KEYNOTE: What, Why, Who and How of Designing for Effective Online Learning

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ABSTRACT

What is educational design?

Why is educational design essential for facilitating effective online learning?

Who works together in the process of developing online learning courses?

How can it all come together?

There are always more questions than answers in this complex area of educational design, but this paper will provide some principles which might facilitate the exploration of these questions and the formulation of tentative answers.

1. WHAT IS EDUCATIONAL DESIGN?

A general description of 'educational design' might be 'a planned process of making curriculum decisions about how best to support student learning in some defined area'. Let's begin by looking at learning. 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 laboratory procedures 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.

Another way to look at the complexity of learning is to examine the diversity of beliefs about what constitutes learning. This is often called the instructivist/ constructivist divide. Roblyer and Edwards' (2000) approach of looking at the relevant emphases of Directed Instruction and Constructivism is perhaps more helpful.

	Directed Instruction	Constructivism
Characteristics. Model tends to:	1. Focus on teaching sequences of skills that begin with lower-level skills and build to higher-level skills. 2. Clearly state skill objectives with test items matched to them. 3. Stress more individualized work than group work. 4. Emphasize traditional teaching and assessment methods: lectures, skill worksheets, activities and tests with specific expected responses.	1. Focus on learning through posing problems, exploring possible answers, and developing products and presentations. 2. Pursue global goals that specify general abilities such as problem solving and research skills. 3. Stress more group work than individualized work. 4. Emphasize alternative learning and assessment methods: exploration of open-ended questions and scenarios, doing research and developing products; assessment by student portfolios, performance checklists, and tests with open-ended questions; and descriptive narratives written by teachers.
Needs addressed by model	1. Individual pacing and remediation, especially when teacher time is limited. 2. Making learning paths more efficient, especially for instruction in skills that are prerequisite to higher-level skills. 3. Performing time-consuming and labor-intensive tasks (e.g. skill practice), freeing teaching time for other, more complex student needs. 4. Supplying self-instructional sequences, especially when teachers are not available, teacher time for structured review is limited, and/or students are already highly motivated to learn skills.	1. Making skills more relevant to students' backgrounds and experiences by anchoring learning tasks in meaningful, authentic, highly visual situations. 2. Addressing motivation problems through interactive activities in which students must play active rather than passive roles. 3. Teaching students how to work together to solve problems through group-based, cooperative learning activities. 4. Emphasizing engaging, motivational activities that require higher-level skills and prerequisite lower-lever skills at the same time.

Table 1: Characteristics of, and needs addressed by, Directed Instruction and Constructivism

Table 1 lists the characteristics of and needs addressed by the two approaches.

The paradigms that people adopt for the design and development of educational environments reflect their prior knowledge and experience, the manner in which they were taught, and implicit (or explicit) models of teaching and learning they have experienced in their own educational undertakings (Bain and McNaught, 1996). The adage that 'people teach as they were taught' may be extended to 'people design educational environments based upon their experiences (and perceptions) of teaching and learning'. My own view is that Directed Instruction may well be useful in many specific situations, but our ultimate goals in education are Constructivist. The outcomes of education, especially if we take a life-long view of learning, are more likely to described by broad capabilities, such as the list of clusters of abilities noted by Nightingale, Te Wiata, Toohey, Ryan, Hughes and Magin (1996):

- thinking critically and making judgments;

- solving problems and developing plans;
- performing procedures and demonstrating techniques;
- managing and developing oneself;
- accessing and managing information;
- demonstrating knowledge and understanding;
- designing, creating, performing; and
- communicating.

The development of these capabilities involves personal construction. It is interesting that in 1993 I described constructivism in science in an African context as follows, and my view about the importance of these points has not changed. But, of course, I would include all knowledge and not just science.

- "Students have prior well-formed frameworks of ideas about many of the topics they study in science.
- Learners build up personal, internal conceptual maps as a result of interactive processes between each learner and her or his environment.
- Our frameworks embrace our sociocultural environment as well as our physical environment.
- Learning occurs as an active construction of meaning as a result of reflection on experiences.
- 'Reflection' is one of those concepts which reserves to be reflected upon. It does not just mean thinking over an experience, but implies a conscious integration of experience into an existing framework.
- The process of reflection is not purely rational; motivation and interest are essential." (McNaught, 1993).

As an aside, I will note that I use the term 'educational design' rather than 'instructional design' because the latter has its roots in the paradigm of directed instruction, and I feel we are better to move away from it if we are located in an ultimately constructivist paradigm.

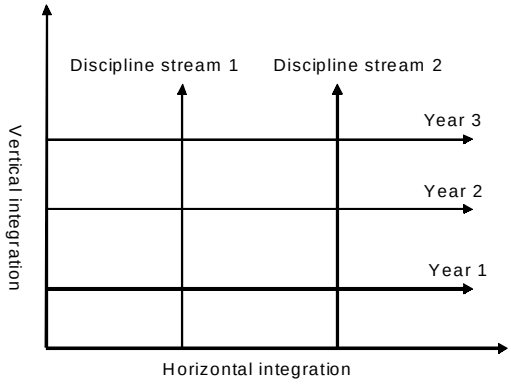
	Program	**Course**
Outcomes	Graduate capabilities	Specific learning outcomes
Evidence	• Graduate surveys • Employment statistics • Portfolios across years	• Assessment • Student evaluation of course • Other monitoring
Relationship	The 'fit' between the program and the component courses is constantly monitored by looking across discipline streams within a program (vertical alignment) and across all the courses in a given year (horizontal alignment).  	

Table 2: The relationship between design at a programme level and design for the component courses

So, the task of educational design is to work out how the ultimate educational goals we have can best be met by specific choices of activities and assessment within individual small modules, units or courses. Biggs (1999) describes this process as curriculum alignment. There needs to be alignment between stated learning outcomes, student activities and assessment. This needs to occur across various levels of skill and understanding. There are implications for the level of achievement in that these need to be specified clearly; for example, it may be that full mastery is expected for some foundational aspects of the discipline but that variation in the attainment of graduate capabilities is expected (and that is certainly what occurs!).

The art of educational design lies on being able to work across both programs and courses, and being able to map student learning across an entire degree or diploma program. Table 2 shows some aspects of this relationship. While I will say little about evidence and evaluation in this paper, it is essential to carry out evaluation and be able to show some evidence that the educational design you have shown is effective. Without such evidence, the concept of the scholarship of education becomes a non-starter and continuous improvement is an impossibility.

2. WHY IS EDUCATIONAL DESIGN ESSENTIAL FOR FACILITATING EFFECTIVE ONLINE LEARNING?

Formal education rests on the premise that learning can be facilitated by students operating in a planned environment. If we don't believe that we should return to the days of unstructured discovery learning that many of us tried in the 60s and 70s (either as learners or teachers) and found very unsatisfying. Basically what I have said above is that not only does the curriculum need to be planned, the nature of the total student experience over, usually, a period of years needs to be considered if curriculum alignment is to occur and result in demonstrable benefits for students. Educational design is essential for facilitating effective learning. What about the 'online' aspect? The key thing here is not to think of online learning as being different to learning which occurs in traditional face-to-face education. The learning process is not different (after all, students are still people with the same neural pathways), but three other things have changed dramatically. Firstly, technology means that there is an increasing range of tools and strategies for us to use in designing programs and courses. Also, alongside this diversity in tools and strategies there is an increasing diversity in the students who enter post-secondary education. This diversity covers academic motivation and orientation, linguistic and cultural background, prior educational experiences, learning styles and approaches to learning. Thirdly, there is increasing diversity in the learning contexts students enroll in; these might be workplace learning, studio-centred learning, programs with intensive block teaching, cross-sectoral programs and tailored industry-related programs.

All of this diversity strengthens the argument that careful educational design is essential for effective student learning. Let's focus a bit more closely on how student learning is linked to the design of online learning environments. Educational designers often note that many discussions with university teachers centre around three levels (McNaught and Kennedy, 2002, in press). In initial discussions the potential of online technology is the focus. What does 'going online' offer that can enhance or replace face-to-face modes of operation? The four areas at the top of Figure 1 are always part of this initial exploration. Communicative interaction, feedback on learning, detailed study support, and content resources that student can engage with, are all potential benefits for which we can find examples these days. 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.

Central to this way of working is an articulation of student learning needs. We have adapted a list from the Open University in the UK Technology Strategy for Academic Advantage (1998) document. These are listed in the middle level of Figure 1. The third level relates to 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 the design of effective student learning environments. In McNaught and Kennedy (2002, in press) this model is developed in more detail and a detailed checklist offered for each student learning need. We discuss questions like the following with teachers:

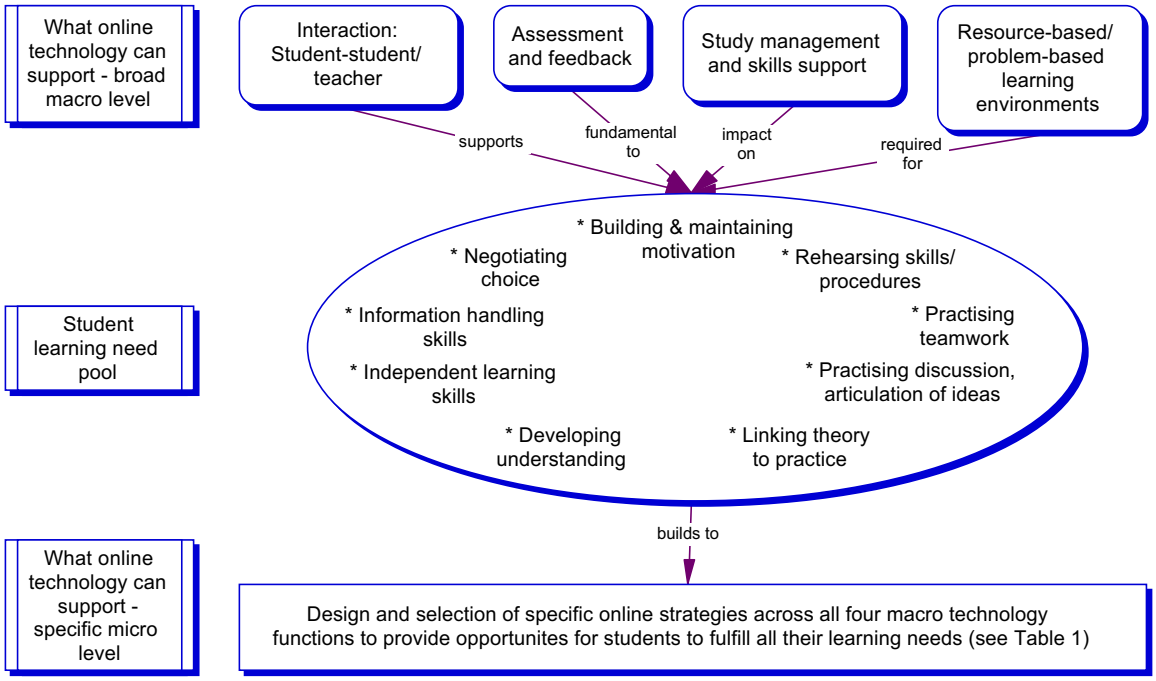


Figure 1: Online technology and student learning needs

- 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 set of strategies that might assist student learning better?

3. WHO WORKS TOGETHER IN THE PROCESS OF DEVELOPING ONLINE LEARNING COURSES?

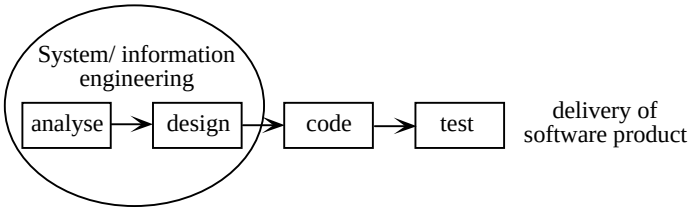
The times when an early adopter (enthusiast) could design, develop, implement and evaluate computer-facilitated learning (CFL) courseware as an individual have long passed (if they ever really existed in the first place). The process of developing multimedia courseware or web-based courses has now become an institutional point of focus rather than merely the domain of enthusiasts and innovators. As CFL has moved from the fringes of higher education to being core components of course materials, issues of software quality, student learning outcomes and integration of CFL modules within the (whole) curriculum context have become paramount (McNaught, Phillips, Rossiter and Winn, 2000). This has necessitated the formation of multi-disciplinary teams for courseware development. Ideally, such teams would be composed of individuals with a range of specialist skills now needed to develop more educationally effective CFL (Freeman and Ryan, 1995). These include:

- experience in teaching and educational design (Kennedy and McNaught, 1997);
- video and audio skills;
- programming skills;
- extensive knowledge of the content domain;
- interface and graphical design;
- formative and summative evaluation (Alexander and& Hedberg, 1994); and
- project management (Phillips, 1997).

No individual has all of these skills and acquiring even a sub-set of them requires considerable investments in time and effort. I will use some images of software engineering models as a way to illustrate how different beliefs about teaching and learning influence the nature of any courseware development

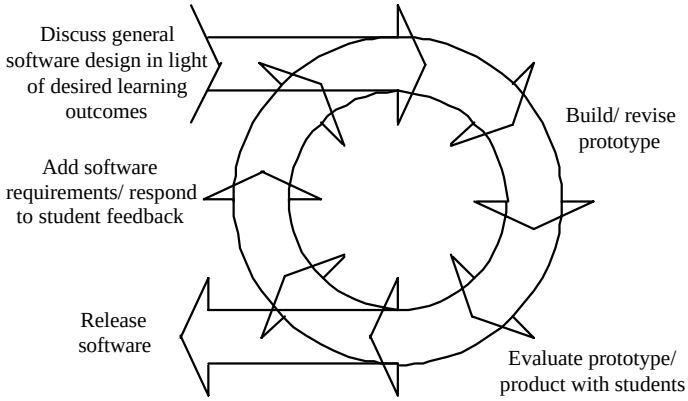
Linear Sequential Model (the waterfall model)

Summary: Highly linear approach, and atomistic (divide and conquer)



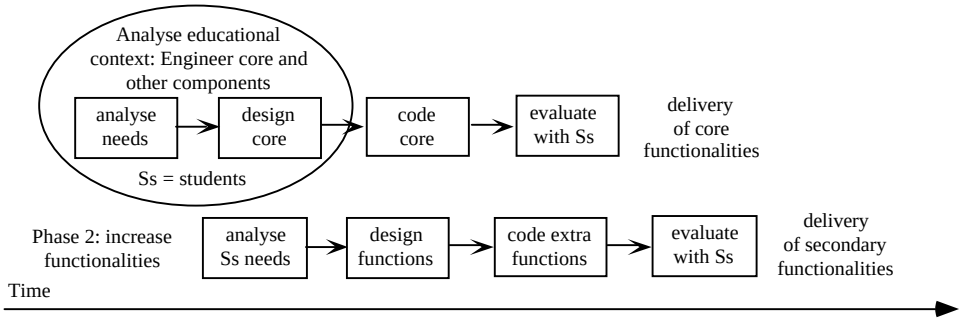
Prototyping Model

Summary: Early prototype, students are involved early, and the prototype informs the design



Rapid Application Development (RAD)

Summary: Incremental, end users and involved, undertaken in modular steps



Evolutionary software process models—Incremental and Spiral

Summary Modular, iterative, ordered, high student involvement, and early evaluation

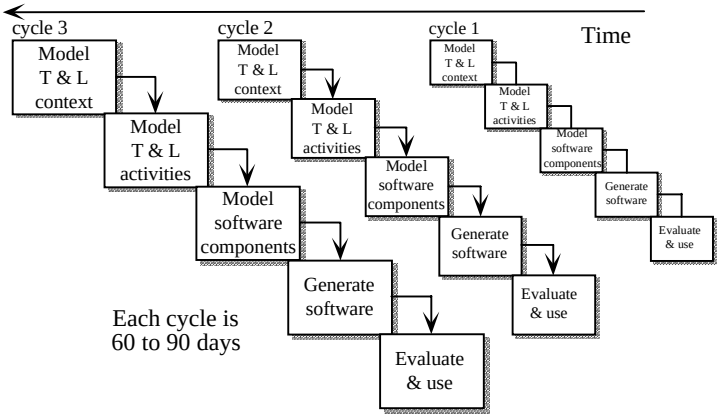


Figure 2: Typical models for software engineering design (after Pressman, 1997)

Summary: Highly modular and ordered, early involvement with students and early evaluation with students and peers

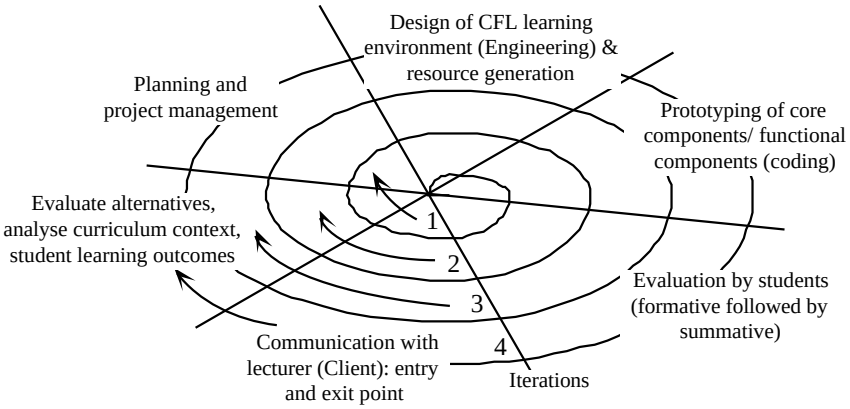


Figure 2 cont'd.: Typical models for software engineering design (after Pressman, 1997)

project. The diagrams in Figure 2 summarize in a highly visual way the differences between software engineering models which in turn relate to the overall manner in which courseware development projects are conceived and operate. More detail about these models can be found in Kennedy (1998). The point I am making is that the decisions the design team make the process they follow is crucial to the quality of the courseware they produce.

Developing CFL with constructivist characteristics requires early, ongoing and meaningful evaluation at a number of key stages with students, which in turn has implications for the model of software engineering employed in any particular project. Hedberg and Alexander (1994) have developed a model for formative and summative evaluation that addresses interface issues and student learning outcomes in the development of CFL. They argue that early formative evaluation with the target group will alleviate many potential design problems. Moonen and Schoenmaker (1992) also state that in higher education the interaction of the user with the program is often very difficult to specify precisely and an early prototype 'almost always elicits comments and suggestions for alterations' (p. 118). It is not too strong a statement to say that formative evaluation is fundamental in CFL development if a quality product is to be delivered (Burkhardt, 1992). It follows from this that any significant courseware development process that does not have early prototypes and opportunities for rethinking and rejigging is much less likely to be successful. This is summarized in Table 3.

4. HOW CAN IT ALL COME TOGETHER?

Educational design is a complex activity and there are no simple recipes. However, one needs to simplify and operationalise the everyday processes of developing coherent online courseware. It is in this spirit that the idea of a checklist is presented.

There are several checklists around of how to ensure success in an information technology project. The checklists in the executive summary from Alexander, McKenzie and Geissinger (1998) are well worth examining; they can be found at <http://www.autc.gov.au/in/in_pu_cu_ex.htm>

Here is a brief summary of some points from this paper as a mini-checklist. When commencing the design of either a new course (module or unit), or the redesign of an existing course there are a number of factors that increase the likelihood of creating an learning environment.

The design team needs to:

- consider how the course is embedded in a discipline or professional context;
- articulate the outcome capabilities of the whole program;
- set up a matrix for vertical and horizontal curriculum alignment;
- discuss the model of courseware development and project management that the design team will adopt and reach a consensus;

Dimension	Early models of educational design	Later models of educational design
Paradigm	Directed Instruction	Constructivist (potentially)
Methodology	Atomistic (focus on the course or module in isolation)	Holistic (focus on the program in relation to the course)
Underlying psychology	Behaviourist	Constructivist
Thinking tools	Essentially linear (flow diagrams)	Concept mapping (hierarchical, interconnected layers)
Model of software engineering	Linear Sequential Model (waterfall model)	Prototyping, Rapid Application Development, Incremental, and Spiral.

Table 3: Dimensions of educational design models

- specify how course learning outcomes are linked to student activities;
- incorporate student activities that require students to engage in active and meaningful tasks;
- provide multiple modes of support;
- provide opportunities for students to discuss their learning;
- link the assessment tasks chosen to specific student learning outcomes;
- check the balance of assessment to ensure whether mastery or flexible standards are appropriate;
- set up formative evaluation checkpoints; and
- enjoy the adventure!

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