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Best Practice in Online Assessment: Principles, Processes and Outcomes

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Abstract: *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 resources. Thus, information technologies are closely inter-woven with the quality of the learning experience, and can be used to create authentic tasks for assessment. The paper presents several examples of authentic assessment utilising information and communications technology.*

Introduction

If assessment defines the curriculum and encapsulates the essential learning experience in higher education, the design of educative assessment tasks could be considered to be the most important element of tertiary teaching (Angelo, 1999). Traditional university education has often operated within a “transmissive paradigm”, emphasising the transfer of knowledge from lecturer to student. The associated assessment practices would focus largely on students’ capacity to recall information and facts in a contrived situation such as an examination. Such a view of learning and assessment is not conducive to constructive, active learning where students take a pro-active role in questioning, sharing ideas and applying prior knowledge to new ideas. Moreover, traditional university examinations may not test for deep conceptual understanding (Anderson & Krathwohl, 2000). For example, an exam requiring recall of facts will encourage learners to adopt a surface approach, whereas assessment of collaborative problem-solving or teamwork on a project will emphasise communication skills, planning and decision making and foster a deep approach.

Technology support for authentic assessment

However, the increased emphasis of generic transferable skills has required a re -alignment of teaching practices with desired learning outcomes (Oliver & McLoughlin, 2001). This means that if self-regulated learning and critical skills are expected of graduates, assessment methods must foster such processes and skills. A further impetus to change is the adoption of self-paced independent learning modes and the integration of Web-based instruction for both on-campus and off-campus students. As institutions move increasingly to online delivery, there is scope for technology to support authentic assessment practices in on-line environments (Herrington & Herrington, 1998).

Gibbs (1992) emphasises that a focus on process, rather than content, is essential in promoting active learning and that evaluation and assessment procedures are central to these issues as students interpret the objectives of a course of study according to the demands of the assessment system. The relevance of this to educational technology is that we can use the attributes of technology to focus on process skills, while developing autonomy and independence by designing authentic assessment tasks. In addition, by making assessment a ‘learning event’ that develops process knowledge (rather than being a one-shot examination) we bring it closer to the context of the workplace, where professionals are expected to have self-management skills, and be able to make judgements about their own and other’s work (Bennett et al, 2000). Indeed, the capacity of technology to foster both process skills and disciplinary understanding through authentic assessment is an area of research that is now attracting a great deal of research attention (Oliver & McLoughlin, 2001b).

The role of technology in fostering learning outcomes

Information and communication technologies have the capacity to support a wide range of learning goals and are now integrated into teaching approaches of many higher educational institutions. Laurillard (2002) for instance suggests that computer-based learning has a major role in promoting:

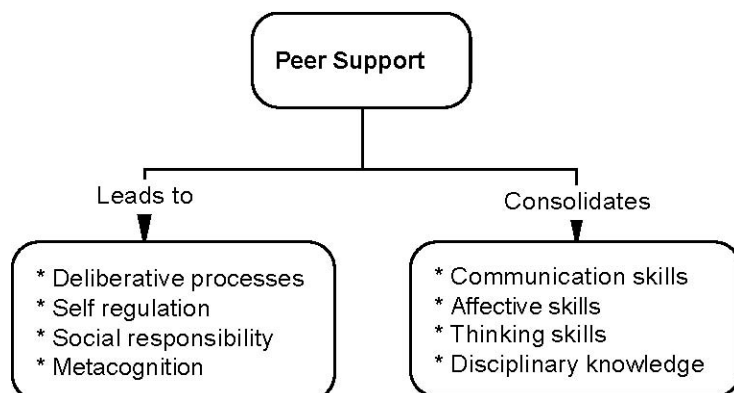
- self-directed learning and increased student autonomy;
- keeping the educational system in line with technological development;
- increased information literacy, ensuring that graduate skills are in tune with those of employers; and
- □ increased productivity and efficiency in higher education. Through computer facilitated learning, students can access WWW sites, bulletin boards and on-line resources to support their own learning in generic research skills, information literacy, retrieval and management of data. However, many students find their experience in tertiary institutions too general or out of context, and cannot transfer these skills into their own professional disciplines (Hicks, Reid et al. 1999). The integration of generic competencies into contextualised, disciplinary areas offers learners a context in which to anchor their learning. 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. Shaffer & 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.

Fostering deep learning through peer work and authentic assessment

Traditional university education has operated within a “transmissive paradigm”, emphasising the transfer of knowledge from lecturer to student. Such a view of learning is not conducive to meaningful, active learning where students take a pro-active role in questioning, sharing ideas and applying prior knowledge to new ideas. However, the increased emphasis of generic transferable skills has required a re-alignment of teaching practices with desired learning outcomes (Biggs, 1999). This means that if independent lifelong learning and critical skills are expected of graduates, teaching methods must foster such processes and skills. Figure 1 summarises the potential of peer learning to support transferable skills.

Figure 1: Schematic overview of how peer learning approaches can support generic skills



In contemporary education one influential group of researchers has identified students' approaches to be either surface level or deep level (Biggs, 1994; Ramsden, 1992). 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 assessment and teaching approaches in higher education, the implication is that the creation of an appropriate learning environment can foster a deep approach. 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. Table 2 presents an overview of authentic assessment activities using ICT creatively, and each assessment strategy is described below in detail, in the teaching-learning contexts where students were engaged in learning tasks.

	Type	Approach	Example of skills assessed
1	Bulletin board discussion	Formative	Interpersonal skills, collaboration and higher order thinking
2	Blogger	Diagnostic, Formative	Reflection
3	Portfolio	Formative & Summative	Lifelong learning, self-direction, metacognition
4	Learning Contract	Formative & Summative	Self-evaluation, peer-evaluation, collaboration, reflection metacognition
5	Self and Peer assessment	Formative & Summative	Collaboration, reflection, metacognition, Self-evaluation, self-monitoring

Table 1: Examples of online and computer-based assessment

Example 1: Bulletin Boards to support collaboration

The examples uses bulletin boards to assess collaborative skills. The Bulletin Board design consists of two main sections that students can contribute to – Teamwork and Industry Project Forum . The Teamwork section gives students the opportunity to discuss team issues, problems, faults and how they were resolved. Based on the literature on collaborative work, five group processes were identified and used to create a framework for categorising Bulletin Board interactions. The intention was to foster team skills, and so the environment was designed to scaffold or support teamwork processes. Scaffolding is a supportive process through which learner efforts are assisted while engaging in a learning or performance task (McLoughlin & Luca, 2000b). Students engaging in teamwork for the first time are often unaware of how to self-manage their own performance and that of others, while also learning new conceptual knowledge. The design of tasks was informed by the research literature on the qualities of effective collaboration as identified by researchers of computer supported collaborative learning (CSCL) Koschmann (1996). The definition of team that informed the research is that of Katzenbach and Smith (1993) which is “.. is a temporary or an ongoing task group whose members are charged with working together to identify problems, form a consensus about what should be done, and implement necessary actions in relation to a particular task area.”

Support for team formation was achieved by designing an interface where the support for communication and on-task behaviour was built into the environment. That is, for each type of communication desired, a corresponding category was established:

- Reflection on your success/failure & considering other feedback
- Team communications strategies
- Interpersonal and social skills
- Clearly defined goals & responsibilities
- Supporting and encouraging peers

The Industry Project Forum section allows students to ask questions or discuss issues related to the course and syllabus under the following headings:

- Design Issues - discuss design issues
- Project Management Issues - PM issues include client, legal, time tracking etc.
- Technical Issues - discuss programming issues
- Syllabus & unit information - questions related to marks, dates, syllabus etc

The bulletin board postings are designed to enable multiple types of response from students. In this technology-supported learning environment, it was intended to provide student support for managing group processes associated with effective teamwork (Johnson & Johnson, 2000).

Example 2: Designing the learning environment for Blogs

Team-based project work was chosen as a focus for assessment for its relevance and congruence to the learning outcomes that were sought. Project work is advocated for its capacity to support professional expertise and vocational skills and has been successful as an instructional strategy in many contexts (Collis, 1998; Klemm & Snell, 1996; English & Yazdani, 1999).

An emphasis on process-oriented approaches was adopted, rather than subject content was adopted as a means of helping student to develop generic communication skills (Biggs, 1999; Candy, Crebert & O'Leary, 1994; Gibbs, 1992; Ramsden, 1992). The researchers designed a learning environment with a focus on learner-centred activities and socially engaging tasks, rather than trying to creating "excellent" lecture notes. This approach is in contrast to traditional didactic methods of teaching in higher education institutions, which emphasise subject specific content and the transfer of knowledge from lecturer to student, which must often be memorised for examination purposes (McLoughlin & Luca, 2002a).

Through a broad review of the literature, it was found that the three elements of self-regulation, reflection and authenticity are the central tenets of instructional design needed to create a learning environment that can develop students' generic communicative and team skills (Luca & Oliver, 2003). These strategies provide a framework for developing suitable learning activities that in turn determine the required learning resources and supports needed for an effective learning environment. On the basis of this framework, learning tasks were designed with a focus on self-regulation, authenticity and reflection (Table 1). After these were established, learning supports and resources were then considered.

Table 2: Designing the learning environment

	Learning Tasks	Learning Supports	Learning Resources
Authentic	<ul style="list-style-type: none"> <input type="checkbox"/> Tasks that are contextual, meaningful, ill-defined, involving collaborative effort and are perceived as having real world relevance outside the academic setting: Developing a multimedia product based on solving the needs of a "real" client. Final product hosted on university server as a CV item 	<ul style="list-style-type: none"> <input type="checkbox"/> Support for students to build expertise and knowledge through authentic activities eg: Variety of project briefs, presentations and information helping to describe client needs <input type="checkbox"/> Tutor advice on time needed for each task and responsibilities 	<ul style="list-style-type: none"> <input type="checkbox"/> A variety of authentic resources to provide a range of perspectives eg: Online samples of past student projects Metrics used in industry for estimating time Server space for hosting projects and storing documentation
Self-directed	<ul style="list-style-type: none"> <input type="checkbox"/> Selecting projects to match skills and interest <input type="checkbox"/> Selecting other team members <input type="checkbox"/> Negotiating contracts for project topic, team members, role, duties and time <input type="checkbox"/> Determining career opportunities 	<ul style="list-style-type: none"> <input type="checkbox"/> Tutor modelling and scaffolding <input type="checkbox"/> Library support <input type="checkbox"/> Online support 	<ul style="list-style-type: none"> <input type="checkbox"/> A range of job selection criteria and online job advertisement for multimedia developers <input type="checkbox"/> Online resources - slides, templates, videos and URL's <input type="checkbox"/> Book and readers
Reflective	<ul style="list-style-type: none"> <input type="checkbox"/> Tasks that encourage reflection and provide feedback: Weekly Blogger entries for self and peer assessment <input type="checkbox"/> Reflective reports 	<ul style="list-style-type: none"> <input type="checkbox"/> Tutor led peer assessment sessions <input type="checkbox"/> Online communication, feedback and discussion with tutor and peers 	<ul style="list-style-type: none"> <input type="checkbox"/> Online Bloggers for students to view their own and peers' attitudes of progress.

Blogger design

An online Blogger was designed which enabled students to provide weekly progress and reflection of their contributions to the assigned team tasks in an open and transparent fashion. The key aims of the Blogger application was to allow both peers and tutor to

view this dialogue in order to clearly see each other's progress and help understand issues and circumstances affecting progress. Each week, students were required to make two key entries: reflections on how successful they have been in completed last week's tasks, and tasks to be completed in the coming week as part of their responsibilities to the team.

These contributions were worth 10%, one mark per entry and were allocated individually. Full marks were awarded for weekly entries of 100-200 words, which reflected an accurate account of planning/tracking history as well as reflective comments that helped the rest of the team and tutor understand the issues surrounding their tasks and progress. The purpose of using Bloggers was to help students clearly outline their tasks as agreed to with their team in weekly meetings and also their progress. By providing this information in an open and transparent fashion to both peers and tutors, students were able to communicate their progress and discuss any issues that arose.

Example 3: Portfolios

The word 'portfolio' comes from two Latin root words: 'port' meaning to carry, to move; 'folio' meaning sheet, leaf paper. Together they suggest a collection of papers (evidence) which are portable (Poehnell & Amundson, 2001, p.8). However, advances in technology have seen opportunities to incorporate multimedia techniques into the storage and presentation of portfolio materials. Hence an electronic version has emerged as a potential foundation for future portfolio development. Today the definition of a portfolio may encompass a learning process:

"It focuses on growth and development over time and can be seen as a concrete representation of critical thinking and reflection of skills and achievements; implemented through the selection of evidence for goal setting and self evaluation and therefore ongoing professional development" (Barrett, 1999, 2000).

Electronic portfolios have received widespread support and uptake in North America and Europe, with a variety of institutions incorporating portfolios as a key element of the student experience. The American Association of Higher Education lists 42 examples of university portfolio programmes at www.aahc.org/teaching/pfoliosearch3.cfm. Florida University provides one of the best examples of a university currently using portfolios (<http://www.career.fsu.edu/portfolio/index.html>). In the US and Europe, online portfolios are becoming the most common platform, whereas in Canada much of their work is still in hard copy format.

The ever-advancing capabilities of computer technology and the increased need for portability of evidence related to qualifications, knowledge and attributes means that the 'shoe-box' approach to storage is no longer adequate. An electronic version offers a different type of storage and a more flexible means of presentation – be it a PowerPoint, hyper linked text, or an Acrobat PDF presentation. Also, as a career management tool to help write job applications, students can quickly and effectively store and access large amounts of information that is easy to update, reflect upon and improve (Rogers and Williams, 1999).

Electronic portfolios focus on 'growth and development over time, implemented through selection, reflection and inspection of skills, attributes and achievements, along with goal-setting and self-evaluation' (Barrett, 2001). Additionally the e-portfolios provide the capability of directly linking students' portfolio evidence to the standards for which they may need to demonstrate achievement. These standards may include the recently introduced Edith Cowan University graduate attributes, employment or graduate studies selection criteria, or practicum and/or course assessment outcomes.

Despite the many advantages of portfolios, there are also disadvantages, many related to their implementation: 'Portfolios are messy to construct, cumbersome to store, difficult to score and vulnerable to misrepresentation (Wolfe, 1999, p.129) and there is always ' the possibility of (portfolios) becoming a useless paper chase and a futile exercise' (Wheeler, 1996, p.89). Also, a lack of technical support and assistance (at both micro and macro levels) is seen as a major area of concern with Bloom and Bacon (1995, p.2) 'highlighting that especially new students may have difficulty with the lack of structure in the process.'

The focus of the application built in this project is not on illustrating creative works or multimedia presentations, but rather on helping students collect evidence for skill development with an emphasis on continual reflection throughout the course of study. Traditionally e-portfolios come in specific forms that have a specific purpose. These include career, technical, course-specific or for general performance purposes. This e-portfolio system is general in its design, and can be utilized to generate an e-portfolio for any area without any modification to the system. In this form of assessment, students create their own digital portfolios and provide evidence to support their learning outcomes.

Example 4: Team contract

Learning contracts have been used as a means of individualising assessment and engaging students in self-directed learning. In this example, team contracts are used as a basis for assessment, To help gain commitment; students were required to complete on-line contracts at the beginning of the semester, signed by themselves, their team members', and the tutor. The contracts outlined each student's major responsibilities within the team (Table 2), and how many marks would be allocated for performing the task at a satisfactory level. Students were advised as follows:

“It is important that you select a team that has complementary skills and personality types, and are prepared to commit the same amount of effort as you. Students are required to estimate their contribution to each assessment item. With a team of **four** students you need to multiply each assessment item by 4 in column “Multiply Factor”. By doing this each student will need to negotiate their assessment and accrue 70 marks for their team effort. If there are 5 students in the team, then the multiplier will be 5, and so on.”

Table 3 - Team Contract

Assessment Items	%	X	Student 1				Student 2	
			EM	EQ	AM	AQ	EM	EQ
Project Proposal	10							
Design Specifications	5							
Rapid Prototype	5							
PM Doc 1	5							
Application Development	20							
Presentation & Online CV	5							
Evaluation Report	5							
Metrics Report	5							
Post Mortem	5							

(EM = Estimated Mark, EQ = Estimated Quality, AM = Actual Mark, AQ = Actual Quality)

Students formed teams and engaged in dialogue and assesment processes online, and negotiated their marks for each task outlined in Table 3. The result was productive and peer learning processes were in evidence.

Example 5: Self and Peer Assessment

Peer assessment involves individuals deciding on what value each of their colleagues has contributed to a process or project. Topping (1998) describes peer assessment as: “an arrangement in which individuals consider the amount, level, value, worth, quality, or successfulness of the products or outcomes of learning of others of similar status” (p.

249). This view is also supported by Falchikov (1995) who defines peer assessment as a process where individuals rate their peers by agreeing on appropriate assessment criteria and then accurately apply the assessment.

A review of the literature on self and peer assessment indicates that in order to promote the development of these skills, the environment should be designed to encourage participants to: Have a clear understanding of the objectives (Orsmond, Merry, & Reiling, 1996; Stefani, 1994); Identify valid assessment criteria (Falchikov, 1995; Ford, 1997; Klenowski, 1995; Sluijsmans, Dochy, & Moerkerke, 1999; Sullivan & Hall, 1997; Topping, Smith, & Swanson, 2000); and Accurately and objectively judge success or failure (Oldfield & MacAlpine, 1995; Woolhouse, 1999).

Self-assessment refers to people being involved in making judgements about their own learning and progress, which contributes to the development of autonomous, responsible and reflective individuals (Sambell, McDowell, & Brown, 1998; Schon, 1987). This is also supported by Boud (1992), who has expressed the defining characteristics of self-assessment as: "The involvement of students in identifying standards and/or criteria to apply to their work and making judgements about the extent to which they have met these criteria." (p. 5)

Both self and peer assessment can be used to help inform the design of the learning environment in an attempt to help make teamwork more equitable.

Self and Peer Assessment Journals

The self and peer assessment journals allowed students to fill out weekly online templates to assess their own performance as well as their peers. Students were required to firstly fill out the self-assessment journal, before being able to perform peer assessment. They were required to consider how effective they had been within the team in completing their own tasks, and discuss reasons for non-performance and any pending or important issues that may affect their team performance. Students would rate their success in completing allocated tasks according to three scales: success, quality, and time taken. This information was available to peers to help them draw conclusions about peer performance.

After students had considered their own progress, they would then assess the performance of peers. This was confidential to the tutors only, so students could discuss peer performance in an honest and open fashion without fear of being compromised or embarrassed. Peer assessment was based on the following four criteria: Was he/she regularly at group meetings and punctual? Did he/she contribute ideas, suggestions, volunteer services, cooperate and generally motivate team spirit? Did he/she complete the assigned tasks for the past week to the best of their ability? To what quality did he/she carry out the tasks assigned for the last week?

After grading each of their peers, students could give comments and reasons as to why they allocated the assessment. This was an important part of the peer assessment strategy, as tutors would need to have good reasons for negative assessments that would be considered in tutor led peer assessment sessions.

Conclusions

These examples of how ICT can be used to assess student learning indicate that a range of strategies can be employed to ensure that students develop process skills, knowledge and generic competencies that enable them to demonstrate learning outcomes. While ICT does not automatically add quality or guarantee better learning outcomes. It can however, facilitate and support processes of collaboration, engagement and reflection and create spaces for group work and teamwork. These processes, if managed within a sound pedagogical framework can provide rich opportunities for innovative and engaging forms of assessment.

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