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Learning designs: Bridging the gap between theory and practice

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This paper summarises the work being conducted in an ongoing research agenda focused on exploring how the ‘learning design’ construct can be used to support university educators to create both pedagogically sound and interoperable e-learning experiences. The premise of this work is that a learning design can be used to support the pedagogical design process and the integration of international e-learning standards, such as learning object metadata and IMS-LD, enabling resources and tools to be technically interoperable across different standards-compliant systems. The paper presents the rationale guiding this research focus, describes the features of the research that is underway, and outlines future directions of this research.

Keywords: learning design, university, education, design, e-learning, online learning, online teaching

Introduction

In university education, online technologies have driven major change, transforming both on-campus and distance learning by encouraging greater participation and improving access. University teachers worldwide now find themselves, almost routinely, designing online learning as a complement or replacement for face-to-face classes. There is no shortage of tools to use, the predominant being the institutional learning and/or content management systems. Yet, many teachers are not implementing learner-centred approaches that make effective use of online technologies (Herrington, Reeves & Oliver, 2005). Instead, they are continuing to use conventional information delivery or content-focused approaches. As a result, strategies that foster high quality learning are not consistently finding their way into practice. This is despite significant advances in understanding about what constitutes good university teaching (Biggs, 2003; Ramsden, 1992). Furthermore, while university teachers may be disposed to changing their teaching practices, the added complexity of teaching online (Bennett & Lockyer, 2004) may make this process too daunting.

Thus, designing effective online learning experiences remains a significant challenge for university educators. There is a range of expert advice available for online teaching (cf. Bates & Poole, 2003; Laurillard, 2002; Salmon, 2002) and a multitude of descriptive case studies and applications can be found in the educational literature. Various professional development approaches have also been implemented to help university teachers improve their online teaching (McNaught, 2003; Littlejohn, 2002; Taylor, 2003; Wilson & Stacey, 2004). What is missing however, is the practical, relevant and flexible supports and tools that university teachers need as they design for online learning. Importantly, these design supports need to be embedded within the learning management system so as to provide guidance and support in a just-in-time and contextual manner.

Currently, the lack of embedded design support limits existing approaches because a teacher must either start with an empty shell or use a pre-existing contextualised course. Both of these options do not offer guidance about opportunities for different teaching and learning strategies or when and why to use certain tools that might facilitate those strategies when adapted to different contexts. The idea of embedding design support within the online environment of a learning management system is an area that has not

been explored. This is the ultimate research goal guiding this research team. Herrington, Reeves and Oliver (2005) concur as they conclude:

...producers of course management systems need to provide software that more appropriately guides online teachers to a range of innovative strategies reflecting contemporary constructivist philosophies and advances in learning theories (p. 365).

Research vision: Learning designs as a tool to support online design

The research team propose that 'learning designs' offer a means to providing effective design support. A learning design describes the sequence of tasks that learners undertake, as well as the content resources and support mechanisms required to help learners complete the tasks.

Using learning designs as a communication mechanism to document and share 'good practice' for teaching and learning is an idea that is gaining interest. For example, in Australia, it is being applied in various ways across educational sectors, such as, to promote multiliteracies in school education (Lockyer, Brown & Blackall, 2003; Kalantzis & Cope, 2005), and to disseminate e-learning strategies in vocational education, (www.flexiblelearning.net.au/designing). In higher education the concept has been used to document over 30 high quality multi-disciplinary learning designs that make exemplary use of information and communication technologies (ICTs) as part of the *Information and Communication Technologies and Their Role in Flexible Learning* project that was funded by the Australian Universities Teaching Committee (Agostinho, Oliver, Harper, Hedberg, & Wills, 2002). These learning designs were selected by an international panel of expert reviewers using an evaluation prototype based on principles of high quality learning in higher education, developed for the project by Boud and Prosser (2002).

High quality designs were defined as those that engage learners' prior knowledge and experiences, set learning effectively within the broader context, challenge learners through active participation and encourage learners to articulate their understanding to themselves and peers (Boud & Prosser, 2002). The learning design documentation provided in this project included: information about how the design was derived from theory and/or practice, research evidence to support the approach, guidance for how it should be implemented and ideas about how the design might be adapted to other learning contexts. A graphical representation was developed that serves as a visual summary of the learning design as that experienced by the learners (Agostinho et al., 2002). Preliminary research into university teachers' interpretations of the learning designs indicate that the formalism can be readily understood and adapted to support the design process (Agostinho, 2006; Bennett, Agostinho & Lockyer, 2005)

Our research focus is to explore the use of the 'learning designs' concept as a basis for the development and research of online design support that is embedded within the learning management system environment. Designing consists of activities, such as planning schedules, writing course outlines, preparing materials, determining assessment tasks, and anticipating students' needs (Lockyer & Bennett, 2006). Designing may involve modifying a previous course, updating material or trying new strategies. Much of the design work for online learning occurs within the environment of a learning management system (LMS) such as *WebCT*, *Blackboard* and *Janison Toolbox*. These systems for administering, designing and facilitating online learning are common in Australian universities.

The key to using learning designs to support the design process is to embed them within the LMS. This proposed strategy will provide support within the online environment, in the context and at the time it is needed. Rather than provide models to be applied or templates to be completed, the strategy will give teachers the flexibility to customise the learning design to suit their context. This places the teacher in the mediating role of professional decision maker rather than prescribing a particular approach, and seeks to further develop professional knowledge and judgement.

This is an entirely new strategy in supporting online design. None of the major learning management systems currently embed specific supports for designing for effective learning. All provide functions to help teachers create and arrange content, and add communications tools. All provide technical support manuals. Recent developments have focused on expanding the range of teaching and learning tools available within a learning management system (LMS) (eg. www.moodle.org) or developing a visual interface to help teachers create 'digital lesson plans' external to the LMS that can be stored and used by others (Conole & Fill, 2005; Dalziel, 2003). But none offer guidance within the LMS about how the tools might be used to promote high quality learning.

The research team is also investigating the use of current and emerging international standards for sharing educational designs and integrating digital resources. These two particularly relevant areas have been the focus of frenzied technical research, but have had little practical application in education. The first is the IMS Learning Design (IMS-LD) specification, which is a standardised computer language developed specifically for describing educational processes (Koper & Tattersall, 2005). The second is the international technical standards that relate to learning object technology. Learning objects are digital resources made available through online collections that can be searched, allowing teachers to locate appropriate content and activities to integrate into their materials (Koper, 2005).

The vision is that a single lesson or whole course could be saved as an IMS-LD document and then read into any LMS compliant with the standard (illustrated in Figure 1).

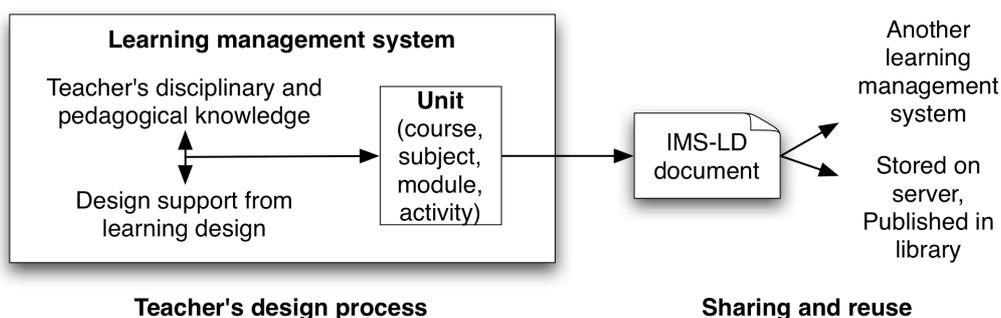


Figure 1: Applying international standards for sharing and reuse

After creating a lesson or course in an LMS and saving it as in IMS-LD document, a teacher could share it within a teaching team, institution or digital library, allow it to be edited in any other LMS that complies with the standard, and the new version could be saved as a new IMS-LD document. This new application of IMS-LD strategy has great potential to not only make particular lessons or course sharable/interoperable so that they can be reused and adapted by others, but for the learning designs on which they are based to also be shared and reused.

This is the ultimate research vision for the team. Work in progress towards this vision has involved the development of a software prototype to explore how learning designs can support the design process and the reuse of learning objects (see Bennett, Agostinho, Lockyer, & Harper, 2006.). The rationale for the prototype is that learning objects are resources and learning designs serve as a pedagogical framework into which learning objects can be incorporated. How learning designs can be captured in IMS-LD is also being explored through enhancements made to the prototype. An explanation of the prototype is provided in the next section.

Research work towards the vision

Prototype development

The prototype developed guides the user in a step-by-step process to contextualise a selected learning design according to the subject/topic, the particular tasks the students need to complete, what resources or learning objects are required and how the students are to be supported in the learning setting. The output from this process is the generation of an IMS-LD compliant 'unit of study' (Koper, 2001).

The initial research focus for the prototype was to explore how a teacher could be supported in the design process to incorporate learning objects into pre-defined learning designs. The software prototype comprises two editors that can be invoked from the main menu as shown in Figure 2.

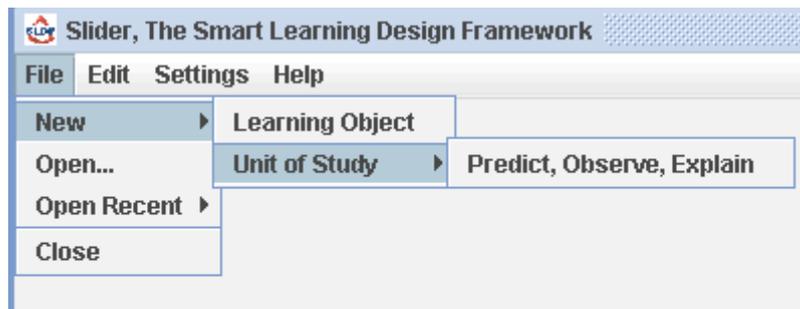


Figure 2: Main menu showing the option to create a unit of study based on a learning design

The Learning Object Editor provides the basis for converting existing resources into a ‘digital item’ in MPEG-21 format either as single files or as groups of associated files (eg. Web site). The designer can then create a metadata record based on a simplified version of LOM (Agostinho, Bennett, Lockyer, & Harper, 2004) which is associated with the digital item. This technical process turns resources into ‘learning objects’ that can then be located and referenced through the system using their metadata records.

The Unit of Study Editor guides the user in choosing a learning design that is pertinent to the subject matter and context. Currently this choice is limited to the learning designs and guidance that were the outcomes of the *Information and Communication Technologies and Their Role in Flexible Learning* (Agostinho et al., 2002), although provision is made in the design of the system for expansion of the options available. After a learning design is chosen, the author selects appropriate learning objects with assistance provided by the integrated help system and via the intelligent interrogation of the learning objects’ metadata. Invoking the Unit of Study menu as shown in Figure 2 reveals choices of learning designs. In the current implementation, the learning design Predict, Observe, Explain (POE) (Kearney with Wright, 2002) can be chosen (see Figure 3). The question mark icons indicate the availability of further written information, which appears in a pop-up window.

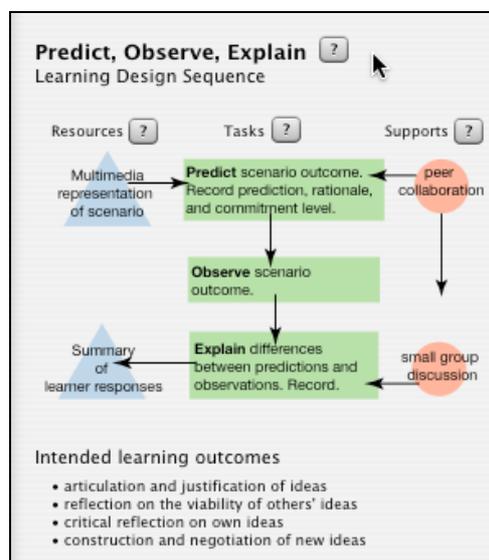


Figure 3: Representation of learning design as presented on the screen

For this learning design, students are required to follow a three-step process: (1) make a prediction based on a given scenario; (2) observe the outcome of the scenario; and (3) explain any differences between their prediction and observation. The learning objects to be included in this learning design are an image to visually describe the scenario and a video clip to illustrate the outcome of the scenario.

The process of creating the unit of study (UOS) consists of the following three steps.

Contextualise the learning design

The authoring process consists of entering the necessary contextual information and selecting appropriate learning objects to develop the unit of study (see Figure 4). The form displayed on the screen contains the

pedagogical elements required to build this unit of study. The pedagogical elements were identified by analysing how the required resources, tasks and support would be operationalised. For a simple design like POE this was a relatively straightforward process, but for more complex design it can be time-consuming. Ultimately, the system will also included options for the teacher to adapt the design by adding or rearranging elements as they wish.

Provide metadata to describe the unit of study (optional)

The author can provide information to describe the unit of study (see Figure 5). This can be used to provide information about the unit of study for other teachers when sharing this unit of study. The metadata scheme used was developed specifically as part of this project developed from the IEEE LOM standard for learning objects (IEEE, 2002). A different profile was developed for the UOS because many of the items relevant to learning objects are not readily applicable at the UOS level, largely due to differences in granularity (for a full description of the UOS metadata, see Lukasiak, Agostinho, Bennett, Lockyer, Harper, & Powley, 2005)

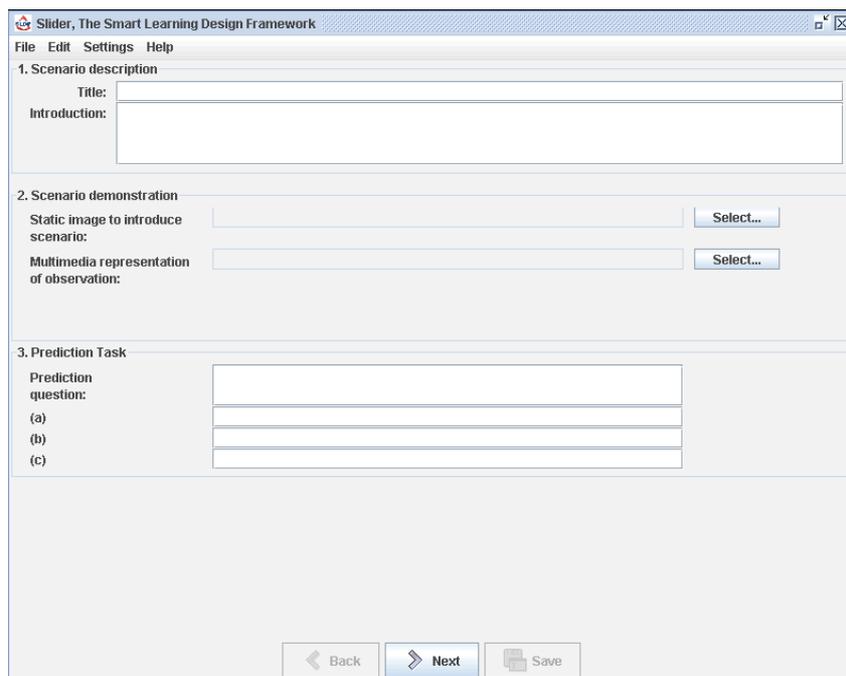


Figure 4: Contextualising the learning design

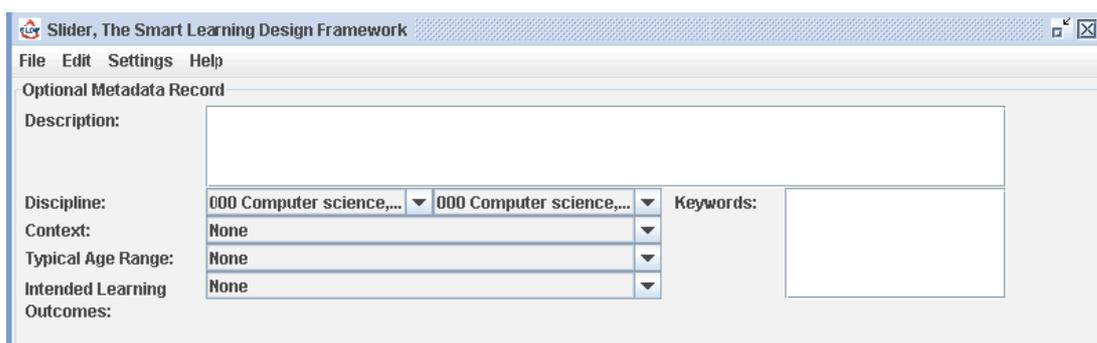


Figure 5: Provide metadata to describe the unit of study

Select form of delivery

The prototype demonstrates that only a single unit of study need be developed yet can be delivered to the intended audience in different formats. For example, the POE unit of study can be delivered to the learner in the form of a web site (which the student can work through as an online experience) or as a hard copy worksheet (which can be used in a face-to-face class). In addition, selected metadata describing the context of the unit of study can be provided (in the form of teacher notes). Such information can be useful for appropriately deploying or reusing the unit of study. One or all three outputs can be selected, allowing for variations in delivery including fully online or blended variations of the same unit of study.

An enhancement to the prototype is the provision of exporting the unit of study as an IMS-LD package. The research team is currently examining how learning designs can be captured in IMS-LD. The thinking that is being explored is to separate the pedagogical elements a teacher needs to think about in terms of creating the learning design (as illustrated in Figure 3) from the technical information required to make a unit of study IMS-LD compliant. In doing so, the team is examining how much of our learning design construct maps against the mandatory elements of IMS-LD to determine how much can be automatically generated to automate as much of the mandatory elements of IMS-LD as possible to minimise the burden for the teacher to complete.

There are a number of advantages offered by this approach.

- By separating the thinking about pedagogy from the technicalities required to make the courseware interoperable the focus of the design process is on the pedagogy.
- The system provides support for the teacher to adapt a high quality learning design as the basis for the unit of study. (IMS-LD is pedagogically neutral and therefore does not support any particular approach to teaching and learning.)
- Use of the learning design construct provides an interface for a teacher or designer to interact with without requiring any knowledge of IMS-LD. Heinrich (2005) argues that whilst IMS-LD seems like a promising approach to describing learning designs, there is a need for support tools to “present learning designs in a format easily comprehensible by an instructor” (p. 27).
- The use of automation wherever possible for the completion of IMS-LD fields makes this approach much less daunting than the forms provided in other tools.

Thus these advantages aim to support the teacher to not only create a learning experience that has the potential to be pedagogically sound but also be interoperable between standards compliant systems, and therefore sharable between communities of teachers and designers.

Ongoing research into learning designs

This work has formed the basis for an ongoing research agenda for which the authors have been successful in attracting national competitive grant funding. The work will be guided by four research questions:

1. How do university teachers design learning experiences?
2. How can ‘learning designs’ support university teachers in designing for online learning?
3. How can international technical standards be applied to describe ‘learning designs’?
4. How can an online learning management system that incorporates ‘learning designs’ support teachers in the design of online learning experiences?

This research will develop an understanding of the role that learning designs can play as an online support, in facilitating university teachers’ design practices.. The project approach is characterised by three features:

- It involves researchers collaborating with practitioners to identify problems in terms of previous research and current practice; to devise solutions that can be tested; and to evaluate those solutions within realistic contexts.
- It is an iterative process in which evaluation feeds back into the design process to allow testing and refinement of solutions.
- The outcomes will generate new knowledge that is directly relevant to practice.

Participants

The project will involve university teachers across three broad disciplinary groupings: the Sciences, the Arts and Humanities, and the Professions. A teacher’s assumptions about approaches to teaching and learning are largely determined by the discipline in which s/he teaches (Silver, 2003). Thus, involving practitioners from each group will ensure collection of a range of perspectives.

A reference group (RG) comprising six university teachers (two from each discipline group) will be established at the beginning of the study and will be involved throughout. The university teachers will be recognised experts in their disciplines who have received national teaching awards and have disseminated their ideas via scholarly publications. The role of the reference group is to inform the initial analysis of theory and practice, participate in the evaluation phases, and contribute to the interpretation of the

findings. A practitioner group (PG) of university teachers representing each discipline group will be recruited to participate during in the analysis and evaluation phases of the project. The practitioner group will comprise of participants from different teaching career stages and with varying expertise in teaching online. Participants will be drawn from both metropolitan and regional universities in south- eastern New South Wales to ensure the sample is representative of the broader Australian university sector.

Process

The project will consist of three phases. Figure 6 highlights the activities to be conducted in each phase and how all participants will be involved.

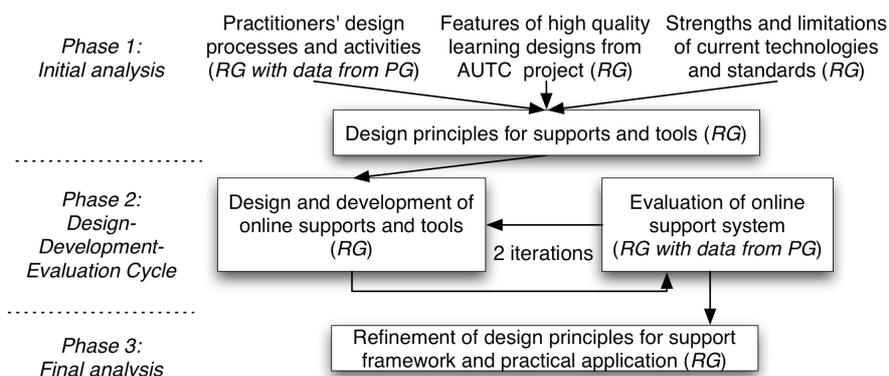


Figure 6: Project process and timeline

Phase 1: Initial analysis

The purpose of this phase is to derive principles for the design of the online supports and tools by drawing together findings from three initial research activities. The researchers, informed by the reference group, will use the outcomes of each of these investigations to derive and document the principles that will underpin the design supports and tools. These principles will define how the learning designs will be integrated with teachers' design practices and how the technical standards will be adopted to enable support to be embedded within the learning management system.

1. Identify practitioners' design processes: The outcome of this activity will be a description of the processes university teachers undertake when designing for online learning. As little is known about how university teachers design for online learning (Goodyear, 2005), the researchers will investigate the range of processes and activities university teachers typically engage in when designing for online learning, how they make design decisions, and the considerations and factors that influence the final design. Pedagogical and practical aspects will be explored through focus group interviews with members of the practitioner group (representing each discipline group). The interviews will be conducted within discipline groupings to promote discussion of discipline-specific approaches and assumptions about designing for learning. Interview data will be analysed to identify patterns in design across disciplines. The interviews will also be important in developing a better understanding of context-specific factors that influence design decision-making.
2. Analyse high quality learning designs: The outcome of this activity will be the identification of the features of high quality learning designs that must be incorporated into the online supports of a learning management system. The project will use the evaluated learning designs from the AUTC-funded project: *Information and Communication Technologies and their Role in Flexible Learning* (Agostinho et al., 2002). The reference group will select a subset of the learning designs most likely to support good teaching within or across disciplines. The researchers will identify the features of these designs that will need to be integrated into the online support within the learning management system, including the design activities teachers will need to undertake and the learning interactions that the LMS will need to support.
3. Evaluate international technical standards: The outcome of this activity will be the identification of appropriate international technical standards for online learning that will support practitioners' design activities and the learning processes contained in the selected learning designs. The team will investigate leading edge technologies and standards, such as IMS-LD and learning object technologies to determine their applicability. The researchers will determine how these can be employed in the software, and develop and test prototype tools. The technical and commercial implications of incorporating these standards into the learning management system will also be considered.

Phase 2: Design-development-evaluation cycle

The next step in employing learning designs to support the design process will be to embed them within the learning management system, and implement tools that enable the design activities and processes practitioners use. The purpose of this phase is to operationalise the principles derived in Phase 1, through a cycle of design, development and evaluation involving the following.

1. Design and develop the supports and tools and embed into the LMS: The researchers will develop design specifications consistent with the principles identified from the initial analysis and work to determine how technologies and standards can be used to support design activities. For example, issues for investigation are how learning designs can be captured in IMS-LD to be exported to other systems and how access to learning object repositories can be embedded in the online system. The research team will work collaboratively throughout this process with the programming team of Janison Solutions to prototype and refine the software. In addition, the reference group will engage in a usability testing protocol as the online support for the LMS develops.
2. Evaluate realistic use of the supports and tools with practitioners: Evaluation of the system by practitioners representative of the ultimate users of the system is an essential part of this project. Two iterations of the cycle will allow for two evaluation periods, each time involving members of the practitioner group.

As teachers design their courses over days, weeks or months, it is not feasible to investigate this process naturalistically within the timeframe of this project. Instead, the evaluation process will involve each participant undertaking a simulated design exercise relevant to a course or lesson they wish to re-design. This approach has been successfully pilot tested in preliminary research (Bennett, Agostinho, & Lockyer, 2005). Each participant will be asked to choose a learning design they would like to adapt to their own teaching. The participant will then work through design activities using the online supports and tools in the presence of one of the researchers, who will observe the process. A retrospective interview will be conducted upon completion of the exercise to elicit further reflections from the participant. After all individual exercises have been completed the participants will be assembled for a focus group interview to further explore any issues raised.

Data in the form of interview transcripts, field notes and documents produced during the evaluation activities will be analysed using a process of data reduction, data display, and conclusion drawing and verification (Miles & Huberman, 1994). This will entail stages of summarising, coding, and identifying themes in line with constructs derived from the research questions and those that emerge from the data itself. The findings will be used to revise the supports and tools, and improve the usability of the online system, and thus further refine the understanding of teachers' design processes and how these can be best supported.

Phase 3: Final analysis (Year 3)

The purpose of this phase is to distil the design principles and document their practical application in the form of naturalistic generalisations (Lincoln & Guba, 1985) that are useful to practitioners. The reference group will refine the design principles based on the findings from the initial analysis and the evaluation process, and document the implications for the theory and practice of learning designs as a support for designing online learning. Thus, the lessons learned from this research will contribute to the body of knowledge about how university teaching can be improved.

Conclusion

This paper has presented an ambitious research agenda, one that is focused on supporting university educators to create both pedagogically sound and interoperable e-learning experiences. The premise of this research is based on the use of a 'learning design' construct as the key tool to support the design process. The research vision is to embed this specific support tool within a learning management system. This is an entirely new strategy to support online design as there is currently no pedagogical support provided in the existing major learning management systems. The findings from the research work conducted by the authors to date confirm that the 'learning design' construct has merit and thus our research agenda remains on track as it forges new paths in education for the 21st Century.

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