
Exploring Technology-Mediated Learning from a Pedagogical Perspective

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ABSTRACT

A considerable amount of the effort and enthusiasm that goes into the development and implementation of technology-mediated learning environments often fails to create effective settings for learning. Too often the opportunities and advantages of the use of technology in the learning process are poorly exploited. This paper explores ways in which contemporary pedagogical principles can inform and guide the design of technology-mediated learning environments. The paper argues the need to plan learning settings based on meaningful and relevant activities and tasks which are supported in deliberate and proactive ways by the tutor. The paper presents and describes a framework which supports a design process comprising three critical strategies: the selection of learning tasks; the selection of learning supports; and the selection of learning supports as a strategy for the development of online learning settings that promote knowledge construction.

INTRODUCTION

A common trend in distance education has been to support independent learning through the provision of learning materials which have been designed to teach students. Such materials are typically characterised by:

- Texts written in the teacher's voice;
- Sequenced and structured instructions and activities;
- Teaching aimed at familiarising students with content;
- Assessment strategies that measure content acquisition.

With the move to technology-mediated learning settings such as the World Wide Web, this form of teaching has continued and many examples of Web

courses share these characteristics (e.g., Burbules & Callister, 2000; Dehoney & Reeves, 1999; Mioduser, Nachmias, Oren, & Lahav, 1999). Many writers have recognised the opportunities that are often missed in the design of contemporary learning settings and have suggested a number of strategies by which the design processes might be improved. For example, Collis (1997) argues the need for re-engineering of the learning design rather than repackaging of the course content into electronic forms.

Much of the instructional design that has been applied to Web-based learning environments has been guided by the principles of instructional-systems design, an approach widely used for the development of learning materials prepared for correspondence and print-based forms of flexible delivery (e.g., Dick & Carey, 1978; Gagne & Briggs, 1974). These approaches are based on the notions that learning occurs primarily through the consequences of internal and external conditions relating to the learner and the instruction (e.g., Ragan & Smith, 1996).

Models developed from the approaches identify discrete instructional events as a means for developers to create instructional materials to support teaching at a distance. In such materials, the instruction usually takes the form of a narrative, where learners are led through a learning sequence by a well-choreographed story that seeks to impart knowledge in much the same way as teachers impart knowledge in lectures and classrooms. The end result of such designs in online learning settings are often disappointing from a learning perspective because they too often fail to take advantage of the learning opportunities afforded by the new technologies. In fact, it is often very difficult to see any form of intentional-learning design in such materials which often appear as electronic forms of didactic lectures.

CONTEMPORARY LEARNING THEORIES

The emergence of the new learning technologies has coincided with a growing awareness and recognition of alternative theories for learning, theories that suggest many problems and inefficiencies with conventional forms of teaching. The theories of learning that hold the greatest sway today are those based on constructivist principles (e.g., Duffy & Cunningham, 1996). These principles posit that learning is achieved by the active construction of knowledge supported by various perspectives within meaningful contexts. In constructivist theories, social interactions are seen to play a critical role in the processes of learning and cognition (e.g., Vygotsky, 1978).

The strength of constructivism as a theory of learning lies in its description of learning as a process of personal understanding and meaning making which is active and interpretative. Learning is viewed as the construction of meaning rather than as the memorisation of facts (e.g., Jonassen & Reeves, 1996; Lebow, 1993). Technology-based approaches to learning provide many opportunities for constructivist learning through their provision and support for resource-based, student-centred settings and by enabling learning to be related to context and to practice (e.g., Barron, 1998; Berge, 1998).

Many writers have provided guidance for the design of constructivist learning settings by articulating the underpinning characteristics. For example, Cunningham, Duffy, and Knuth (1993) argue that constructivist learning environments are characterised by seven pedagogical goals. They suggest that constructivist learning settings are those which concurrently:

- provide experience in the knowledge construction process;
- provide experience in and appreciation for, multiple perspectives;
- embed learning in realistic and relevant contexts;
- encourage ownership and voice in the learning process;
- embed learning in social experience;
- encourage the use of multiple modes of representation;
- encourage self-awareness in the knowledge construction process.

Lebow (1993) presents five principles that he considers are needed to integrate the affective and cognitive domains of learning in ways that support constructivist principles of learning. He argues the need for learning environments to:

- maintain a buffer between the learner and the potentially damaging effects of instructional practices;
- provide a context for learning that supports both autonomy and relatedness;
- embed the reasons for learning into the learning activity itself;
- support self-regulated learning by promoting skills and attitudes that enable the learner to assume increasing responsibility for the developmental restructuring process;
- strengthen the learner's tendency to engage in intentional learning processes, especially by encouraging the strategic exploration of errors.

There are, however, a number of discrete learning designs that provide strong supports for knowledge construction and whose forms can provide designers with guidance and structure in the design of actual constructivist learning

settings. In the literature, many of these designs remain ill-structured in their definitions and descriptions which can limit teachers in their choice and use of them. The descriptions, which authors provide, of the elements required for constructivist learning settings can help designers to understand the forms of learning activity which are required but often fail to provide adequate guidance for the actual learning designs that can encapsulate such principles in cohesive and supportive ways.

DESIGNING SETTINGS THAT PROMOTE KNOWLEDGE CONSTRUCTION

In this paper, we describe a process which we have used successfully in many settings to guide the design of Web-based learning settings that promote knowledge construction. Our experiences have shown the following three-stage design process to be an effective and efficient strategy for this. The three-stage process involves the following activities:

- The design and specification of *tasks to engage and direct the learner* in the process of knowledge acquisition and development of understanding;
- The design and specification of *supports for the online learner* to scaffold the learning and to provide meaningful forms of feedback;
- The design and specification of *the learning resources* needed by the learner to successfully complete the set tasks and to facilitate the scaffolding and guidance.

Our experiences in the design and development of online-learning settings that promote knowledge construction continually reinforce our use of this process as a successful organising strategy. The following sections describe how each of the stages can be implemented and the forms of decisions that need to be made at various places.

Designing Learning Tasks

Designing a learning environment by commencing with the design of learning activities creates a setting where the focus of the planning centres on formulating the forms of learning outcome being sought rather than considering what content will be covered. The literature describing the characteristics of learning environments that encourage knowledge construction suggest that

appropriate forms of learning settings are open-ended learning environments (e.g., Hannafin, Hall, Land, & Hill, 1994). These are characterised by learner engagement in cognitively complex tasks involving such activities as problem solving, critical thinking, collaboration and self-regulation.

In our previous research (e.g., Herrington & Oliver, 2000; Oliver & Herrington, 2000), we have explored situated learning as a design basis for learning environments that support knowledge construction and we have explored the forms of learning activity that best support this learning design. These include:

- *An authentic context* that reflects the way the knowledge will be used in real life (e.g., Brown, Collins, & Duguid, 1989; Collins, 1988; Honebein, Duffy, & Fishman, 1993).
- *Authentic activities* that have real-world relevance, and which present complex tasks to be completed over a sustained period of time, rather than a series of shorter disconnected examples (e.g., Bransford, Vye, Kinzer, & Risko, 1990; Brown et al., 1989; Reeves & Laffey, 1999).
- *Authentic assessment* which is seamlessly integrated with the activity, able to provide appropriate criteria for scoring varied products (e.g., Herrington & Herrington, 1998; Reeves & Okey, 1996; Wiggins, 1993).

The use of these principles provides a sound framework for the initial stage of the design of an online learning setting. Other forms of learning design which can be employed to incorporate these and other knowledge construction principles include those such as task-based learning, problem-based learning and case studies. These approaches provide learning tasks that are not simply provided as opportunities to practice skills and processes taught in more didactic ways, but more as integral and organising features of the entire curriculum. The activity(ies) give a meaning and structure to the study of the course, but little directed content. In such instances, assessment of the learning can be determined on the basis of the success of the activity. Assessment is usually integrated with the learning activity as well as providing a measure of student performance and success.

Having chosen the form of learning design, the three-stage model, we have proposed, suggests the accompanying component of the design process that should then be planned and determined is the choice of learning supports. Learning supports are the strategies planned to enable learners to successfully implement and enjoy success in completing the learning tasks.

Planning Learning Supports

Flexible and online learning environments need learning supports to be designed as integral parts of the learning process. The support is necessary to guide learners and to provide a feedback mechanism which is responsive and sensitive to their individual needs (e.g., McLoughlin & Oliver, 1998). In distance-education contexts, learner support is a term that often embraces more extensive mechanisms such as academic support, library support and counseling. In the context of an online learning environment, we use the term *learning supports* to refer to those elements in the setting which are used to provide guidance and feedback to the learners in the learning process.

A number of writers have developed strong frameworks to describe the ideal forms of support required for online learning environment and in each case, there is usually a strong argument made for an active and involved teacher (e.g., Laurillard, 1993). The role of the teacher, however, tends to be defined as that of a coach and facilitator in place of the more didactic style often assumed. In contemporary settings, this form of learning support is called *scaffolding* in recognition of the way in which it helps to build knowledge and is then removed as the knowledge construction occurs.

Scaffolding has long been considered as an activity in which teachers provide support and assistance to learners. It has, however, far-broader connotations, and can be provided by a range of other elements in the learning process, for example, learning resources, interactive technologies, and/or other learners. In open-and-flexible learning environments, there is often a diminished role and opportunity for teachers in providing direct teaching and the forms of assistance usually associated with scaffolding. In such instances, opportunities for scaffolding are often to be found in the student-centred nature of the learning environment.

Scaffolding describes a situation where learners receive some degree of assistance and help in the learning process as they attempt to make meaning and construct their own knowledge. The essence of scaffolding is that the assistance and help is gradually reduced as the learning progresses to the point where the learner is finally able to act independently. In online learning environments, learners often need help and assistance in the various learning activities they undertake. In settings where technology provides open communication lines between learners, many opportunities exist for learning to be scaffolded through the purposeful design of activities involving peer cooperation and collaboration.

In the selection of appropriate learning supports for situated learning designs, we look to create ways to encourage, guide and enable learning through the use of such supporting strategies as:

- *Creating collaborative learning opportunities* (e.g., Brown et al., 1989; Collins, Brown, & Newman 1989; Hooper, 1992);
- *Coaching and scaffolding of learning by the teacher and other students* (e.g., Collins et al., 1989; Greenfield, 1984);
- *Providing opportunities and support for reflective learning* (e.g., Boud, Keogh, & Walker, 1985; Collins & Brown, 1988; Kemmis, 1985);
- *Encouraging articulation and expression of understanding* (e.g., Collins et al., 1989; Edelson, Pea, & Gomez, 1996; Lave & Wenger, 1991).

Depending on the form of learning design underpinning the planned setting, different support strategies can be employed. Once the learning design and the learning supports have been chosen and planned, the remaining design task is to select the resources that learners will require to enable them to achieve the learning outcomes being sought.

Selecting the Learning Resources

Choosing and developing content for flexible technology-based learning is seen by many teachers as the most important step in creating online learning environments. This is reflected in the resulting materials that often have a content-focus (e.g., Dehoney & Reeves, 1999). It is sometimes estimated that online teachers spend 90% of their planning and development creating content and online learning resources. Contemporary thinking suggests that the content can, and should, assume a far lesser role in the design process (Odlyzko, 2001).

In learning environments that support knowledge construction learners need to be exposed to a variety of resources and to have choices in the resources that they use and how they use them. An important aspect of resource development is to provide content that provides them with perspectives from a multitude of sources (e.g., Herrington & Oliver, 1995). The materials need not all be online. The use of conventional materials along with electronic sources can provide the diversity often required. Previously, designers created course materials where the content was selected, organised and presented to the learners in a strict scope and sequence. Today, it is recognised that learners need to be able to access resources in a variety of ways and strictness and rigidity should be lessened (e.g., Lebow, 1993).

Duchastel (1997) argues that content also needs to be chosen in a fashion which provides authentic examples and contexts. This argument is very much in line with situated learning principles. The move to outcomes- and competency-based education is a reflection of this form of thinking. In such instances, the content is presented as a means to an end rather than an end in itself, and it is the learner who must make most of the choices about which material to use and how to use it.

In our design and development of learning settings based on the principles of situated learning, we endeavour to ensure that not only are the resources

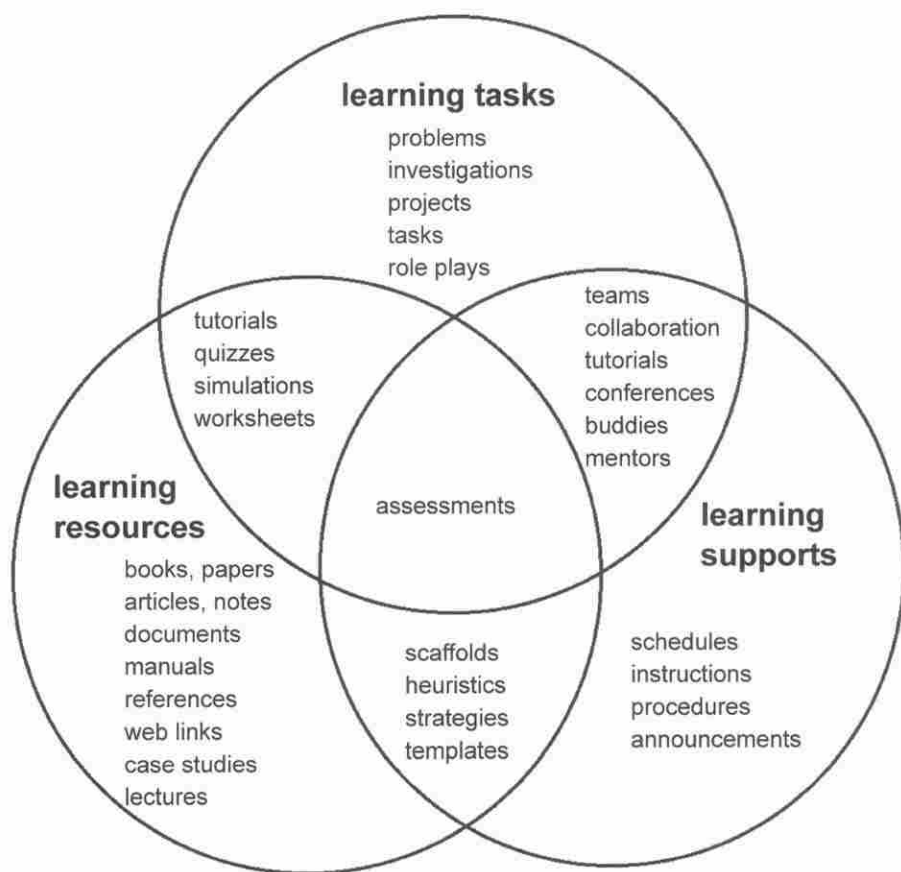


Fig. 1. Constituent elements of online learning settings.

relevant and authentic but also include elements that provide:

- *Access to expert performances and the modelling of processes* and access to the social periphery of real-life episodes wherever possible (Brown et al., 1989; Collins, 1989; Lave & Wenger, 1991);
- *Multiple roles and perspectives*: different perspectives on the topics from various points of view (e.g., Collins et al., 1989; Honebein et al., 1993; Spiro, Feltovich, Jacobson, & Coulson, 1991).

The Design Framework

When this form of design process is undertaken, it creates a framework and design strategy that tends to separate elements in the learning process in organised ways. Figure 1 provides a framework that demonstrates the constituent elements in the overall online learning setting.

SAMPLE LEARNING SETTINGS

There are now many examples of Web-based learning settings which have been designed following this process which can be used to illustrate the type of learning environment the process is capable of producing. The following examples have been chosen to illustrate the forms of learning environment that can result from this process.

Youthwork

Youthwork is an online learning package developed by the Holmesglen Institute of TAFE in Australia through funding provided by the National Flexible Toolbox Project. The Youthwork learning environment was designed to support learning among students seeking level accreditation and certification at Certificate Level IV in Community Services in Australia. The course is comprised of a series of units, each of approximately 40-hr study (Fig. 2).

Learning Tasks

Each unit of study in the online course has been designed around a problem or activity which learners are required to complete and solve. The developers of the setting spent considerable time in the design stage considering the intended learning outcomes and planning learning tasks by which learners might acquire the underpinning knowledge, understanding and skills set.



Fig. 2. The Youthwork online learning setting (www.international.holmesglen.vic.edu.au/tds/youthwork/home.htm).

The learning tasks all involve the development of some artefact or product and the assessment of students' learning is intended to be assessed on the basis of the quality of the product that is developed. Each unit is based around completion of a large anchoring task which has been chosen to reflect realistic and workplace activities. In this setting, the learner assumes the role of a worker and undertakes the tasks in the virtual workplace setting provided by the environment.

Learning Supports

In designing the learning settings, the developers also took great care to provide a supportive learning environment through such means as:

- The provision of a suggested learning pathway and strategy for dealing with the various learning resources to enable achievement of the intended learning outcomes;
- The inclusion of collaboration in the learning activities to enable learners to articulate their ideas and to learn in a reflective setting;
- The planned use of communication facilities involving discussion and argument around a series of related and relevant issues and events;

- A supportive tutor role within the environment providing learners with feedback and guidance on request and at critical points in the learning setting.

Learning Resources

The scope and extent of the support designed into the learning setting was also enhanced by the forms of learning resources designed and developed for the setting. The learning resources that were developed and which form an integral part of the learning environment are very much based around the authentic workplace setting and reflect the resources such a setting would provide. These include:

- Manuals and documents describing company procedures and policies;
- Tutorials and training packages as might exist in the workplace;
- Magazines and reference materials in the area;
- Virtual people that can be interviewed and spoken with;
- Workplace documents and templates;
- Sample documents and files as would be found in the workplace setting.

When the forms of activity and engagement of the learners in this setting are considered, it is clear that the vast majority of the elements of a knowledge construction environment are present (e.g., Duffy & Cunningham, 1996).

IMM 4141: Online Teaching and Learning

Online Teaching and Learning (IMM4141) is a course of study in the Graduate Certificate of Online Learning offered by Edith Cowan University in Australia. The unit was designed to meet the needs of teachers faced with the prospect of teaching online possibly for the first time, without sufficient knowledge of either the technology or appropriate pedagogical approaches for online delivery.

Learning Tasks

The tasks students complete as they study the course, form the basis of the entire unit of study. Students are asked to complete one complex task which is evaluated at three points. They assume the role of a university academic and become involved in the evaluation and creation of a prototype online unit, which should exemplify the findings of recent theory and research. In the first part, students evaluate an online course which on first glance looks appealing and effective, but on deeper analysis, it is not representative of research

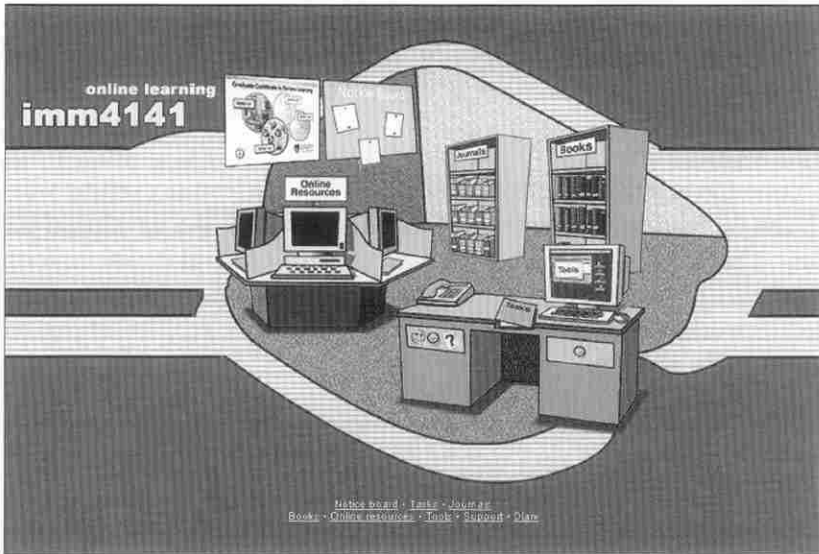


Fig. 3. The main interface of Online Teaching and Learning, allowing access to resources.

findings in the area, and is more like an electronic book than an engaging online environment. In the second part of the task, the students work collaboratively with other members of the 'consortium' (other students studying the course) to produce a model of effective online design, and finally they design a unit of study which exemplifies their model. The tasks are presented to students in the form of memos, not unlike they would receive as academics in their professional roles. Figure 3 shows the Web interface for the support site for the course.

Learning Supports

The supports available to students as they work through the tasks are a combination of resources provided on the site, scaffolding and assistance provided by the tutor, and the substantial support provided within the collaborative groups and by other students. If students click on the telephone on the desk of the main interface, they find a range of supports including administrative details, but also other advice on issues such as the general approach of the course, why collaboration is so helpful, and approaches to the online journal and the importance of reflection. Students have access to a

discussion board which provides a crucial function in supporting their learning and providing them with a place to express their growing understanding of the issues, and the tutor support provided is available through both the discussion board and through e-mail.

Learning Resources

In completing the realistic tasks assigned, students have a range of resources upon which to draw. There is no content provided by the author of the course. Instead students use the tasks to guide their research, and to justify the type of resource they need in order to complete the activity. Resources include:

- Unit information and student details (students introduce themselves);
- Online articles and papers (both specific papers and entire online journals);
- Databases relevant to the field of enquiry;
- Lists of appropriate books;
- Links to relevant Websites (the students can contribute to this growing list by adding their own URLs);
- Links to online bookstores, the University Library and other related resources;
- A private online journal or diary where students can reflect on their learning.

Through such resources, students are encouraged to examine many perspectives on online learning, not simply those suggested by the author or teacher of the course.

SUMMARY AND CONCLUSIONS

This paper has presented a framework for the design of online learning settings that promote knowledge construction. The paper has argued the need for design approaches that focus on the selection of appropriate learning activities as the organising element of the instructional-design process. Conventional instructional-design approaches tend to focus on online learning from the perspective of content delivery and produce learning settings whose main organising element is the course content. The focus on learning tasks provides designers with the capacity to effectively consider the intended

learning outcomes, how learning will be assessed and what elements are needed in the online setting to support students to achieve their goals.

This design framework can be relatively easily applied in most instances where online courses are being designed. The strategy suggests a sequential process that designers can follow to plan and choose the necessary and constituent elements. The sequential strategy supports the development of the learning setting in ways which promote and encourage learners' knowledge construction.

The development of online learning settings through this process is not intended to deliver online courses that are so rigidly defined as to be 'teacher-proof' (see, e.g., Reeves, 1993). Rather, the three-stage model provides a context for creating settings where learners learn with the technology and where online teachers still play fundamental roles in supporting and facilitating students. Application of the model does not presuppose the use of any particular forms of learning design but serves to provide a framework within which the use of any learning design such as problem-based learning or situated learning, may be planned and developed for online delivery.

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