

## The pathway to enriching teaching and assessment with technology

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**Abstract:** *Embedding learning technologies into teaching requires a range of new skills and knowledge for academics in higher education. While teaching programmes are designed for learners to achieve different learning outcomes, academics can adopt alternative teaching strategies and assessment methods to provide a conducive learning environment through learning technologies. There is a need to collaborate with technical experts to design and develop interactive materials, while academics need to acquire skills in the daily operation of networked learning environments. To implement and manage these new practices, academics need to set clear expectations as they take on different roles to guide and support students to exceed their potential. Finally, academics can review effects on student learning and teaching practice to see if changes in practice can provide further evidence of achieving the intended outcomes.*

**Keywords:** *technology, teaching, assessment*

The use of a networked electronic environment such as the Internet to promote learning (e-learning) has become increasingly important in universities in different parts of the world. More and more universities in Australia, the USA, Canada, Central and Eastern Europe, and Malaysia are shifting from providing traditional on-campus programmes to a dual mode that also offers flexible online delivery utilizing the Internet in the teaching and learning process (Tait and Mills, 1999). While information and resources can be accessed easily on the Internet and database resources through networked libraries, real-time and asynchronous communication channels are available through networked environments, learning is no longer bounded by a physical setting. Academics are expected to adopt new teaching practices even in conventional programmes to provide enriched learning experiences.

Can technologies improve student learning experiences? Laurillard (2000) remarks that networked environments provide a channel through which to develop a learning conversation between participants in which learners receive individualized feedback and develop different perspectives through asynchronous discussion activities. While technologies can be designed to engage students in active learning and help them to develop skills in analysis, synthesis and evaluation as part of their course requirements (Institute for Higher Education Policy, 2000), learners can retrieve timely and individual feedback about their performance when they participate in online activities (Palloff and Pratt, 1999). However, what are the implications for academics when planning curriculum and their practice if they want to embed learning technologies?

## Curriculum planning

When academics plan a curriculum, they are required to design what and how to teach in order to bring about desired changes in knowledge and skills. Teaching professionals need to re-examine the traditional mode of teaching, including face-to-face lectures, seminars, and laboratory or fieldwork, to identify what new possibilities are enabled by a networked environment. This may represent a gap between the individual's present level of technical competence and that required to deliver a programme with new learning technologies. Continuous professional development is necessary to become proficient in such teaching.

Faculty members need to have been made aware of the types of student learning experience made possible by technologies so that they can reappraise current practice in areas such as syllabus, curriculum, instruction and assessment (Johnston, 1999). To design a curriculum with integrated technology, Kyriash (2004: 8) advocates the 'purpose first, technology second' approach. As in Figure 1, academics need to (1) identify course aims and objectives; (2) define students' learning needs, which includes the current level of understanding of a subject and where this needs to be; and (3) to design learning activities, learning actions required and feedback provided through technologies (Laurillard, 1993). To align the assessment activities with the intended learning outcome, Biggs (2003) stresses the need to provide purposeful assessment activities when planning a curriculum.

While learners respond intuitively in face-to-face interactions, they require some lead time to reflect before responding in online interactions; however, Bennett (2004) suggests that a balanced use of these two modes can complement the strengths and mitigate the limitations of each. Faculty members may consider (1) providing extra resources for learners with different levels of understanding of a subject;

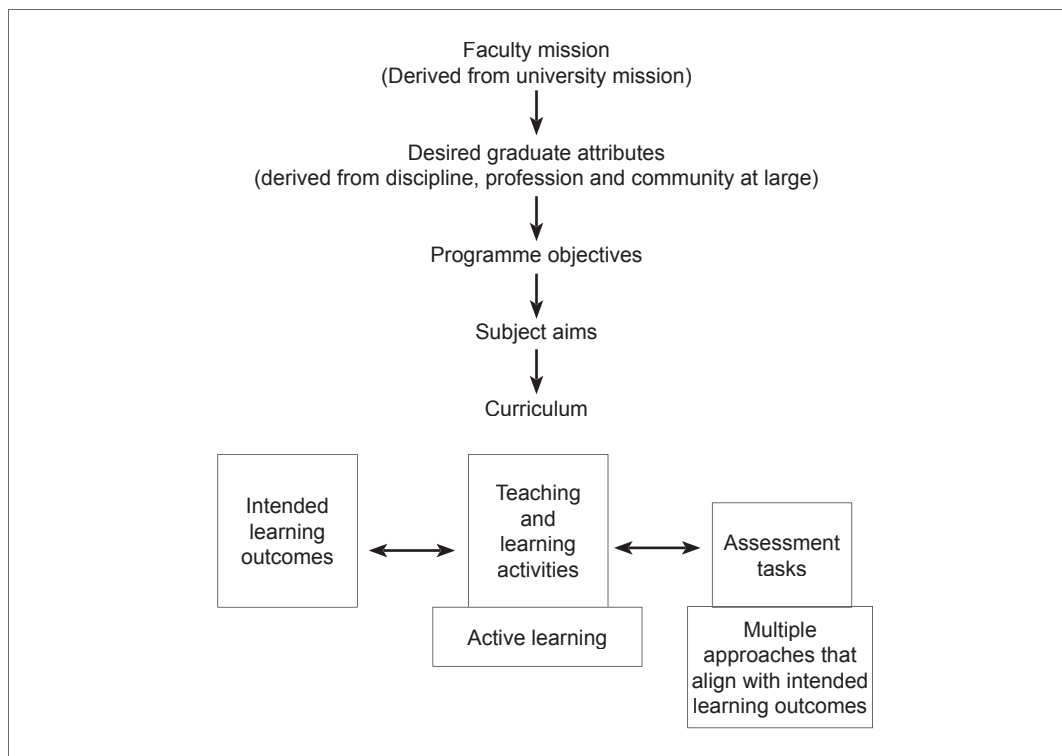


Figure 1. Adopted from Dunn et al. (2004). Curriculum design

and (2) using a mixed mode of delivery, which would include both face-to-face and online components, when planning a curriculum.

### **Selection of instructional strategies**

Having identified the aims and objectives and learners' needs, it is necessary for faculty members to have an understanding of what instructional strategies are available for their subjects and design appropriate learning activities that align with them. Based on constructivist theory (Bruner, 1996) and engagement theory (Kearsley and Shneiderman, 1999), the learning activities provided have a vital purpose for learners in stimulating thinking and constructing new ideas, and having dialogue and interactivity with peers. The goal is not merely to replicate face-to-face instructional experiences via technologies but to create new designs that will stimulate learners to take charge of their curiosity and critical thinking (Wagner, 1994).

The types of activity will naturally vary to accommodate the specific learning outcomes of the course. For example, to acquire listening, speaking and writing skills in a second language, a variety of instructional strategies can be employed. While learners can practise orally in face-to-face tutorials, they can practise and rehearse their communication skills by repeatedly reviewing recorded audio or video clips and testing their understanding with automatic feedback in computerized online exercises. Programmed activities can be provided to improve language skills (Knight, 2002). Alternatively, students can be assigned to practise drafting ideas and have them critically reviewed by their peers in open forum activities.

To enable learners to develop problem-solving and decision-making skills, case studies in contextual situations may be designed, whether they are presented in paper-based or online format (Brown, 2000). However, selecting the use of two-way technology applications such as recorded audio- and video-conferencing, e-mail and online forums can provide a history of learners' work, which can provide feedback to those learners and raise their awareness of how problems are solved and how decisions are made (Zumbach *et al.*, 2004).

In some disciplines, learners need skills in experimental work in laboratory settings to test hypotheses. Apart from doing hands-on experiments, they can also develop skills when exploring data gathered from simulated experiments. Experimenting with simulation activities on the Web or simulated scenarios through CD-ROMs promotes the development of analytical skills when learners are able to test their assumptions and hypotheses (Knight, 2002), while learners can repeat the simulated experiment and reflect on the outcome and experience.

Furthermore, to develop reflective practice, learners studying social work and nursing are commonly required to record critical incidents and reflect on what is learned (Brown, 1999). Logging the learning experiences, students can become more aware of both what and how they experience in the learning process. More importantly, reflecting on actions allows students to be proactive in avoiding repetition of the same mistakes. Students may compile their reflection in papers, but a better organization of these reflections can be done in a web log, which can be updated regularly (Dunn *et al.*, 2004).

To help learners to develop interpersonal skills and group and individual accountability in simulating a real working environment, collaborative group activities can be designed and published in a networked environment. Bennett (2004) claims that a range of communication tools and strategies are needed: learners can communicate by e-mail, through the online forum or by telephone in addition to face-to-face meetings. Group members can learn to manage problems and negotiate with other members who have encountered difficulties in group processes.

## Selection of assessment activities

Given the variety of learning activities students can experience, some of them will be used for assessment. The ways in which student learning can be assessed fall into two main categories: formative assessment, in which regular feedback should be provided to students; and summative assessment, which indicates learners' performance (Miller *et al.*, 1998). Assessment can focus on a variety of activities, either alone or in combination, including research and analysis, a dissertation or thesis, a project, a portfolio of work, clinical fieldwork, laboratory work, independent and self-directed study, oral presentation, and original writing (Glasner, 1999; Knight, 2002). However, levels of ability in a broader range of professional knowledge and skills can be assessed through the use of learning technologies. A number of academic subjects have adopted both conventional and innovative assessment methods. For example, students in some subject areas are required to give audio-visual or video-taped presentations in addition to coursework and written examinations (Glasner, 1999). This allows students to demonstrate practical skills and knowledge through the use of multimedia presentations.

While teaching staff in the majority of subjects test the understanding of course content through closed-ended questions in a multiple-choice format, they can also assess students on their understanding of the subject by using electronic multiple-choice testing. Questions and options can be selected at random from a large database of questions. Because the ratio of tutors to students is increasing, the use of automated comment banks can provide prompt feedback to students (Freeman and Lewis, 1998). However, there is no guarantee that this type of assessment activity will be done by students individually unless it is conducted with supervision.

Students may be assessed on their ability to solve problems or to demonstrate critical thinking skills by investigating authentic cases in groups in their subject disciplines (Brown, 1999). In this case, the online environment provides a flexible space for this type of collaborative project work. Students can be divided into small groups, members of which are required to demonstrate those skills by sharing and debating their findings in online discussion forums. Graham and Misanchuk (2004) suggest that group and individual accountability can be made possible with the inclusion of peer evaluation and self-evaluation, while individuals report their contributions and reflections during the process against professional criteria and standards.

Furthermore, students in some subjects, commonly art and design and architecture, can be required to demonstrate their creativity by collecting samples of their best work into a portfolio (Brown, 1999). Students will need to compile evidence of initial ideas, lines of thought developed and the final product. Portfolios can be structured so that they contain evidence to demonstrate a learner's professional development by documenting their experiences and reflections. Presenting a portfolio in an electronic format offers a much greater degree of freedom and thus allows greater creativity.

New technologies provide a range of alternative methods of assessment. These assessment activities can (1) provide prompt feedback to learners; (2) consolidate concepts in the learning process; (3) demonstrate skills and knowledge; (4) allow learners to document a learning history, which may be used as part of their career portfolio; and (5) provide further evidence of student achievement that cannot be collected in conventional types of assessment. Academics can identify a mix of online and conventional assessment activities and select whatever are most suitable for their own situations. They may also consider the weighting to be given to these activities. For example, according to a study by McFann (2004), when they assigned a grade for a course, six of the twenty academics interviewed allocated between 10 and 30 percent of that grade for participating in online discussions and in-class activities.

## Designing and developing materials with learning technologies

If academics aim to design and develop interactive materials for use in a networked environment, this demands technical competence and encompasses a range of technical skills. Academics may even have to undertake technical roles related to media production if they are expected to design and develop these materials (Hughes et al., 1997).

It would be a steep learning curve for most academics if they had to handle the entire programme single-handedly. Thus, teaming up with technical staff is desirable in all phases when designing and developing these materials. This includes teaching staff, who write the teaching materials; an educational technologist, who provides advice on materials organization and presentation in the networked environment; and a team of technical staff who have expertise in graphic design, media production and web programming (Ryan et al., 2000). Universities may have in-house production teams, which may include computer interface designers, instructional designers and data resource personnel to support the design and development of materials. Academics may consider other options, including the use of off-the-shelf commercial products, outsourcing to production houses or recruiting technical teams for in-house production, depending on the type of support and resources available. Alternatively, they can develop some technical skills so that they have greater control over the design and development of materials, and they will have more flexibility in the maintenance and updating of these materials. They can also attend hands-on workshops organized by their institutions.

## Implementation and management of learning technologies

Students will have developed a strong dependence on their teachers during their primary and secondary schooling. Therefore, they cannot automatically be weaned off this habit of dependence and become self-directed in an electronic environment in tertiary education. McDowell and Sambell (2000: 77) remarked that ‘Students were not necessarily willing or able to accept higher levels of independence and responsibility’. To help students to develop from being dependent learners to independent learners, they need to be oriented towards the teacher’s expectations and be given guidelines for online activities and their own roles in the online learning community. Academics need to demonstrate technical skills if activities are new to students and to spend more time guiding and interacting in both face-to-face and electronic communications. However, not all students participate equally. To encourage students to take advantage of constructive discussion, Selinger (2000) reported that lecturers assigned a variety of tasks such as critiques of research reports, debates on current issues and group assignments in both face-to-face and online activities. To make this process run smoothly, faculty members need to set clear guidelines and expectations, sequence tasks and activities from simple to complex, and provide good support. They also need to manage students’ questions, acquire skills in facilitation, and monitor and manage student progress and behaviour through the Web platform.

However, academics need to bear in mind that group size is critical in determining the efficiency of such activities. A small group is particularly important in an asynchronous environment, where large numbers of people may stall the decision-making process. Three to four students per group is optimum for group projects, eight to fifteen students for discussions, and around twenty for seminars (Harasim *et al.*, 1995). Faculty members need to organize private forums for group preparation and an open forum for presenting final reports. This allows participants to read other presentations and to ask questions or make comments.

McLoughlin (2000: 124) suggests that academics need to take on different roles, as facilitators overseeing and guiding students’ progress, as ‘mentors’ and ‘co-discussants’ when students reflect on their learning experience, and as ‘co-learners’ when experiencing new issues with students. While roles in teaching are changing, Selinger (2000: 97) remarked that moderating virtual meetings and facilitating group discussion

is 'an emerging skill'. Anyone taking on the role of moderator needs to pay greater attention to the social dynamics and patterns of interaction (Kimball, 2002). In networked environments, faculty members need to be sensitive to individuals or groups that appear to be disadvantaged or are not participating. They need to explore possibilities for online collaboration to encourage full participation. Consequently, they need to observe online behaviour to ensure that there is no exploitation by a dominant group or harassment of any kind, to encourage passive viewers who make no contributions and to help those who encounter technical problems (Salmon, 2000). From time to time, faculty members need to show their presence, i.e. motivating in the initial stages, making encouraging comments when students are heading in the right direction and asking probing questions if students are unsure and have problems researching topics.

Furthermore, when innovative assessment methods are chosen in addition to a timed written examination, whether students are required to do electronic multiple-choice quizzes or participate in online group projects, there are key steps to take in their implementation (McDowell and Sambell, 2000):

- a discussion with students on their experiences of conventional forms of assessment before the introduction of new forms of assessment;
- provision of clear guidelines and a substantial induction programme to help students to become familiar with the purposes of new assessment activities and assessment criteria;
- maintenance of frequent communications and provision of prompt feedback during the assessment process; and
- allocation of fair marks for effort and product.

### **Evaluating uses of learning technologies**

Teaching staff may design customized evaluation questions on the uses of learning technologies in addition to the standardized, university-wide evaluation for courses and programmes offered across faculties and departments. They may also want to identify factors that affect the quality of learning when integrating technology into their teaching. Evaluation can be about exploring interactions between students in networked environments, or faculty members can focus on specific issues (Offir *et al.*, 2001).

Apart from evaluating users' perceptions of their uses of learning technologies, faculty members can evaluate a student's level of participation and quality of contributions in assigned individual and group activities to assess whether they have achieved the intended learning outcome. However, Bonk *et al.* (2004) comment that assessment and grading in online activities that embed group interactivity are an unresolved area for academics, and constructive assessment techniques should be explored further. While there are many factors that affect how students learn when learning technologies are not the only medium for accessing resources and providing interactions between learners and academics, improvement of learning outcomes may not be achieved merely as a result of their integration into conventional teaching. However, academics should not be discouraged from investigating alternative methods in teaching and in assessment of student learning, such as the use of computer-based testing (McFadden *et al.*, 2001), student attitudes towards learning and using technologies (Liu and Johnson, 2001) and the impact of online activities on student learning (Hodgson *et al.*, 2001; McFann, 2004). Academics can subsequently refine their content and teaching methodology to match students' needs for the next cohort (Palloff and Pratt, 1999).

### **Conclusion**

To promote learning in many university disciplines, technologies can provide a wider range of opportunities than conventional teaching. Learners can interact in the classroom or through technologies, allowing

them to respond intuitively and reflectively and enabling them to move from dependence on their teachers to a state of interdependence between learners and facilitators. However, academics may require a range of skills and knowledge to introduce learners to new practices, although it may not be apparent to them that embedding technology can lead to a change in teaching strategies, assessment methods and implementation processes. Teaching programmes can be better planned and delivered if academics have these items in their toolkits. They may find that learners are better engaged through alternative learning opportunities, although more research is required to evaluate the efficacy of the new methods.

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