POWERFUL LEARNING IS INTERACTIVE: A CROSS-CULTURAL PERSPECTIVE

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Abstract

For centuries traditional university education has primarily focused on building foundational skills in particular disciplines via the transfer of knowledge from instructor to student. Today however, simply being able to reproduce knowledge is no longer adequate; students must also be able to apply their knowledge to changing, real world contexts. By sharing lessons learned and drawing parallels across cultural boundaries, the University of Antwerp, Belgium and the University of Arkansas, USA provide additional insight into how to effectively teach students these skills. Topics that are addressed include: the concepts of powerful learning, interactivity, adequate dialogue, and the post-development evaluation and effective use of e learning environments.

The AILO Powerful Learning Model At The University of Antwerp

In recent years a number of European institutions have been working to reform teacher education programs (Blanquart, 1999). These efforts include the adoption of a concept known as powerful learning and the implementation of various new and innovative web-based technologies (or ICT) to improve learning. A Flanders government educational policy evaluation report (Schooldirect, 2001), stated that graduates of teacher education programs in Flanders are often not prepared well enough. The report cited two important issues: a disconnect between existing program curriculum and professional practice and a failure to model technology integration. In an effort to bridge this gap the University of Antwerp, Department of Education launched three pilot studies in two different teacher education programs that proposed that traditionally taught courses could be transformed into powerful learning environments by adding web-based/ICT-supported components as shown in Figure 2. The initial pilot was launched in 2001, and a second iteration (of the three pilot studies) that also included CD-ROM supplements was launched In October of 2002. These ICT components included three modules in Didaktiks (the science of teaching) and one module in teaching methods. Two different teacher education programs known as Academic Initial Teacher Education (AILO) with different target audiences were modified: a program designed for professional teachers for Dutch to non-native speakers and program designed for general teacher education in which the students working towards degrees in education or other disciplines.

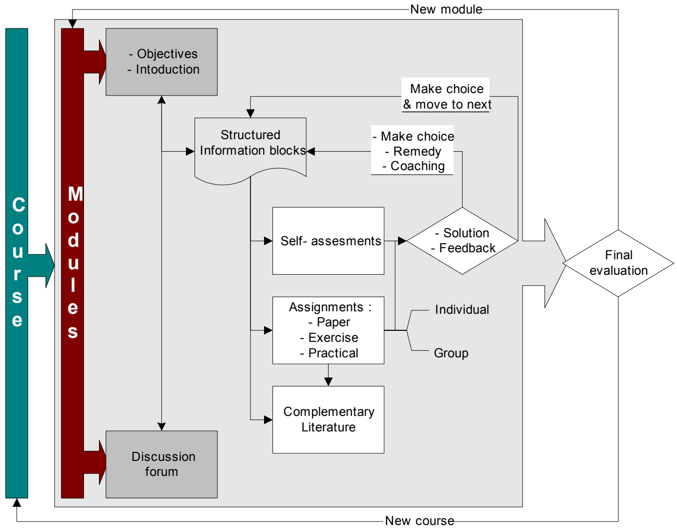

Figure 1. The AILO Powerful Learning Environment

Instructional Design: Theoretical Underpinnings

Powerful learning environments are based upon the theory of constructivism. In essence constructivists assert that students are not merely passive recipients of a knowledge transfer, but are actively engaged in constructing their own meanings. I.e., powerful learning environments enable students to acquire new knowledge and then put it into pragmatic practice De Corte (1996). Figure 2 shows a generic model of these ideas.

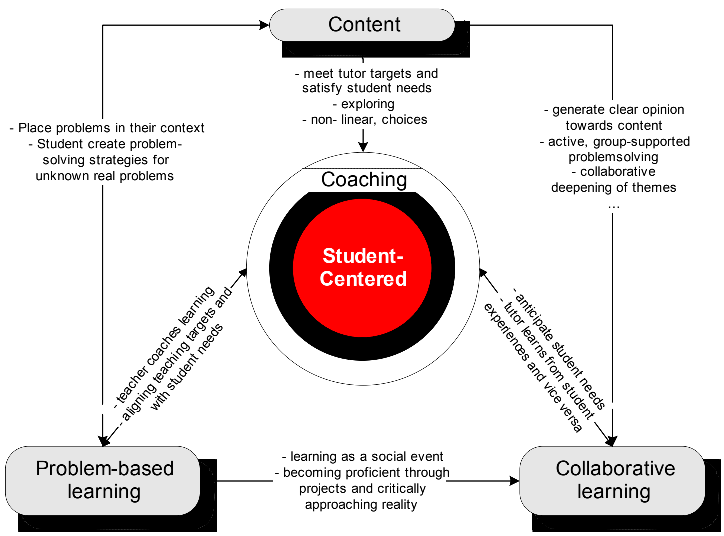

Figure 2. Diagram learning processes In Powerful Learning Environments

Following this model the AILO web-based/ICT-supported components included a presentation of content that delivered basic knowledge, collaboration and coaching opportunities that promoted deeper comprehension and problem-based tasks that made the knowledge applicable. All of the components of the AILO e environment were designed to work together as the student negotiated with their respective teacher to meet basic course objectives and personalized learning goals. This freed up time during face-to-face instruction in the traditional classroom for skill building and putting acquired theory into practice using a wide variety of teaching methods.

AILO Web-based/ICT Course Components

The supporting content for each course was organized in a modular format and sub-divided into chapters with specific instructional objectives. Each chapter presented students with the opportunity to study via self-assessments and complementary literature and web links. Self-assessments enabled students to evaluate whether or not they had mastered basic materials and concepts before moving on. The structure of the content encouraged students to take responsibility for their own learning by supplying them with: a means by which to monitor their own progress and opportunities to develop and deepen their own areas of interest by accessing additional literature. The collaboration component was promoted by requiring students to post links in the AILO website and participate in AILO discussion forums. Project oriented group work further encouraged students to share personal experience and expertise while they worked together to increase their teaching skills (Schweizer, 1999). The problem-based learning component presented students with a series of questions that forced them to re-evaluate their mastery of basic/formal knowledge, as well as exercise skills in authentic classroom practise. A special/innovative feature within this component is the use of case study video footage as a teaching tool. Various studies have shown that video has been successfully used to show dramatic examples to specific contexts and teach procedural knowledge, as well as to provide audio-based instruction (Moore 1996). Actually being able to observe teachers and students in natural classroom settings provided both inexperienced and experienced teachers opportunities to build basic skills and/or expand master practise.

A database-driven website using ASP – technology (Active Server Pages) was created with Macromedia Dreamweaver so that the content be could be easily updated by faculty. Both instructional and case study video segments were provided in Windows Media and RealPlayer format in the first iteration and on CD-ROM in during the subsequent iteration. In addition, the discussion forum included a database-based system that allowed student participation to be tracked.

Post Development Evaluation: AILO Student Perceptions of Powerful Learning with Web-based/ICT Support 2001 & 2003 Iterations

All of the student who participated in each of the AILO pilot studies were asked to: rate their overall learning experience and suggest improvements. Tables 1 and 2 are a summary of these results.

Use of web-based/ICT support to:	Rating		Areas to address / Actions taken
	2001	2002	
Engage students in problem-based learning	+ +	+ +	Bandwidth limited access to the video segments. This was a technical issue and not a flaw in instructional design. The problem was largely solved in 2002, by making the videos available on a CD-ROM).
Engage students in collaborative learning	-	+ +	In 2002, more efficiently structured content, additional resources and additional independent learning activities were added. These additions freed up additional time for more intensive classroom–based discussions, and reflection and problem-based learning activities. *Discussion forum use increased dramatically during the second iteration (see Table 2).
Provide Coaching	- -	-	During the evaluation of the first iteration: students requested stronger facilitation of discussion forums; including instruction for “first time” users. During the evaluation of both iterations students requested more detailed and personalized feedback during online self-assessments and paper-based summative evaluations. *Student ratings of this feature improved during the second iteration.
Model technology integration in traditional classroom settings	++	++	Both iterations rated highly, even though some students with below average computer skills indicated a lack of motivation towards independent learning activities.

Use of web-based/ICT support to:	Rating		Areas to address / Actions taken
	2001	2002	
Ease of access to additional literature and resources; web-based versus traditional research in library	++	++	Both iterations rated highly: In the second iteration students were explicitly encouraged to pursue their own interests and set personal study objectives accordingly. Easy access to electronic materials was rated highly.

Table 1. Student Perceptions of Web-based/ICT Support

Summary	**Year**	
	2001	**2002**
Total # of Threads		
Teachers	11	17
Students	14	103
Average # of Messages per Thread	6,24	6,04
Average # of Messages Per		
Teacher	7,5	20
Student	2,9	5
Total # of participants	47	133
Total # of messages	156	725

Table 2: Analysis summary discussion forum usage

During the first iteration pilot, students were asked to participate at least twice in any of the forums but their contributions were not included as part of the student's final grade. As a result, students rarely used the forum and primarily asked questions regarding course content or assignments. During the second iteration pilot, instruction on how to use the forum was expanded and student participation was calculated as a percentage of each student's final grade. The expanded instruction included a short list of written rules that encouraged students to make substantive contributions to the discussions. As a result the content and structure of the threads became more defined and the quality of the contributions increased dramatically. Participation rose from 45% to nearly 100% during the second iteration.

The Interactive Web-based Instruction/Adequate Dialogue Model At the University of Arkansas

In 1998, the Department of Poultry Science at the University of Arkansas, Fayetteville (UAF) was awarded a United States Department of Agriculture (USDA) Higher Education Grant to address a growing instructional void in introductory poultry science. The objective of this project was to address this instructional need by developing two web-based poultry production courses that would cover the management of broilers, turkeys, breeders and layers. The Internet was chosen as the platform for course delivery because it is asynchronous and may be accessed from any connected site around the world. A team of three which included a content expert, an instructional designer and a graphic designer built the courseware using Macromedia Dreamweaver, Flash, Adobe Photoshop and other software. The content expert dedicated approximately 10% of his full-time 12 month appointment, the instructional designer 50% and the graphic designer 50% over a two-year period.

Instructional Design: Theoretical Underpinnings

Literature across a number of disciplines indicated that to be effective the proposed courseware needed to be interactive, but a concise definition of the term was not offered. Therefore, a definition of interactivity was established as a framework to guide the design and development of this courseware. The UAF definition of interactivity was formed according two criteria: established distance education theory and current media analysis. In 1990, Moore posed a theory regarding the nature of distance in all educational settings. In 1993, Laurillard offered an analysis of the roles of students and teachers in the learning process, and the strengths and weaknesses of various technological mediums as support mechanisms for those roles. According to Moore (1990, 1996) three different types of interactions are essential to distance education: learner-instructor interactions, learner-content interactions, and learner-learner interactions. Laurillard’s (1993) ideas add depth to Moore's theory by describing in more detail what Moore's learner-instructor and learner-learner interactions might actually look like. A term for this deeper concept of interactivity called adequate dialogue was chosen. Adequate dialogue may be established by using instructional techniques or technologies that fit within Moore's theory of transactional distance, while fulfilling at least eight of Laurillard's 12 conversational framework guidelines. A synthesis of these ideas is shown below in Table 3.

For reference Larillard’s Steps are as follows: 1) The teacher (T) can describe conception: 2) The student (S) can describe conception; 3) The T can re-describe in light of the S's conception or action; 4) The S can re-describe in light of the T's conception or action; 5) T can adapt task goal in light of S's description or action; 6) T can set task goal; 7) S can act to achieve task goal; 8) T can set up world to give intrinsic feedback on action; 9) S can modify action in light of intrinsic feedback on T's action; 10) S can adapt actions in light of T's description or student re-description; 11) S can reflect on interaction to modify description, and; 12) T can reflect on S’s action to modify re-description.

Highly Interactive 12 Steps	Tutoring system Tutorial simulation
10 Steps	U of A Poultry Courseware*
9 Steps	Tutorial program (1-7, 10, 12) Audio-vision (1-7, 10, 11)
8 Steps	Adequate Dialogue
7 Steps	Computer supported Collaborative work (2, 6, 7-9, 11) Multi-media resources (1, 2, 4, 7-9, 11) Micro-world (2, 6-11) Modeling (2-11) Self assessment questions (2, 4, 6, 7, 10, 11)
6 Steps	Concept Mapping (2, 4, 7, and 9-11)
4 Steps	Audio conferencing (1-3, 5) Video (1, 6, 8, 11) Poultry Science Rich Print (1, 3, 6 and 8)
3 Steps	Television (1, 6, 8) Simulation (6-9) Hyper-text (1-3) Computer conferencing (1-3) Threaded email (1-3)
1 Step Relatively Static	Print (Step 1 only)

Table 3. Rating Levels of Interactivity of Media

Post Development Evaluation

A qualitative case study research design was used to: evaluate levels of interactivity against the criteria set for establishing adequate dialogue, examine user patterns and explore student perceptions and attitudes. This design was selected as it allowed the researchers to conduct a naturalistic inquiry to probe a real-life context within a unique case orientation (Patton, 1990). This study posed two specific research questions but allowed themes to emerge from nominal group interview data that was open-ended.

The study was conducted on one module within the first course, poultry physiology; twenty-one students volunteered to contribute. All of these students completed pre- and post-content knowledge concept mapping exercises and six students were chosen to participate in the nominal group interview process based upon their pre-content knowledge concept mapping exercise performance.

A quantitative scoring scheme designed by Novak and Gowin (1984) was used to evaluate two concept mapping exercises administered before and after the students studied the on-line poultry physiology materials (Edmondson, 1999, p. 25). However, please note that the concept map scoring data was analyzed from a qualitative rather than a quantitative viewpoint as attempts to establish the reliability and validity of concept maps has been shown to be problematic in previous studies.

The goal of this evaluation was two fold: revealing changes in student mental models of temperature regulation in poultry, and as an alternative method of assessment. In contrast to other types of graphic organizers, Novak's concept mapping emphasizes the importance of specifying the links between key concepts, including cross-links across branches of any given hierarchy and adding examples to anchor concepts to the real world (Trowbridge & Wandersee, 1999). In addition, when reviewing the scoring scheme please also note that the number of possible answers for each category was established using an expert concept map as a guide, however the expert map was not made available to participating students at any time during the study. The highest possible score was figured by multiplying the number of possible answers by the point value.

The two research questions were: 1) Does concept mapping contribute to interactivity between students and print-based course content? 2) Does concept mapping contribute to learning within a web-based distance education format?

This study made use of data triangulation and investigator triangulation. Data triangulation is "the use of a variety of data sources" (Patton, 1990, p. 187). The data sources were the threaded email communications and discussions captured electronically by the Netforum, concept maps, videotaped interviews and interview transcriptions. Investigator triangulation is "the use of multiple perspectives to interpret a single set of data" (Patton, 1990, p. 187). In this study there were two perspectives present.

Result Highlights for the Research Stage UAF Study

The results of the research stage of the UAF grant project suggested that the combination of interactive components chosen for inclusion in the undergraduate courseware provided highly interactive and effective web-based distance education instruction. A triangulation, all of the data strongly suggested that the test module content itself fulfilled Laurillard's conversational framework steps 1, 3, 6 and 8, while the concept mapping exercises acted as the support mechanism for students to fulfill their role in steps 2, 4, 7, and 9-11. Results for question one were best drawn from the nominal group interviews; results for question two were best drawn from the comparisons of concept mapping exercise pre- and post-scores.

Student responses during the nominal group interviews revealed that the inclusion of concept mapping exercises required the students to review the content multiple times. In addition, the students specified that animations, thought questions, and other components helped to clarify and emphasize the content and that the concept mapping exercises forced them to articulate and re-evaluate their knowledge.

The comparison of pre and post-concept mapping exercise scores strongly suggested that student knowledge of introductory poultry production increased significantly because concept mapping exercises were imbedded into the courseware. Changes in concept mapping scores are shown in Table 2.

Category	Possible Answers	Pre	Post
Valid Relationships	55	0	0
(Conceptual) Hierarchy	13	2.81	9.20
Cross-links	14	0	11.20
Examples	30	7.47	10.35

Table 4. Changes in Concept Mapping Score

Drawing Parallels: Powerful Learning Is Interactive & Other Lessons

The two e environments described in this paper are based upon similar ideas even though different taxonomies are used to define them. Both environments place emphasis upon eliciting active student engagement as a means of encouraging students to: construct and restructure their own meanings and knowledge, monitor their own learning processes and apply their new skills to solve real world problems. Powerful learning was described by Buchberger (2000) as an active process regulated by students goals that is social in nature. Both Moore’s theory of transactional distance (1990, 1996) and Laurillard’s (1993) conversational framework support this definition, but when combined they provide the deeper concept of interactivity called adequate dialogue (Shortridge, 2001). By further combining both the UAF and AILO theoretical approach a new more robust, detailed model emerges and new common term for this model could be offered: Powerful Adequate Dialogue Learning.

In addition, comparing the AILO web-based/ICT support to the two UAF poultry science courses not only provided an avenue for equating and expanding the concepts of powerful learning and adequate dialogue, it also enabled each institution to learn from the other. In regards to learning from one another two examples stood out when a comparison of instructional design methods and pedagogical foundations was made between institutions: AILO's use of video and Laurillard's clarification of student and teacher roles in the learning process. The use of video segments within the AILO courses illustrated an innovative and effective format for framing observation-based problem solving tasks within a web-based environment that is worthy of duplication in future iterations of UAF poultry or other courseware. Conversely, the authors of the AILO project could apply Laurillard's 12 Steps by explicitly defining teacher/coach and the student responsibilities within their web-based/ICT environment to improve its coaching mechanism and better facilitate student participation in collaborative learning. (Please refer to Table 1. and note that when asked to rate their overall learning experience University of Antwerp students requested additional feedback, coaching and stronger facilitation of discussion.)

Conclusions, Implications and Future Directions

Each of the e environments presented in this paper and their post development evaluations represent single case studies and as such cannot be broadly generalized, however each case illustrates sound guidelines for the effective design of e learning environments that may be replicated with confidence by others. Additional proof of the quality of the courseware presented in this paper may be gleaned by reviewing a seminal study that was conducted by Mioduser, Nachmias, Lahav and Oren (2000). In this study, the authors evaluated teaching practices within 486 educational web sites and concluded that use of the web to teach has caused teachers and institutions to choose ineffective, out-dated pedagogy. Of the web courseware sampled by their study only 5.0% provided students with opportunities for problem solving, only 4.6% provided opportunities for creation and invention, whereas 52.5% left students with few options other than rotate memorization (p. 63). Both the UAF courseware and the AILO web-based/CD-ROM ICT support materials rate highly when evaluated within this matrix. New generations AILO and UFA courseware are currently being constructed and continued evaluations of these iterations will eventually provide an opportunity for the authors of this paper to conduct a meta-analysis of multiple case results that may provide additional findings and insight. In addition, the comparisons drawn between pedagogical models and processes, and types of programs and courses provides both institutions, as well as interested readers with a beginning basis for continuing to work on forming a common taxonomy of terms.

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