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A learner-centred approach to developing team skills through web-based learning and assessment

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Abstract

In traditional face-to-face classrooms, collaborative learning has been endorsed as an effective pedagogy that fosters skills of analysis, communication and higher order thinking. Increasingly, as online learning environments for tertiary learners make use of course support systems, there is greater recognition of the potential of communications technologies to foster dialogue, networking and team skills among learners. Such skills are now among the recognised core attributes that graduates are expected to develop. In face-to-face classroom students learn the skills of collaboration and teamwork by engaging in tasks defined and supervised by a teacher. In online environments teacher presence is often limited to task definition, management and feedback functions. Team skills and collaboration therefore need to be supported though different pedagogies and processes such as establishing a climate of trust and openness, communication protocols, resolution of conflict and group processes that provide sanctions and support. In this paper we describe an innovative approach to building the skills of decision-making and conflict resolution, leadership and clarity in goal setting and communication. A case study of tertiary learners illustrates how the essential aspects of task definition, resources to support group learning and integrated online assessment foster team skills.

Introduction

Traditional university education is quite different from professional learning, not only in the organisation of curricula, but also in its forms of delivery. According to Taylor, (1997) the curriculum addresses knowledge for and about practice, and is delivered both in formal institutional settings and in the field of professional practice. Often, students studying for the professions are mature age and are highly motivated as they

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are studying for a definite purpose. Traditionally, the fields of applied and pure knowledge have been separated and professional courses are sometimes regarded as secondary.

Nevertheless, in certain university courses which are considered professional, such as law, the development of a knowledge base is regarded as the precondition for entry to the profession, while the development of other professional skills is not well catered for. Today, with the increasing use of information technologies, trends towards internationalisation and the burgeoning of work practices based on teams and networking has extended the skills needed by professionals. Employers expect not only a strong knowledge base, but also diversified social, communication and cooperation skills, flexibility to work in different contexts and the capacity to manage information and self and others. Experts must continually construct and reconstruct their expertise through lifelong learning processes. These demands must be met by the providers of higher education, and pedagogies to foster these skills must be adopted by tertiary educators.

The aims of higher education

Because of economic realities tertiary educators are compelled to consider new delivery strategies and approaches to developing lifelong learners. Recent discussions of higher education would seem to portray a view that the aims of higher education are consistent with the demands of working life. Several writers have explicitly stated that the outcomes and purposes of higher education include the provision of a general educational experience with subject-based disciplinary knowledge, personal transferable skills and generic academic outcomes (Allan, 1996; Atkins, 1995). Development of personal transferable skills that are required for the professions include integration of theoretical and practical knowledge, communication skills, reflection on one's own knowledge and management of self, others and information (Oliver and McLoughlin, 2000). However, educational practice in general and the pedagogies that are applied in higher education and not well attuned to the development of professional expertise (Mandl, Gruber and Renkl, 1996). Often through inappropriate design of curricula, the learning activities and forms of assessment mean that students develop inert knowledge, rather than transferable skills attuned to the complexities of professional life. In real life contexts, experts work in teams, share knowledge and apply it, revise and transform it through discussion, application and analysis. In tertiary contexts, skills and knowledge are often decontextualised and transferable, and generic skills are not accorded sufficient emphasis in the teaching and assessment. The present study is an attempt to develop personal transferable and professional skills needed for project management in a tertiary education unit utilising online learning and self-directed learning pedagogies. The design of the environment is presented within a framework for professional knowledge development and the tasks and forms of engagement that occurred in this empirical study are described.

What is professional knowledge?

One of the characteristics of being a professional is having the capacity for self-directed learning and being able to apply practical strategies and skills in contexts that require

them. Professionals have a body of expertise and in addition have lifelong learning skills and self-direction. Boud (1988) suggests that the capacity for self-direction includes elements of independence, dependence and interdependence and proposes that these form a continuum whereby the learner progresses from dependence, to independence and then to interdependence (Figure 1).

For example, the research of Billet (1996) shows that experiential learning in the workplace requires interdependence in the sense of learning from others, choosing among multiple courses of action, learning about organisational culture and using a wide range of opportunities to shape one's professional identity.

If we compare the emphasis of traditional higher education and professional training, it would seem that while higher education emphasises the intrinsic value of learning, professional education gives priority to operational outcomes and skills. A further difference is that higher education emphasises the centrality of propositional knowledge, while professional education emphasises personal and process knowledge as equally important (Erhaut, 1992). The framework proposed by Erhaut provides the foundation for the discussion of professional skills developed in this case study (Figure 2).

According to Erhaut, three kinds of knowledge contribute to professional knowledge and understanding: propositional knowledge, process knowledge and personal knowledge. Table 1 summarise each form of knowledge and provides exemplars.

For tertiary educators, the increased emphasis on generic transferable skills has required a re-alignment of teaching practices with desired learning outcomes (Biggs,

Figure 1: Continuum showing progress from dependent to interdependent learning

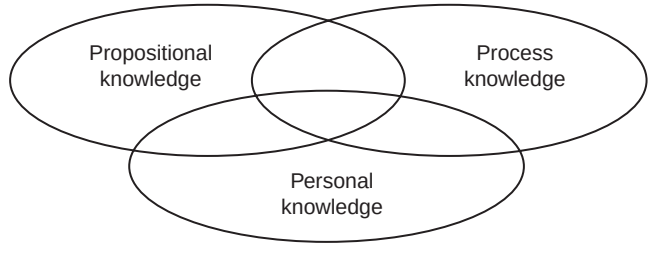

Figure 2: Professional knowledge as the integration of process, personal and propositional knowledge

Table 1: Three forms of knowledge in professional education (Erhaut, 1995)

Propositional knowledge	*Process knowledge*	*Personal knowledge*
Discipline based concepts	Acquiring information	Interpretation of experience
Generalisations and practical principles	Skilled behaviour	Understanding of assumptions
	Deliberative processes	
Specific propositions about cases, decisions and actions	Giving information	
	Controlling one's behaviour	

1999). The framework of three types of knowledge constituting professional development as proposed by Erhaut is a framework that can be adopted as a starting point for course delivery. The implications are that if such skills are expected of graduates, teaching methods and learning resources must foster both process knowledge and propositional knowledge.

Self-directed learning and the social processes of professional learning

In contemporary educational theory one influential group of researchers has identified students' approaches to be either surface level or deep level (Biggs, 1994; Ramsden, 1992; Candy, 1991). A deep learning approach is consistent with a search for knowledge and understanding, whereas a surface learner is concerned only with passing exams by memorising facts. Applied to teaching approaches in higher education, the implication is that the creation of a constructivist, learner-centred environment where curriculum outcomes and tasks are aligned can foster cognitive skills and a deep approach to learning. This can be achieved by enabling learners to take an active role in learning by initiating, managing, monitoring, reflecting and evaluating learning tasks and processes. Gibbs (1992) emphasises that a focus on process, rather than content, is essential in promoting active learning. For example, communication and negotiation skills are socially based processes and come into play as learners face new challenges when they are engaged in authentic problem solving. Such skills are part of the emphasis on self-directed learning, as Candy (1991, 246) wrote:

> "In the past learning was seen essentially as a personal quality or attribute, ... a fixed and enduring set of facts to be mastered... In the new view self-direction is acknowledged as a product of the interaction between the person and the environment."

Here, Candy affirms that learning is essentially social and interactive, located in the context and socio-cognitive processes of interaction with. Essentially this means that professional learning is experiential and that skills are acquired and refined through social interaction, dialogue and negotiation with others (Laurillard, 1995). In the creation of a Web-based learning environment to prepare learners for the multimedia industry, project management skills were fostered by incorporating experiential and constructivist learning principles. The design features of the online environment are

task-based and experiential, leading to the development of competent professionals skilled in project management.

Context of the study: professional project management skills

The context of the study is a degree program in Interactive Multimedia, in which students are required to develop skills and expertise in project management. Graduates are normally employed in the multimedia or telecommunications industries where they work in teams to create products and resources. The units are designed to enable students learn about a range of project management methodologies through both online and face-to-face interactive teaching sessions, and apply these skills in the creation of a team-based project that consolidates skills. The learning outcomes are designed to foster a range of project management competencies appropriate to developing multimedia products. These include, developing appropriate project management models, performing a needs analysis, developing design specifications, (storyboards, concept maps and rapid prototypes) conducting formative and summative evaluation, addressing legal and copyright/intellectual property issues. These skills require not only knowledge of the procedures and processes, but also competence and capability in applying this knowledge. As Stephenson and Weil (1992, 73) have indicated, competence entails "... the ability to make satisfactory and effective decisions in a specific setting or situation". Thus, in designing the learning environment, attention was given to creating tasks that required students to develop situation specific transferable skills rather than abstract skills.

Integration of learning and assessment

The unit of study on project management is delivered on-line using WebCT software, and is available on-campus and in the distance mode of study. Project management skills such as needs analysis, design specifications, storyboards, concept maps, evaluation, legal issues, quality auditing, scheduling are developed and applied in the creation of a Web site by "project teams", or small groups of students who work collaboratively as they would in an industry context. The objective of the team project is to promote team and client collaboration skills by focussing on a common task. Learning and assessment processes are integrated throughout the duration of the one semester unit. The assessment consists of project team-based work, task-team work, peer assessment, individual reflective reports, a client mark and individual postings to a weekly online forum. The task team assessment requires the team to publish a short summary paper on the bulletin boards at the beginning of the week on an aspect of project management such as team dynamics, legal issues, scheduling etc. and to raise issues for discussion. The task team is also responsible for moderating the discussion during the week and then providing a synopsis at the end of the week. Usually students assume roles within the forum so that each team member participates in a task such as:

- production of a short outline/issues paper
- discussion moderation
- questioning
- synopsis and summary.

Students are assessed on bulletin board contributions, which account for 30% of their total mark. These online discussions are intended as areas for refection, discussion and analysis of problems. Assessment in the online unit is base on authentic tasks planned for their relevance to workplace settings. Students work in teams to create a product which is offered to clients (peers) for evaluation, and tested for functionality in real context. Working online enable students to provide multiple forms of peer support though shared tasks, team work, collaborative work, and opportunities for feedback and peer review. These supportive processes develop communication skills, create an affective climate of support for thinking skills, discussion, negotiation and building consensus among an online community.

Providing social support for professional skills

The online environment is based on group-based problem solving, which is a form of learning closely associated with collaborative learning (Paloff, 1999; Slavin, 1996; Crook, 1995). Group-based project work has been advocated for its capacity to foster professional skills and experiential learning (Collis, 1998; Klemm and Snell, 1996). By enabling groups to work on complex tasks in a problem-based learning format, opportunities are provided to develop independent and interdependent skills such as teamwork and communication. The structure of learning is as follows: Students engage in group discussion online which is relevant to the assigned topic and the forum is therefore truly student centred. The structure of the weekly contributions and roles of team members do not vary, and each week there is a forum leader, a questioner and a summariser of information. In order to provide a structured learning environment for collaborative and group work, assessment processes are integrated with learning processes and formative evaluation of activities occurs progressively throughout the semester. Grades and point are awarded for individual and group work as follows:

- a team mark based on the quality of the written assignments and final web product, addressing fixed criteria;
- an individual reflective report which encourages students to think about team and client issues they have identified as important in each stage and discuss how they would do it differently next time;
- a peer assessment mark, negotiated with the team. Marks can be deducted from team members who are not performing and added to the score of other team members. This encourages students to carefully consider their role and contribution in relation to the others while working in a team.

Essential features of the environment are the social support or scaffolds provided to learners to enable them to learn in all three modes: dependent, independent and interdependent (Figure 1). Cooperative social modes of interaction were enabled through bulletin board communication and discussion in order to foster interaction, articulation of ideas and development of team skills. This pedagogical decision is consistent with social constructivist theories in which learners create knowledge and understanding through interaction and conversation with others, enabling articulation, negotiation and reflection on ideas (English and Yazdani, 1999; Abrami and Chambers, 1991).

The shift to student self-direction and autonomy means that students need to take more responsibility for their own learning, but many need assistance in achieving this skill. Technology supported learning environments enable students to become more self-directed and to articulate their learning goals. When learners are trying consciously to achieve the goal of managing a project and building a team to create a Web site, as they are required to do in this unit, they are fulfilling a learning intention and therefore become more goal directed. According to Scardamalia and Bereiter (1992) intentional learning is likely to be more metacognitive and self directed. Technologies have traditionally been used to support the goals of teachers in conveying information and ideas, but not of learners. In the environment for project management, learners must defend the decisions they make in completing tasks, articulate plans with team members and defend the solutions and proposal that they make. This focus on process knowledge is developed systematically throughout the unit of study, utilising the visual and communicative features of the online environment to the best advantage.

Providing cognitive support for professional learning

The development of project management skills that are transferable to real world contexts mean that learners have to assume more responsibility for their own learning, but many need assistance in achieving this skill. Shaffer and Resnick (1999), maintain that technology can be used to create authentic contexts for learning, and provide resources that give students opportunities for:

- connectivity: to connect to the world outside the classroom, to research topics that would otherwise be inaccessible, to access experts and to engage in conversation with peers;
- computer modelling: to create simulations that assist the creation of authentic tasks and contexts for assessment; and
- epistemological pluralism: to express and represent ideas in many different ways.

Applied to task design, representational pluralism enabled by computer technology expands the range of channels available to students to demonstrate understanding (Gardner, 1993; Hammond, 1998). For example, instead of using narrowly defined learning outcomes tested by examinations, technology offers a total environment where real life skills, such as written and verbal communication, collaboration and team work can be assessed by the team and tutor by giving learners multiple channels of expression, such as visualisation, multimedia presentations, audio and video. Thus, information technologies are closely inter-woven with the quality of the learning experience, and can be used to create authentic tasks for assessment. In this online environment, the technological tools were used to foster team skills, process knowledge and personal knowledge. A range of technological and collaborative scaffolds (support systems) were made available to students to support team processes, communication and group decision making.

What is scaffolding? Scaffolding is a form of assistance provided to a learner by a more capable teacher or peer that helps the learners perform a task that would normally not be possible to accomplish by working independently. Integrated into pedagogical

practice, scaffolding is intended to motivate the learner, reduce task complexity, provide structure and reduce learner frustration. Scaffolding can be provided both by technology and by tutors or peers and may be a progressive self-test, hints about solving a problem or completing a task, or guided tasks that lead the learner towards more complex, extended, independent performance (McLoughlin and Oliver, 1998b). The most important point about scaffolding is that it engages the learner actively at his/her current level of understanding until the point where the support is no longer required. Technologies can provide a range of supports for learning and can be used to create contexts for thinking and knowledge construction (See Table 2).

Web-based instruction for project management is used to support experiential learning so that the process of learning is integrated with real world experiences where students to engage in authentic problems and real life events and develop problem-solving strategies. Learning on task enables learners to develop "know how" or procedural knowledge, which is essential in the professions and is characteristic of the cognitive flexibility of lifelong professional learning (Eraut, 1994). The following scaffolds were provided to students to foster process, propositional and personal knowledge.

- *Student workspaces*: Students are encouraged to display and share their work and to form knowledge building communities where exploit each other's skills and benefit form exposure to multiple perspectives. These shared spaces provide social scaffolds where students engage in dialogue, revision of ideas and reach a greater awareness of their own knowledge construction processes.
- *Asynchronous communication*: Activities were designed to be carried out asynchronously using discussion software. In groups on individually, students could ask questions related to any issue. Weekly topics were also set for discussion.

Table 2: How technologies scaffold learning

Technology as scaffold	*Cognitive process supported*
Tools for knowledge construction	Representation of ideas, beliefs and understandings
Information vehicles for exploring knowledge	Accessing information, comparing and evaluating perspectives and world views
Contexts to support learning by doing	Representing and simulating real world environments and situations
Controllable, shared problem space	Sharing and comparing ideas, revising, hypothesising and arguing
Social medium for conversation, communication and collaboration	Knowledge creation by supporting discourse, argument and inquiry among a community of learners
Intellectual partner to support learning by reflecting	Articulation and reflection, mindful thinking and meaning making by constructing personal representation of reality

- *Resource based-based scaffolding*. The student activities were supported by a range of tools which provided access to on-line course materials, allowed students to record their own notes and provided links to external sites.
- *Synchronous communication*. Project teams needed access to synchronous means of communication so that they could work in real time to develop their projects. Table 3 provides a summary of these forms of scaffolding.

Task design based on project-based learning

In this tertiary setting, the development of professional skills was linked to the creation of a project-based learning environment. Group-based project work was chosen for its relevance and congruent to the learning outcomes that were sought. Project work is advocated for its capacity to support professional expertise and vocational skills and has successful as an instructional strategy in may contexts (Collis, 1997; Klemm and Snell, 1996; English and Yazdani, 1999). Learner activities were undertaken in groups and teams.

This style of problem-based learning involves a number of activities and tasks that appear to provide support for the development of a number of key skills. The activities which the students are required to undertake each week include:

- Problem solving. The tasks require students to seek information from appropriate sources in order to solve a problem that reflects state-of-the-art knowledge about project management. The students are able to use the WWW as an information source but have to select from the many resources available those that are relevant to the task.
- Peer evaluation. Having solved the problem, the students are required develop criteria to apply this to peer projects and to defend the criteria they have developed to explore the options and possibilities available in developing a solution. The students have to examine the information, consider the scope of their inquiry and decide the parameters in which they are going to work.
- Collaboration. Each group consists of 4–5 members. The problem-solving task requires members to organise themselves into productive teams who share the workload, undertake separate tasks and maintain tight deadlines and schedules from

Table 3: Online course support features for developing skills

Student workspaces	*Asynchronous communication*	*Resource-base scaffolding*	*Synchronous communication*
Individual presentation areas	General discussion forum	Online course materials	Online chat
Team presentation areas Shared workspaces	Specific discussion forum	Personal notes	Shared electronic whiteboard
	Private forum, Email	Links to external sites	

one week to the next. Such activities demand that students consider the requirements of others, be adaptive, responsible and flexible.
- Personal reflection on task and process. Each student maintains a reflective journal in which personal views of progress of skills and competencies are recorded. Students consider the skills and cognitive skills they have applied, note the skills that need to be developed and develop learning goals that are carried over to the next task. This provides a strong framework for the development of personal and process knowledge.

Summary of the design features of the present study

In Figure 3 we have depicted the core elements of learning environments that provide opportunities for professional development. These pedagogic features include authentic assessment, cognitive support, social support and design of appropriate learning activities, in particular those which enable students to engage in problem solving.

1. Professional expertise requires the integration of three forms of knowledge: propositional or content knowledge, process knowledge and personal knowledge and understanding of experience. Consequently, these are skills that higher education should foster.
2. Traditional teaching (transmission of content) produces inert knowledge. Teaching for professional competence requires learners to question and apply knowledge and to become self-directed in their approach to learning. Pedagogies need to foster self-regulation and self-direction.
3. Online learning environments should include authentic problem solving tasks and integration of propositional, process and professional knowledge. Such tasks foster transfer of skills to real world problems, application of knowledge and practical demonstration of skills.

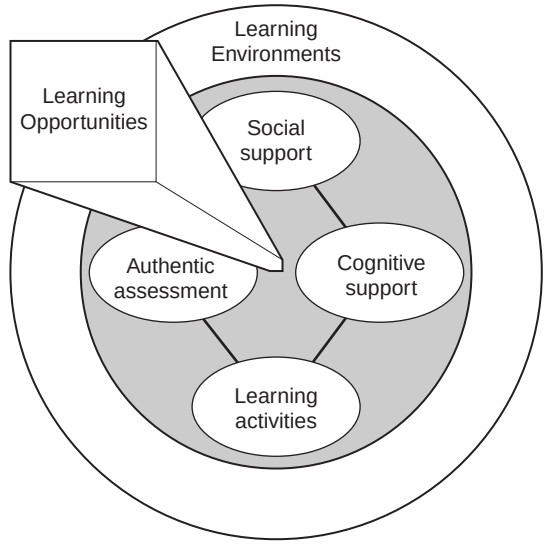

Figure 3: Design features of the online environment that foster professional learning opportunities

4. Learning needs to be deliberately scaffolded or assisted so that novices develop competence. Scaffolding can be achieved by offering social, cognitive and affective assistance in the form of help, online resources, heuristics or peer support. In an online environment, the technological tools can be harnessed to provide social support through online discussion forums, group dialogue and feedback processes. Cognitive support can be offered by providing procedural clues, problem-solving strategies, access to databases and search engines.
5. The development of professional skills is achieved through experiential learning. Tasks are designed for real world relevance and for their authenticity. Problem-based learning enables students to engage in tasks that are motivating, realistic and complex. Group-based project work encourages learners to develop multiple perspectives on the task, articulation of differences and contrasting views, resulting in a rich and robust knowledge base.

In all of these pedagogic features, the technology acts as a cognitive tool, placing the learner in control, affording shared virtual spaces for dialogue and shared visual spaces for display of work in progress.

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