

Designing computer based learning environments: a review of models and guidelines

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The key to effective learning with computers is good educational design. (Cummings et al, 1999). This paper reviews literature relating to models and guidelines for designing computer based learning environments and resources for effective learning. Taken as a whole such models and guidelines emphasise the need to design computer based learning environments which:

- Accommodate a whole person perspective
- Encourage rich and active learning
- Promote emotionally sound learning
- Meet the needs of learners from different groups

As these above categories provide a useful framework for discussing the features of these models my discussion is structured around these categories.

Accommodating a whole person perspective

Martinez (2000) contends that web learning environments should be designed from a "whole-person perspective" which takes into account individual learning differences. This enables online learning environments to be personalised to meet the needs of different learners. She says the web makes this possible as it enables adaptation of content to meet different learner needs.

Much of the current research on individual learning differences tends to focus on cognitive interests and mechanisms for processing information and knowledge building and they often overlook the whole-person learning need which includes the influence of emotions and intentions.

She outlines four learning orientations which includes whole-person needs and is based on learners' inclinations to learn or perform. These are: transforming, performing, conforming and resistant. These learning orientations help to identify learner difference profiles which "guide analysis and design of instruction and environments, and tailor solutions that improve learning ability"

For each learning orientation she outlines how learners in each category approach learning and then goes on to outline some instructional strategies for the first 3 learning orientations. Transforming learners are self motivated and self managing and committed to building new knowledge and meaning. They prefer a

learning environment which is loosely structured and supports discovery and self managed learning.

Performing learners focus on learning selectively to suit their interest. They prefer semi structured and a coach based environment which supports pursuing of personal interests. Conforming learners tend to be low risk takers who conform to group standards. They prefer environments which are safe, structured and help them achieve easy learning goals in a linear fashion without making mistakes. The resistant learner tends to avoid learning for achievement of academic goals assigned by others. No strategies are provided for this learning orientation.

Martinez provides a range of instructional strategies for the three learning orientations and it includes learning issues relating to: general environment, goal setting and standards, learner autonomy and responsibility, knowledge building, problem solving, user interface, presentation, feedback, motivational feedback, learning module size, examples, information needs, content structuring, sequencing methods, peer interaction, quality of assignments, and questioning habits.

She claims that these strategies are a first step in "recognising and accommodating individual learning differences" and should contribute to more successful learning via the web. She further states: "If we are serious about providing good online instruction for learners we must provide multiple ways to provide instruction and environments so that all learners have opportunities for success"

Encouraging rich and active learning

Cummings et al (1999) suggest that computer based learning environments should be designed to include rich activity sets which include worked examples, demonstrations, simulations, games, challenges, exercises and exposition. They argue that the key to effective learning with computers is educational design. "Educational design that gives rich activity sets to go with a learning environment is the key to effective learning with computers". They suggest that educational design needs to draw up a view of learning, knowledge of educational computing, and research on learning and teaching expertise. Good educational design, they say, will yield a rich set of activities and many types of interactions which can lead to enhanced learning and meet the needs of a variety of teachers and learners

Dunlap (2000) outlines some guidelines for creating rich environments for active learning (REALS) in web based learning environments. She also provides examples of how these could be applied in web environments

REALS are based on the constructivist view of learning. It is student centred and based on the social process of negotiation, conversation, testing and challenging.

Her guidelines are as follows:

- Promote intentional learning by encouraging the growth of student responsibility, initiative, decision making and intentional learning
- Apply dynamic, generative learning activities that promote high level thinking processes (ie analysis, synthesis, problem solving, experimentation, creativity and examination of topics from multiple perspectives) to help students generate new and old knowledge and thereby create rich and complex knowledge structures
- Utilize authentic learning contexts to promote study and investigation
- Encourage collaboration to cultivate an atmosphere supportive of knowledge building communities
- Reinforce reflection by embedding opportunities to reflect on the learning process as well as on the content acquired to promote both learning and metacognitive skill development

Winfield (1999) outlines six design guidelines that were used to create weekly learning activities in a web based course in Health Assessment to enhance student motivation and participation.

These guidelines are as follows:

- Build up user confidence with technology
- Build in the instructors presence and personality
- Provide a clear set of learning activities
- Build on personal and professional experience of participants
- Relate content to real situation using case studies and simulation
- Build in collaboration and facilitated team projects

Winfield surveyed the participants in this course to test the effectiveness of these guidelines and reported that most of the survey questions, which related to these design guidelines, received overwhelming positive responses. Whilst surveys

were completed by 60 percent of the students no mention is made of how the survey was carried out and if there were any limitations in this method of evaluation.

Promoting emotionally sound learning

Astleitner, et.al. (2000) focused on an aspect of instructional design that has had little attention, namely strategies for making instructional technology emotionally sound. These strategies are based on findings in the research on emotion, learning and instruction.

They claim that existing instructional design approaches do not adequately address the question relating to how instructional technology should be designed to help learners learn in an emotionally sound manner.

Instruction, which is emotionally sound, occurs when instructional strategies are used in instructional technology to increase positive and decrease negative emotions. The positive emotions relate to sympathy and pleasure. The negative emotions relate to fear, envy and anger. They suggest that the instructional designer needs to understand and use five basic categories of emotional conditions to produce emotionally sound instructional technology.

Meeting the needs of learners from different groups

McRae (2000) has come up with guidelines for the development of online resources for use in computer-based learning environments of Australian schools. He does this from reviewing existing literature relating to this area and points out some conditions that must be met to cater for specific groups within the community. First, the materials “must respect and reflect the actual cultural makeup of our country”(p. 96). This includes students of Aboriginal and Torres Strait Islander heritage throughout Australia and students who speak English as a second language or dialect and who do not have an Anglo-Celtic background. An awareness of cultural backgrounds, experiences, identities, and the formative processes they share is necessary. McRae described this as both a “duty and a functional requirement for effective learning” (p. 96).

He suggested that learning will not occur if the material is culturally inappropriate or the experiences and knowledge the students bring with them to the classroom are not acknowledged and linked to the intention of the learning process. In particular, he argued that materials should also consider both genders and represent them equally. Also students with disabilities should be kept in mind when developing online materials for both educational and legal reasons (McRae, 2000).

Kelly (2000) in her paper on why girls get turned off by computers offers some strategies to bridge this gender gap and make computers more appealing to girls. These include:

- Weeklong summer camps for girls where they can learn without having to compete with boys who tend to monopolise computers and wade girls off them
- Single sex computer sessions in schools. However she warns that critics of this approach say that this will not fix the disparity but encourage discrimination by gender. They feel that the focus should be on designing a motivating and effective learning environment for computer use as it is really good learning design which promotes productive computer use for all students irrespective of gender.

Apart from these broad strategies, she does not go on to provide specific guidelines for designing learning environments to assist the learning of girls.

Conclusion

From the above literature review relating to guidelines for designing computer based learning environments, we can note that there are a range of guidelines. Their emphasis seems to be on designing computer based learning environments which accommodate a whole person perspective, encourage rich and active learning, promote emotionally sound learning and meet the needs of learners from different groups. As designers of computer-based learning environments heed to these guidelines, as they be able to create effective computer-based learning experiences for all students.

References

Astleitner, et.al (2000) "Designing Instructional Technology from an Emotional Perspective" Journal of Research on Computing in Education

Curriculum Support Directorate (1977) Computer-based technologies in the primary KLA's. New South Wales Department of Education and Training.

Cumming, G. et. al. (1999). "Educational Design for effective learning: Building and using a Computer-Based Learning Environment for statistical concepts". Advanced Research in Computers and Communications in Education. Amsterdam: IOD Press. 558-565.

Dunlap J. C (1999) "Rich Environments for Active Learning on the Web: Guidelines and Examples" WebNet 99 Conference Proceedings, Honolulu, Hawaii.

Harper, et.al (2000) *Review of Research: the on-line experience: the state of Australian on-line education and training practices*. Report prepared for NCVER

Huber, B.R and Schofield J W (1998) "The Gender Gap: Why Do Girls Get Turned Off to Technology?" *Education, technology, power: educational computing as a social practice*, ed. H Bromley and M W Apple, State University of New York, USA pp103-131

Joiner, R.W (1998) "The effect of gender on children's software preferences", *Journal of Computer Assisted Learning*, 14: 195-198

Kaye, J. C. (1996) Characteristics of effective networking environments. Paper presented at the Annual Meeting of the American Educational Research Association, New York, NY, April 8-12, 1996. (Eric document ED394502).

Kelly, Karen. (2000) "The Gender Gap: Why Do Girls Get Turned Off to Technology?" *The Digital Classroom*, ed. D. T. Gordon, The Harvard Education Letter, Cambridge, pp 154-160

McRae, D (2001) What to make, and why: principles for the design and development of online curriculum content. Report prepared for SOCCI. [Available URL: http://socci.edna.edu.au/content/pdf/lit_res.pdf]

Martinez, M (2000) Successful Web Learning Environments: New Design Guidelines. (Eric document ED446745).

McKenzie, J. (1995) "Did anybody learn anything?" Assessing technology programs and the learning accomplished. *From Now On*. 5(4). [Available URL: <http://fromnowon.org/Dec95/simpletext.html>].

Queensland University of Technology, Faculty of Education, (2001) SOCCI Market Research Report [Available URL: <http://socci.edna.edu.au/content/>]

Wiesenmayer, R. & Koul, R. (1998) Integrating Internet resources into the science classroom: Teachers' perspectives. *Journal of Science Education and Technology*. 7(3), 271-277.

Winfield et al (1999) Design Considerations for Enhancing Confidence and Participation in Web Based Courses

Young B. L. (2000) "Gender Differences in Student Attitudes towards Computers", *Journal of Research on Computing in Education*, Winter, 33(2): 204-213