and answers would be generated by learners who have deeply studied the person being simulated.

Putting the results of their thinking process back out onto the internet serves 3 purposes: it focuses the learners on a tangible task; it gives them an audience to create for; and it opens up the possibility of getting feedback from that distant audience.

Critical Attributes

WebQuests of either short or long duration are deliberately designed to make the best use of the learner's time. There is questionable educational benefit in having learners surfing the net without a clear task in mind, and most schools must ration student connect time severely. To achieve that efficiency and clarity of purpose, WebQuests should contain at least the following parts:

1. An **introduction** that sets the stage and provides some background information.
2. A **task** that is doable and interesting.
3. A **set of information sources** needed to complete the task. Many (though not necessarily all) of the resources are embedded in the WebQuest document itself as anchors pointing to information on the Web. Information sources might include web documents, experts available via e-mail or realtime conferencing, searchable databases, and books and other documents physically available in the learner's setting. Because pointers to resources are included, the learner is not left to wander through webspace completely adrift.
4. A **description of the process** the learners should go through in accomplishing the task. The process should be broken out into clearly described steps.
5. Some **guidance** on how to organize the information acquired. This can take the form of guiding questions, or directions to complete organizational frameworks such as timelines, concept maps, or cause-and-effect diagrams as described by Marzano (1988, 1992) and Clarke (1990).
6. A **conclusion** that brings closure to the quest, reminds the learners about what they've learned, and perhaps encourages them to extend the experience into other domains.

Some other non-critical attributes of a WebQuest include these:

1. WebQuests are most likely to be **group activities**, although one could imagine solo quests that might be applicable in distance education or library settings.
2. WebQuests might be enhanced by wrapping **motivational elements** around the basic structure by giving the learners a role to play (e.g., scientist, detective, reporter), simulated personae to interact with via e-mail, and a scenario to work within (e.g., you've been asked by the Secretary General of the UN to brief him on what's happening in sub-Saharan Africa this week.)
3. WebQuests can be designed within a **single discipline** or they can be **interdisciplinary**. Given that designing effective interdisciplinary instruction is more of a challenge than designing for a single content area, WebQuest creators should probably start with the latter until they are comfortable with the format.

Thinking Skills required

(from Marzano, 1992)

1. Comparing: Identifying and articulating similarities and differences between things.
2. Classifying: Grouping things into definable categories on the basis of their attributes.
3. Inducing: Inferring unknown generalizations or principles from observations or analysis.
4. Deducing: Inferring unstated consequences and conditions from given principles and generalizations.
5. Analyzing errors: Identifying and articulating errors in one's own or other's thinking.
6. Constructing support: Constructing a system of support or proof for an assertion.
7. Abstraction: Identifying and articulating the underlying theme or general pattern of information.
8. Analyzing perspectives: Identifying and articulating personal perspectives about issues.

Design Steps

Learning to design WebQuests is a process that should go from the simple and familiar to the more complex and new. That means starting within a single discipline and a short-term WebQuest and then moving up to longer and more interdisciplinary activities. Here are the recommended steps:

1. Become familiar with the resources available on-line in one's own content area. Toward that end, it exists a Catalog of Catalogs of Web Sites for Teachers [1]. This provides short list of starting points for exploration broken down by subject matter discipline.
2. Organize one's knowledge of what's out there. For example, Non-WebQuest 3 [2] will guide the teacher in organizing the resources in their discipline into categories like searchable database, reference material, project ideas, etc.
3. Following that, teachers should identify topics that fit in with their curriculum and for which there are appropriate materials on-line.

Selecting a WebQuest Project

WebQuest projects have to be well chosen [3]. There are four filters that the idea must pass through. The WebQuest should:

1. Curriculum Standards

One temptation is to do things just because they are cool. We've all seen labs filled with kids creating animations or comic strips or games. Once you get past the novelty, you might ask yourself what children learn from such things. Sometimes the glitz has an instructional goal that is well thought out, other times not.

The movement towards definable standards in all content areas is apparent everywhere and is unstoppable. Nowhere are they perfect. Even where the standards are disorganized or unclear, though, it is wise to spend your time creating lessons that can be tied to definable goals that others recognize as important.

We'll assume that you have access to the standards that apply to your location, grade level and content, and that you'll consult them as you juggle possible ideas.

2. Creative Discontent

Creating a first WebQuest is going to take a fair amount of time. (the second will go more quickly and will be of higher quality…) Since that's so, the chosen project must be something taught before and never been fully satisfied with. The WebQuest designed should replace something and improve upon it rather than being yet another add-on in an already crowded year. When the going gets rough, you'll draw energy from the fact that your newborn WebQuest will make a part of your teaching more effective and enjoyable.

3. Using the Web Well

The Web adds a unique dimension to teaching. It brings in primary sources that would not ordinarily be available to schools. It brings in timely information that is fresher than tomorrow's newspaper. It allows for colorful pictures, sound and animation. The basic structure of a WebQuest could be done with a pile of books and magazines. You should choose a project that could not be done solely with print materials. Using print alongside the web is a great idea... but let's pick something that couldn't be done as well without web access.

4. Understanding

Not everything teached requires deep understanding. Some things are best taught with direct instruction because there's no room for creativity and no need for synthesis, analysis or judgement. Irregular verbs in Spanish, the list of NATO member states,... these are not good material for WebQuests. Choose content and standards that invite creativity, that have multiple layers, can have multiple interpretations or be seen from multiple perspectives. In short, pick material that requires students to transform what they seen into something different.

There are great lesson ideas that will not pass through all of these filters. They might make for terrific classroom activities, but they won't make terrific WebQuests. The task now is to juggle possible ideas until they meet all four criteria.

The Process

How deal with these four filters? Think about the teaching, the curriculum standards, and the kinds of things found on the web so far. Then go through the process as outlined here. You may need to use your newly honed web searching skills to see what's out there on your topic. When you can't answer YES, either modify your idea or pick another one. When you can answer YES to all four questions, you're ready to go on to the next stage.

Adapted from : Selecting a WebQuest Project [3]

Tools

QuestGarden

QuestGarden [4] is an online authoring tool, community and hosting service designed to make it easier and quicker to create high quality WebQuests. No knowledge of web editing or uploading is required. Prompts, guides and examples are provided for each step of the process. Images, worksheets and other documents can easily be attached or embedded in the WebQuest, and users have complete control over the appearance of the final lesson.

QuestGarden is modeled after a community garden with all the resources needed to bring great WebQuests to life. Users are encouraged to comment on each other's work, to share links and images, and to build new WebQuests on existing ones. Rather than starting from scratch, users can bring a WebQuest written by another member of the community into their workspace, modify the content or appearance to suit their needs, and use it with their own students. Attribution to the first author is maintained, and authors are notified when another member of the community makes an improved or modified version of their work.

The main features are:

- Step by step guidance through the entire process of creating a WebQuest
- WYSIWYG [5] editing of each section of the WebQuest
- Ability to insert images and upload supplementary documents to be linked to the WebQuest
- Publication of the WebQuest in a layout over which the creator has complete control of colors and fonts.
- Attaching a WebQuest to a group which allows for easy feedback and commenting among group members. This is designed especially for use by WebQuest workshop leaders and teacher educators.

QuestGarden is more than just a tool, it's a community of educators with many goals in common. Members are encouraged to become critical friends of each other's work, to generate ideas for improvement that benefit all of us.

San Diego City Tool

The Technology Challenge Grants Website from the San Diego City schools suggest step-by-step online tools to create WebQuest forms. Each block of a WebQuest is detailed here with some examples for each block [6].

Then people can see two differents templates with lot of details of what to do for each block, when and how :

Student page [7]:

- Several blocks: Title, Introduction, Task, Process, Evaluation, Conclusion.

Teacher page [8]:

- Several blocks: Title, Introduction, Learners, Curriculum Standards, Process, Variations, Resources Needed, Evaluation, Conclusion.

Examples of WebQuests

Investigating Archaeotype

The goal of this short term WebQuest was to give student a sense of how Archaeotype [9], a simulated archaeological dig, was conceived and implemented at two very different school sites. The exercise took about 2 hours and involved students working in groups to answer a series of questions. They were given a set of resources to read and interact with which included project reports and theoretical papers on the Web, copies of a portion of the Archaeotype documentation, and directions to go to another room and interact with a teacher via video conference, or with a staff member via speakerphone. The students broke up into groups to experience each of these sources of data and then spent time telling each other what they'd learned. The end result was that each person in the class could explain what Archaeotype was and what problems and successes came with its implementation.

A look at other school Pages

Short term WebQuest in which the student teachers examined a number of web pages put up by schools [10]. The point of the exercise was to expose them to a variety of ways in which a school could portray itself on the web in preparation for their creating web pages. By the end of the exercise they were able to articulate general principles of good and not-so-good design for school web sites.

A Webquest about Webquests

Short term WebQuest about WebQuests [11]. The student teachers have to develop an understanding of the differents possibilities of web-based lessons. To do it, they analyze a number of webquest examples and discuss them from multiple perspectives. By the end of the exercise they are able to recognise the good and the bad features of a WebQuest.

Other WebQuests

The most recently published WebQuests [12]

The best WebQuests [13]

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Wiki-supported project-oriented learning

Draft

Definition

We define **wiki-supported project-oriented learning** as some kind of relativly open enden project-based learning design that uses the wiki as sole (or central) tool. Of course, such a design also can be adapted to other project-oriented learning designs, e.g. inquiry learning

Pedagogical goals:

- Create applicable and/or "deep" knowledge in some domain
- Learn how to conduct a research project.

Example architecture (1)

Below are some suggestions for a *minimalist design* that need to be adapted to your needs.

Context

- This model has been tested in 2006 with a semester-long undergraduate class in history of deviant social behavior. Both teacher and students didn't have much exposure to Internet technology.

Preparation and wiki training

- DSchneider helped designing the course (2h of work) and then sometimes met with the teacher and the class. All in all it rather was a "low cost" operation and no systematic observation was performed. Evaluation by students was "ok", but some complained about the workload.
- Students received less then half an hour of wiki training in the beginning and a short help text including short editorial guidelines were prepared. Most students ignored some important features of the wiki, e.g. some didn't really undestand how links work, why one should use titles, how to organize a discussion page, how to fill in a home page, etc. A few forget to save articles from time to time and lost stuff, because they didn't know how to copy/paste after an editing timeout and this created some frustrations. The overall result (wiki pages) however was acceptable, but DSchneider believes that more structure and more training may improve results, but it interested to observed that a minimal approach also works.

Stages

The model has four stages.

(1) Preparation

- Teacher defines global course topic
- Defines (ajustable) milestones and student evaluation procedure
- Student teams (5 to 7 members) are formed according to their interests (each student had to write a short text in the wiki)

(2) Planning

- Team members search resources, start some reading
- Students write the initial specification of the project, for example goals and questions.
- Students add some planning elements: Rough definition of tasks (work packages) and important milestones.
- Teacher gives feedback and students revise the project plan (at least 2 times)

Each team works with the following pages

- A single *project / research plan page*.
- A page for the paper (i.e. the *research*
- Other pages for shared activities (see below)

(3a) Implementation of the research project

- Students were set to work on their project. More or less informal deadlines have been set for important common milestones (like reviews of the literature, initial fieldwork, methods, fieldwork, etc.)
- After some initial fieldwork (interviews/reading documents) students were asked to present their research methods (this is somewhat particular to history). Also, sometimes students made adjustements to the plan themselves.
- Teachers insures that some cooperation (either off-line or on-line happens). Some presential classes have been cancelled and replaced by meeting time for students.
- Once per week teacher gave feedback in the wiki (mostly in discussion pages).
- Repeat the previsous steps until all milestones are met and/or the course end approaches

(3b) Other activities

Students also were asked to:

- Work on a common bibliography
- A dictionary of terms

(4) Finalization

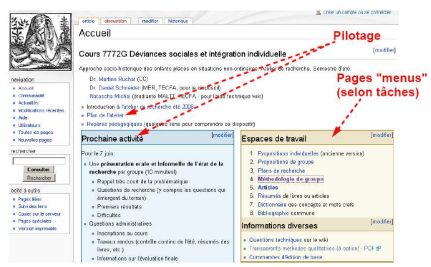
- It was required that final project (a long wiki page) somewhat met academic standards
- Each group had to present result to class and then make some adjustments
- Grades and the whole experience are discussed in a final meeting.

Organization of the Wiki

On the frontpage, there should be:

- Planning (1): The current tasks on which students should work (with deadlines)
- Planning (2): A pointer to the overall program (syllabus) of the course.
- A menu leading to index pages for various tasks (project planning pages index, project pages index, dictionary index, common bibliography, etc.). These also have to be made by the teacher.
- Extra-information like Wiki Help

Below is a screenshot (in french)



Mediawiki-supported project-oriented learning in history

Other examples

this is still missing, e.g. out experiences with biology teaching at high-school level, or writing-to-learn designs at master level...

Software

Any sort of wiki can do, although we suggest to use a wiki that allows tagging and linking. Some "Wikis" that are embedded in pedagogical platforms are not really wikis (but just simple CMS tools that allow both students and teachers to edit pages through the web.

See the wiki article for technical details.

Writing-to-learn

Draft

Definition

- **Writing-to-learn** refers to a family of instructional design models that postulate positive effects of pedagogical scenarios that engage learners in writing activities.
- **Writing-to-learn** is also known as the **writing across the curriculum movement (WAC)** movement, in particular in science teaching. According to Keys, WAC was inspired by Britton's (1970) work.

As of 2010, writing-to-learn is still an active field of research and this article needs some upgrading, e.g. see the Discussion page for some comments by Alan Jones. - Daniel K. Schneider 19:33, 7 October 2010 (CEST)

Overview

Research reveals that one learns both from and with interactive technology. Writing-to-learn focuses on the use of ICT as social expressive digital media. In this cognitive tools approach, interactive expressive tools are given directly to learners to use for expressing what they experience and know to themselves and also to others.

(1) "Writing-to-learn" has a long research tradition that initially focused mostly on the effects of individual writing and related cognitive issues. Klein's (1999) detailed research review identifies four major research lines and associated main hypothesis:

1. The "point of utterance" hypothesis: writers spontaneously generate knowledge when they write (Galbraith, 1999).
2. The "forward hypothesis": writers externalize ideas in text, and then reread them to generate new inferences.
3. The "genre hypothesis": writers use genre structures to organize relationships among elements of text, and thereby among elements of knowledge (Newell, 1984).
4. The "backward hypothesis": writers set rhetorical goals, and then solve content problems to achieve these goals (Flower & Hayes, 1994).

These four hypotheses invoke different aspects of writing and are in principle compatible with regard to the learner's competence matrix. According to Klein (1999:252) there are plenty of supportive studies, but only the genre hypothesis has been systematically tested against measures of writers' learning, and shown to have generally positive effects. See also the debate on genres

(2) More recent research mainly conducted in the CSCL (computer-supported collaborative work) community focused on collaborative learning mechanisms, its impact on individual learning and development of tools that enhance collaborative and social learning. Learners can be co- located, e.g. in computer-integrated classrooms

(Tewissen, 2001).

Writing activities are essential to many different CSCL paradigms. While mainstream "writing-to-learn" research focuses on the production of larger texts or at self self-contained entries, writing in the CSCL perspective concerns rather producing short texts in various genres (questions, arguments, definitions, etc.). Learner productions plus interactions are meant to provoke various meta-cognitive mechanisms beneficial to learning e.g. conceptual change and deeper understanding. "Restructuring learning environments" (Flower & Hayes, 1994; Erkins et al. 2003) are based on the main hypothesis is that knowledge transformation leads to knowledge constitution (Galbraith, 1999).

Restructuring and knowledge building can be enhanced through computer-supported "knowledge building communities". Writing then contributes to a larger collective body of knowledge whose elements can be edited, manipulated and put in relation. A good example are so-called computer-supported intentional learning environments (CSILE) (Scardamalia & Bereiter, 1994), that aim at reframing classroom discourse to support knowledge building in ways extensible to out-of-school knowledge- advancing enterprises and make school education more situated (Lave & Wenger, 1991). In one scenario, records made at the place of work (knowledge in action) "ground" reflective activities in the classroom.

Many compatible instructional models, like inquiry-based learning, problem-based learning or project-based learning can integrate research results from successful experimental of clinical studies.

(3) Co-construction enhanced by collective knowledge management is also related to organizational learning. Community memories are to communities of practice (Wenger, 1998) what human memories are to individuals. They make use of explicit, external, symbolic representations that allow for shared understanding within a community. They make organizational learning possible within the group (Stahl, 2000). Conversely, such communities need a social infrastructure around the technical infrastructure (Hakkarainen 2003; Bielaczyc, 2001). Interest in knowledge-building communities is both shared by education and the business literature (Snyder, 2003; Bereiter, 2002; Paavola, 2002). In other words, individual learning in school and workplace, life-long learning, and organizational learning are related issues in this perspective (Scardamalia, 2001).

The genres debate

Writing-to-learn refers to different instructional design models. Bereiter and Scardamalia (1987) introduced the difference between writing as "knowledge telling" and writing as "knowledge transformation". For Bereiter and Scardamalia, the rhetorical goal of a text incites exploration that leads to discovery of new knowledge/ideas. They distinguish between two processes are used used, depending on the capacities and knowledge of the author:

- **Knowledge-telling:** ideas that respond to the rhetorical goal are retrieved from long-term memory and transferred directly into written text. This process of writing is used by those knowledgeable in the topic being considered.
- **Knowledge-transforming:** ideas retrieved from memory are transformed by the effort to resolve a conflict between the ideas and the rhetorical goal resulting in the generation of new ideas, content and a deeper understanding of the subject. This is the process of writers that lack expertise in the topic of the text being produced.

Scrutinizing and reworking Bereiter & Scardamalia's model, Galbraith introduces writing as a **knowledge-constituting** process (Galbraith, 1998), where content is derived from a "dispositional dialectic" (Galbraith 1996 in Galbraith, 1998): the translation process that takes place during a cycle of “spontaneous articulation of thought… during text production” that responds to the stimulus of the emerging text – Galbraith (1998). The subject and the task at hand invoke a network of ideas referred to as "units". If an idea is satisfactory, other ideas are suppressed. If an idea does not meet the needs of the task at hand, other ideas are examined. During the repetition of this cycle there is an emergence of new or contradictory ideas that lead the writere to a broader and deeper understanding of the subject. Galbraith points out that rhetorical planning is only a “reorganization of existing ideas”… “retrieved from episodic memory” (p.140). The resolution of rhetorical problems leads to neither a deeper understanding, nor the development of new ideas.

The process and the number of times the cycle will be repeated is dependent on the author's knowledge of the subject, as this will determine the quantity of ideas generated, the complexity of the semantic network invoked and the author's capacity to express the ideas linguistically.

The product will also be affected by the "translation" strategies used by the author, i.e. the form in which ideas will be represented. The type of planning used for the writing process, (outline vs. free flow), the format of the output (notes, prose, graphic) and the rhetorical goal will all play a determining role in which ideas will be selected and developed (Galbraith, p.147-148).

Catel (2001) distinguishes several dimensions of research according to genre:

1. **Expository** writing refers to process that engages a learner in reusing existing knowledge, e.g. to test his knowledge in an examination.
2. **Scientific** writing: learners are engaged into different kinds of academic writing, like lab notes, field notes, presentation (including report and explanation) in poster or paper form.
3. **Interpretative** (expressive) writing in different genres focusses on exploration of personal thinking, like conceptual cards, stories, slogans
4. **Social** (collaborative, cooperative and collective) writing social pratice, usually computer-mediated and often referring to practices of the scientific community.

Many authors seem to agree that diversification of genres is important. E.g. Prain & Hand (1998: 158) argue that " ...results indicate that diversification of writing types enhances opportunities for students to develop higher order thinking skills, including metacogntive understandings.".

For some authors it is important that learners write in their own language (Prain & Hand). Others authors claim that all writings should refer to scientific practice (e.g. Keys). These two views may conflict, but may also be sequenced in a learning experience.

Learning styles and writing

It seems likely that personality differences and cognitive styles will influence individuals' writing process and when and how learning takes place while writing. Learning, personality and cognitive style theories have been applied to the teaching of composition and writing with mixed results but which still give some insight into the processes and strategies applied by learners during writing and how the application writing-to-learn in instruction may effect different learners. These individual differences should be taken into consideration when designing instruction and ICTs to support writing-to-learn activities.

Davidson-Shivers (2002) attempted to test the effects of lesson structure on the pre-writing and writing performance of students categorized using Kolb's Learning Style Inventory. No relationship between learning style and lesson structure was evident in the writing performance.

Using Reid's Perceptual Learning Style Preference questionnaire designed for ESL students, Jones(1996) also found that although his students scored variably on the questionnaire [1] they still openly expressed a preference for traditional teacher-centered instructional styles, opting for strong guidance through explicit models to emulate and standards to acheive. Jones attributes this to socio-cultural norms rather than familiarity with and reliance on these norms.

MBTI and writing

Jensen and DiTiberio (1984) have used the Learning style MBTI to tailor instruction in remedial pre-writing and writing strategies and processes for graduate students and have succeeded (qualitatively) in reducing students perceived anxiety over writing tasks and writing blocks.

Extravert - Introvert

Extraverts tend to generate ideas in freeflow text and discussions, writing with little initial planning. Jensen and DiTiberio suggests extraverts can be helped by being allowed to compose freely and then *guided* into selecting the most relevant ideas and developing and organizing them further. *Introverts* on the other hand tend to follow the more traditionally taught phases of outlining/planning, writing, and revising. They like to have ideas clarified before they write. They are often blocked when ideas don't fit into the outline they have conceived. They need to be encouraged to be open to ideas emerging during the writing process as these are key to learning.

The writing process tendencies predicted by the personality type dimension of extravert and introvert are markedly analoguous to Snyder's scale of personality types that categorizes people into *low* or *high* self-monitors respectively. -- KBenetos 16:40, 8 January 2007 (MET)

Sensing - Intuition

The *sensing* types focus on the concrete experience or example and collect lots of data, often neglecting the overall meaning. They benefit from explicit instruction and detailed examples of how to generate ideas and structure and organize them. They often require guidance in formulating thesis statements and summaries and need to be encouraged to look at the relation of their data to these. The *intuitive* types will focus on general concepts or patterns, neglecting the details. They prefer to set their own goals and structures. They tend to generate ideas in a freeflow manner, leaving details, facts and supports for ideas to later revisions. They need to be encouraged to clarify their ideas and support them with facts and examples.

Thinking - Feeling

Thinking types use explicit objective performance standards to guide their writing. They categorize and structure their ideas easily and clearly, relying heavily on their predefined outlines to make content decisions. They do not take the effect of their writing on the audience into consideration. They need help to revise their structures and relate their information to personal experience or that of the audience. *Feeling* types need to feel personally engaged by the topic of their writing. They place great emphasis on the impact of their writing and communicating precise sentiments to their audience, often sacrificing structure, organization and clarification of ideas. Outlines are not particularly adhered to, and the structure tends to develop from the anticipation of the readers' reactions. They need help to balance ideas with examples and consider potential opposing perspectives.

Judging - Perceiving

Judging types limit their topics quickly, dealing with the process goals that need to be fullfilled to bring the task to completion. This often leads to hasty decisions and a strict adherence to an outline and schedule that are not acheivable without revision or reordering of certain process goals. They benefit from 'blank' phases where they can give in to sponataneous needs. *Perceiving* types select broad topics and have difficulty narrowing the scope of their research and writing. They tend to look at exhausitve quantities of data before writing, and have difficulty selecting from the multitude of possible structural and epistemological approaches. While their writing is often thorough, though lacking in focus.

Jensen & DiTiberio observed that writers did best when their early drafts drew on their MBTI strengths and their later drafts filled in what was missing by using their MBTI weaknesses (p.298), suggesting that learning styles can be effectively used to enhance writing performance.

Self-monitoring and writing

In the mid-seventies, Mark Snyder developed a the 25-item *self-monitoring* scale

to measure "how concerned people are with the impressions they make on others, as well as their ability to control the impressions that they convey to others in social situations". Based on the results, individuals are described as either ***high*** *self-monitors* or ***low*** *self-monitors*.

'High **self-monitors** tend to regulate their behaviour based on stimuli from their environment aiming to control the effect they have on others in a given situation.

'Low **self-monitors**' behaviour is regulated by their inner state, expressing themselves according to their thoughts and feelings rather modifying their behaviour and projected self to suit the social circumstances

Galbraith in 1996 (Galbraith, 1999) looked at the writing processes of the two personality types and found that *high self-monitors* tended to generate most of their ideas during note-taking prior to writing, while *low self-monitors* generated most of their ideas while writing. They reported that greater gains in knowledge correlated with a greater number of shifts in ideas. *High self-monitors* simply translated ideas retrieved from episodic memory produced during note-taking (Galbraith, 1999, p. 151). indicating they tend to inhibit new ideas that may conflict with their defined rhetorical goal.

Examples

- This Wiki will be used in some of courses for student writing activities, e.g. they have to improve articles, add new ones, add cases studies, and so forth [more details will follow]
- Keys (1999) discuss a "science writing heuristic" tool for learning from laboratory activities in secondary science and which can be used by teachers as a framework from which to design classroom activities. "There is evidence that use of the science writing heuristic facilitated students to generate meaning from data, make connections among procedures, data, evidence, and claims, and engage in metacognition. Students' vague understandings of the nature of science at the beginning of the study were modified to more complex, rich, and specific understandings." (Keys 1999:1065).

In french

- Encyclopedia written by children [2] - Wikimini is a free encyclopedia written for and by children aged from 8 to 13 years. More languages to come...
- http://fr.vikidia.org/encyclopédie destinée aux 8-13 ans dérivée de Wikipédia, ayant pour objectif de favoriser la participation des enfants à la rédaction. voir aussi la page des projets pédagogiques [3]
- http://fr.wikipedia.org/wiki/Wikip%C3%A9dia:Projets_p%C3%A9dagogiques page des participations à Wikipédia dans le cadre universitaire.

Technology

- Different sorts of cognitive tools
- Wikis
- C3MS Portals
- Knowledge Forum
- Concept maps
- Writing tools
- Fle3

Links

- The WAC Journal [4] (Academic open-access journal)
- By Request December 2004: Writing To Learn, Learning To Write: Revisiting Writing Across the Curriculum in Northwest Secondary Schools [5]. By Request is a booklet series produced at the Northwest Regional Educational Laboratory, Portland, two times per year.

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