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Using Student Learning Needs to Guide eLearning Development Now and in the Future

Carmel McNaught
Centre for Learning Enhancement And Research
The Chinese University of Hong Kong
carmel.mcnaught@cuhk.edu.hk

David Kennedy
Information and Applied Technology Department
Hong Kong Institute of Education
kennedy@ied.edu.hk

Abstract: This paper examines how eLearning sites can be designed to meet learners' needs. After a brief overview of types of learning, we explore the diversity that online learning needs to cater for. Explicit recognition needs to be given to diversity in students' characteristics, diversity in the learning contexts they will be in, as well as diversity of teachers' approaches to and beliefs about teaching and learning. We then develop a model of how different student learning needs can be supported by the various functions of online learning. This will allow readers to understand how the various components of an online learning site, such as information areas, interactive tutorials, quizzes, and access to threaded discussions and chat can support learning for more students most effectively. The model is designed so that as new technologies emerge, they can easily be integrated into the model, and this is illustrated by reference to mobile technologies.

Introduction

This paper has been written in order to articulate and extend a model that the authors have been using for several years. An earlier description of the model, together with an example, is described in McNaught, Kennedy and Majoor (2002). Since that earlier paper, the model has been refined and used extensively in staff development in Australia, Hong Kong and Taiwan. Feedback on these experiences has encouraged us to more clearly describe the model and offer suggestions about its future applicability in a mobile world.

Learning is a Complex Process

How do students learn the important ideas they need to know? Do they assimilate information which they then reproduce? This might be possible for certain ***facts***, but even then, if the facts are all unrelated, it is hard to remember them. Learning is much easier if connections can be made between ideas and facts. How can these connections be made? Is it by rules, as in a system of information processing, much like the way a computer can be programmed? This might be possible for ***learning fixed processes*** which are always the same, for example, a laboratory procedure such as setting up an electrical circuit from a diagram, or routine clinical procedures like taking a patient's blood pressure. But sets of rules are not enough when learners need to solve a problem they have not seen before, or when they want to design something quite new (a bridge, a poem, or a plan for doing new research). Something else is needed then. In these cases, learning appears to be ***a complex process where knowledge is constructed from a variety of sources***. What students learn depends on what they already know, how they engage with new ideas, and the processes of discussion and interaction with those they talk to about these ideas.

Catering for Diversity is Highly Complex

We do need to recognize the diversity that online learning needs to cater for. In the notes below, the references are often to research funded by the Australian government in order to assist universities more effectively deal with all aspects of diversity. Similar shifts in research in higher education can be seen in many other countries.

Diversity in students' backgrounds. Mass education has meant that students come from an increasing variety of socioecomonic backgrounds (Ramsay et al., 1998); varied linguistic and cultural backgrounds (e.g. Anderson et al., 1998) and with widely differing profiles of prior work and educational experiences (Cohen et al., 1997). All of this results in there being a ***diversity of academic motivation and orientation among students***. Biggs (1999) describes how less motivated and/or less academic student often need a higher level of student activity in order to engage with the learning environment. It is important to note that the potential for high level cognitive engagement does not differ between the two groups of students, but the needed level of activity in the environment that fosters this engagement does vary. Not only do we have a greater diversity of students, we also have a much greater ***diversity of learning contexts***. Widely used curriculum options across programs and courses* now include:

- problem-based learning programs; for example many medical and para-medical programs use this model (Camp, 1996);
- workplace learning, common in vocational training courses and now increasingly used in schools and higher education (Martin, 1996);
- studio-centred learning, a traditional model in fine arts and architecture;
- intensive block teaching, often used with part-time students, but also increasingly in off-shore teaching;
- cross-sectoral programs covering both vocational training and higher education with clear articulation pathways (Rosenman, 1996); and
- tailored full-fee-paying industry-related programs – a must for many cash-strapped educational institutions (Gallagher, 2000).

[* The terminology used here is that 'program' refers to the entire curriculum that the students engage with in order to obtain a diploma or degree. A 'course' is one unit or module in that program.]

All of this diversity has added enormously to the workload of teachers. Coaldrake and Stedman (1999) outlined how much the nature of academic work will change in the near future. One factor that is often forgotten in these discussions is the ***individuality of teachers and the diversity of their approaches to and beliefs about teaching and learning***. Teachers rarely accept without question imposed structures about the way they should teach; they are guided by quite deeply held belief systems. Both Quinlan (1999) and Bain et al., (1998) have found a relationship between teachers' beliefs about teaching and learning and they way they structure their courses. Kennedy and McNaught (1997) and Bain et al. (2000) describe how university teachers' choice of specific aspects of technology in their courses can be described in terms of their belief systems. Broadly, these can be related to the instructivist/ constructivist divide, though the diversity is much more complex than that.

So, are there any guidelines to assist teachers and online designers in coping with this diversity? Both our knowledge about human learning and the combined reflective experience that is found in the literature has led to some overall guidelines. When commencing the design of either a new program or course, or the redesign of an existing program or course, there are a number of factors that increase the likelihood of creating an effective learning environment. The teacher/ designer needs to:

- consider how the course is embedded in a discipline or professional context,
- specify how learning outcomes are linked to student activities,
- link the assessment tasks chosen to specific student learning outcomes,
- provide multiple modes of support, and
- incorporate student activities that require students to engage in active and meaningful tasks.

Focus on Student Learning Needs

The centrality of the student and her/his learning needs is clear in the list above. Biggs (1999) provides a valuable model of curriculum alignment focused on students learning through meaningful activities. One key aspect is how students interact with learning materials, with the teacher and with peer learners. Broadly, interactivity for online learning environments can be thought of as interactions with either the:

- content which might be text, audio visual resources, graphics and static visual representations, scenarios, simulations, and/or quizzes; or with
- people via asynchronous online communication (threaded discussions/ newsgroups) and/or synchronous communication (chat).

In reflecting on many years of educational design experience, we have realized that most discussions with university teachers centre around three levels. In initial discussions we are often asked: What is the potential of online technology? What does it offer that can enhance or replace face-to-face modes of operation? Harasim (1989) (now 16 years ago!) suggested that the promise of online education is that it might be able to combine the interactive, communicative benefits of face-to-face education with the time/place independence of distance education. We are still seeking evidence about this 'promise', and indeed the answer is that 'it depends', and that dependence relates to the diversity we described above. For one thing, the nature of interaction is different in an online environment. Our experience has been that part-time or mature age students find online communication satisfying. The traditional younger full-time students feel a stronger need for face-to-face learning situations. Mixed-mode experiences often work well.

Being more explicit about the functionality of online education, the four areas listed at the top level of Figure 1 are always part of this initial exploration. We specify four broad functions of technology – communicative interaction, feedback on learning, detailed study support, and content resources that student can engage with – which may have potential benefits for the learning design. In discussing these potential benefits we always focus on what students need in order to learn (second level) before discussing particular (micro) design ideas for the particular project in question. These three levels are depicted in Figure 1.

The middle level is an articulation of student learning needs. We have adapted a list from work done in the Open University in the UK in the late 1990s (no longer a public website). The list we use is: building and maintaining motivation; negotiating choices; information handling skills; independent learning skills; developing understanding; linking theory to practice; practising discussion, argument and articulation of ideas; rehearsing skills and procedures; and practising teamwork.

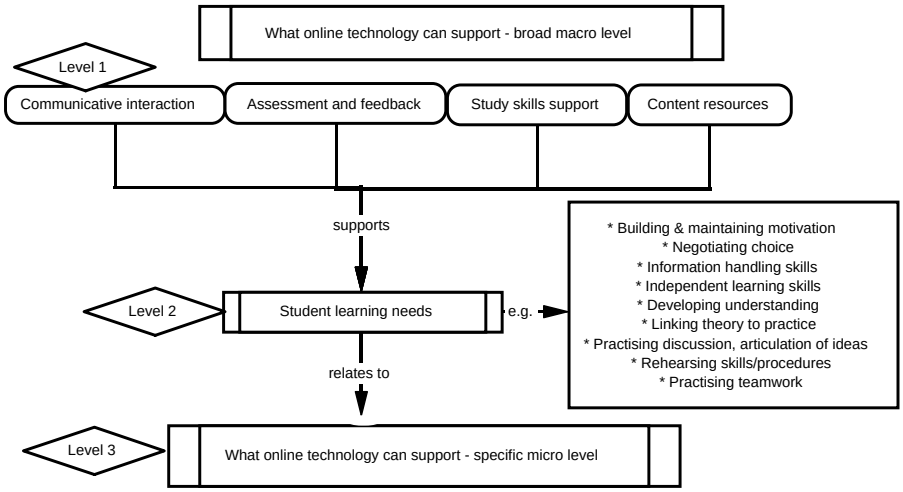

Figure 1: Online technology and student learning needs

For 'micro level' planning, we have found it helpful to link the choice of strategies that teachers might like to use to each of these student learning needs. The second column of Table 1 lists such a set of strategies. The list of strategies is not exhaustive, but the table does indicate that there is a relationship between student learning and the choice of specific teaching and learning strategies. In some ways, this second column of Table 1 acts as an educational design checklist. We discuss questions like the following with teachers:

- What educational purposes do the online strategies you have chosen have?
- How does this set of online strategies relate to the learning outcomes you have for this subject?
- Is there another design (set of strategies) that might assist student learning better?

Student learning need	Examples of appropriate use of online strategies which can be used easily today	Additional possibilities for the future
Building and maintaining motivation	• engaging scenarios; • clear and current information*; • early diagnostic feedback.	• avatars in the communication space of the user; • augmented virtual reality to demonstrate relevance and application.
Negotiating choices	• clear and current information; • topic choice based on graduate capabilities; • assessment choice; • discussion threads for negotiation; • evaluation forms for two-way feedback.	• personalization of access to information and communication services.
Information handling skills	• web searching for online resources; • use of databases; • online sharing of resources; • FAQ sites and/or glossary.	• intelligent searching across network boundaries using agents searching on pre-described criteria.
Independent learning skills	• negotiated assignments; • access to IT/information literacy and study skills resources; • use of personal online journals.	• semantic aware services, such as context-aware services, location-aware services, and extensive use of artificial intelligence to assist in information retrieval.
Developing understanding	• students building websites; • collaborative tasks (document sharing, specialist chat groups); • problem solving exercises – from simple quizzes (for formative assessment) to the use of databases linked to case studies; • concept mapping software; • a collection of past/recent exams and sample tests (where appropriate).	• wider access to peers and experts through deviceless communication; • conversational interfaces to allow easy speech across language boundaries for discussion of ideas (e.g. Glass et al., 2004); • enhanced multi-modal interactivity with objects, so that speech or hands can effect change in the environment.
Linking theory to practice	• embedded media and simulations; • online tutorials; • students as mentors in online groups; • samples of previous assignments/project work (with documented student permission).	• virtual reality worlds for immersive simulation; • global communication networks for real life simulations in real time.
Practising discussion, argument, articulation of ideas	• online tutorials; • online debates using a threaded discussion; • role playing using a threaded discussion; • sharing essays online.	• clothing with inbuilt network capacity, so-called deviceless communication; • reliable transport among heterogeneous networks and terminals; genuinely ubiquitous connection.
Rehearsing skills and procedures	• regular and frequent online quizzes with feedback; • interactive activities using spreadsheets, multimedia objects, laboratory notes and guides.	• virtual reality worlds for immersive simulation.
Practising teamwork	• group projects progressively sharing resources and annotating peer work using collaboratory software.	• peer discovery, including user addressing across network boundaries. This can result in learners selecting, maintaining or changing their own learning groups.

*Clear and current information includes items such as:

- direct access to the related approved subject or course guide;
- a current timetable/timeline related to outlining face-to-face tutorials, lectures, laboratory/ field work and online activities (with times, dates and location details);
- a map showing online learning activities clearly described/linked to learning outcomes;
- current contact details of lecturers, teachers and tutors;
- lecture outlines; and
- news announcements.

Table 1: Examples of current and future online strategies to fulfil students' learning needs
(column 2 after McNaught, Kennedy and Majoor, 2002)

Extending the Model to Future Technologies

Of course we have a long way to go in working with the technologies we currently have and indeed, as stated earlier, Harasim's vision of 16 years ago is still far from a reality. But the pace of change is fairly relentless, and so we should consider how the emerging mobile technologies might fit into this model. What are the synergies that existing online technologies have with mobile technologies, and also what new opportunities might become more widely available in the future? As Wills (2001) points out, new technologies are being integrated into current practice without a full analysis of the possible ways they can be used, and so often do not realize their full potential. So, we need to do some thinking and planning in early stages. Thankfully, there is some visionary thinking that acknowledges that a focus is needed on how technologies might be used alongside the development of the technologies themselves.

> It has become clear in the discussions in the WWRF that the development of a purely 'technical' vision, debating, say, new network concepts or radio interfaces, will not be sufficient. Rather, such a technical view must be put into a much wider context:
>
> - a user-centred approach, looking at the new ways users will interact with the wireless systems;
> - new services and applications that become possible with the new technologies; and
> - new business models that may prevail in the future, overcoming the by now traditional user, service provide, network provider hierarchy.
>
> WWRF Wireless World Research Forum '*Book of Visions 2001'*

A useful way to envisage the future of mobile technologies is by considering how the individual person might interact with her/his local, global and virtual environments in the future. Some examples are:

- *Personal space*. Wearable communication terminals enabling deviceless communication. Mobile phones and wireless personal digital assistants (PDAs) are the beginning of this trend. It is interesting that technologies such as SMS texting are being incorporated into formal teaching at this stage (Thornton and Houser, 2001).
- *Ubiquitous access to digital knowledge repositories*. The Digital Library for Earth System Education is an interesting example of the beginning of this trend (http://www.dlese.org/).
- *Interconnectivity*. Seamless integration of direct communication services with asynchronous message-based services is envisioned. Research into open interfaces to ensure such active networking is needed here. Powerful interconnectivity maybe by peer-to-peer computing, which is the sharing of computer resources and services by direct exchange between systems, allowing leveraging of their collective power. SETI (Search for ExtraTerrestial Intelligence) is currently the largest distributed computing effort with almost 3 million users, and provides a hint of future interconnectivity. Of course, interconnectivity has a downside such as crippling distributed denial of service attacks (e.g. Dittrich, 2002).
- This may all lead to a *'cyberworld'*, a self-created extension of one's identity with constant connection to one's own (semantic) agents, knowledge bases, communities, services and transactions. There are profound philosophical implications to this level of immersion and connectivity, though it is likely to be some time before the implications of this are clear, let alone realized (Book of Visions, 2001, recently updated and extended as Tafazolli (2004), the Book of Visions, 2004).

In the third column of Table 1 we show that these new technologies can provide support for the same set of student learning needs. This is obviously a work in progress, as it is likely that the possibilities will mutate and advance rapidly over the next few years. But the journey will be an interesting one. Using a model based on student learning needs provides a benchmark that will keep the main purpose of eLearning at the fore and not allow the technology to set the agenda. Our conclusion is that a clear educational framework needs to be adaptable and provide guidelines for teachers which can support them in their current practices and also provide ways to scaffold innovation in the changing world ahead.

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