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ARTICLE

Investigating University Educators' Design Thinking and the Implications for Design Support Tools

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All university educators perform design work as they prepare and plan learning experiences for their students. How such design work is undertaken, conceptualised, and optimally supported is the focus of ongoing research for the authors. The purpose of this article is to present the results of a research study that sought to gain a richer understanding of university educators' design work; investigate how the idea of Learning Design could support design work; and examine how learning designs could be made available within a Learning Management System (LMS) as a design support tool.

An overview of the outcomes from the entire research project is presented. The project's aims and outcomes and what was achieved are explained and potential future directions for this area of research are discussed.

Keywords: learning design; learning management system; virtual learning environment

Introduction

The routine design work that all educators perform when preparing and planning learning experiences for students is an important part of their role. For university educators, designing effective learning experiences requires them to draw together their specialist domain expertise with appropriate teaching strategies, while integrating the range of digital technologies that are now commonplace in higher education. This represents a significant challenge for even the most experienced university educators, one which has been supported by institutions and professional bodies, and through funding initiatives such as the UK's JISC (http://jisc.ac.uk/) and Australia's Office for Learning and Teaching (http://www.olt.gov.au/).

The field of Learning Design has developed a particular focus that is concerned with this routine design work done by educators to create learning experiences for their students. Learning Design refers to ways in which educators can document, model, implement, store, share, adapt and reuse pedagogical ideas. It has a particular focus on guidance (providing tips and advice to educators), representation (documenting pedagogical ideas in consistent way) and sharing (enabling educators to build on the work of others by reusing and adapting pedagogical ideas). Learning Design has emerged as a particular branch of educational research and development that seeks to understand and support the design processes inherent in teaching. This body of work is underpinned by the premise that supporting university educators as they conceptualise, plan and prepare a unit[1] they are to teach in an upcoming academic session will result in more coherent and engaging learning experiences for students, with flow-on improvements in learning outcomes.

This premise for design support has generated a multitude of different approaches, contributing to different aspects of Learning Design (see the Learning Design Conceptual Map, Figure 4 in Dalziel et al. 2013). Some have focused on developing tools to support design by helping educators think about and make decisions about their design ideas (e.g., The Learning Design Support Environment (LDSE) project explained in Laurillard et al. (2013); and see Conole (2013) for a review of Learning Design tools). Others have sought to support the sharing of 'good' design ideas through repositories or online networking tools (e.g., online community sharing (http://cloudworks.open.ac.uk/), and collections of examples or cases (e.g., http://www.pedagogicalpatterns.org/, http://www.learningdesigns.uow.edu.au/). These efforts have been complemented by investigations into different ways in which designs can been effectively represented, e.g. see Agostinho, Harper, Oliver, Wills, and Hedberg (2008), Agostinho (2009), Agostinho (2011), Agostinho, Bennett, Lockyer, Jones & Harper (2013); Conole (2013); and McAndrew and Goodyear (2013). Another line of work has sought to understand more about the fundamental design processes educators adopt in an effort to identify the context in which design occurs, the types of decisions that are part of the design process, and where support might be best located (e.g. Bennett et al., 2011; 2015).

The purpose of this chapter is to present the results of a research study that contributed across several aspects of

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learning design work – namely to understand more about the nature of design work as part of the *teaching cycle*[2], to identify factors in the *learning environment* and explore how they influence design decisions, and to inform the design of tools and specifications to support *guidance, representation* and *sharing*. The project was conducted by an Australian research team with technical input from the Australian developers of a learning management system (Janison Solutions) and researchers from the Open University of the Netherlands. The aims of the project were to:

1. Advance understanding of university educators' design practices by interviewing university educators about how they undertake design (Investigation 1);
2. Improve the methods used for selecting and representing high quality learning designs from real-life cases by reviewing an existing learning design repository and developing a refined learning design representation (Investigation 2); and
3. Determine the feasibility of integrating learning design specifications (IMS-LD) into design support tools within the learning management system (Investigation 3).

Below is an overview of the entire project that provides the background to our work, followed by an explanation of each of the three main investigations (aligned to the project aims as seen above) and a discussion of the key outcomes. A reflection on the outcomes is presented in terms of future directions for research and practice in this area.

Background

The idea for this study developed from research conducted by the authors between 2002 and 2005, and prior to that from their involvement in the Australian University Teaching Committee (AUTC) project, *ICTs and Their Role in Flexible Learning* (2000–2002). The AUTC Learning Design project collected and described examples of teaching practice in higher education that made effective use of Information and Communication Technologies (ICTs). The outcome was an online repository of 32 exemplars derived from real-life cases. These cases are contextualised whilst there also is a smaller number of abstracted designs developed from 5 of the cases[3]. The intention was to provide these exemplars to educators as a stimulus for their own designs, so that they could tailor a learning design according to their particular circumstances and the demands of their contexts.

One of the most significant contributions of the AUTC Learning Design project was the method developed to represent each exemplar, which combined graphical notations of the sequence of tasks, resources and supports, with a textual description of the features of the design, the pedagogical reasoning underpinning it, the context in which it had been applied, and any evaluation/research outcomes (see Agostinho et al. (2008) for a detailed explanation of this learning design representation). The development of this approach to systematically documenting a learning design was not the first attempt at this goal and was one of a number of alternative approaches developed at the time (Agostinho, 2009).

As a teaching and learning grant, the AUTC Learning Design project had a practical rather than research focus, and when the project was completed there were many questions about whether and how this 'new' method of representing learning designs would work. This became the focus for several subsequent research projects conducted by the authors, some of which are outlined below.

For example, some further work undertaken by the authors was conducted as part of an interdisciplinary project, funded by the Smart Internet Cooperative Research Centre (2002–2004). The focus of this research and development work was to examine how metadata standards that were prominent at the time as a way of classifying learning objects (e.g., Learning Object Metadata (IEEE, 2002)) could be used to help educators select appropriate learning designs and incorporate relevant learning objects. A further aim was to investigate the potential of documenting the resulting designs using technical standards that were new at the time, for example, the IMS Learning Design specification (Koper & Tattersall, 2005). The project was a collaboration between educational researchers (the authors) and researchers from informatics and engineering. Although the project outcomes were mainly focused on developing the metadata and technical standards, (e.g. see Agostinho, Bennett, Lockyer, and Harper, 2004), this research work continued the authors' interest in learning designs as a means of supporting educators' design processes. During the same period, work was undertaken on several smaller projects that sought to develop the learning design approach further by applying the method to representing designs relevant to the school sector, and working with school and university educators to test the application of learning designs in practice (e.g. see Bennett, Agostinho, and Lockyer, 2005).

The culmination of this research work led to a conceptualisation of learning design support tools that formed the basis for the research study discussed in this article. This conceptualisation is explained by the following scenario that illustrates how the research team envisaged the process by which an educator could use a learning design support tool to select a shared learning design, adapt it and implement it in their particular teaching context using any learning management system (LMS) and then possibly re-share the adapted learning design.

1. *Select a learning design*: An educator reviews the learning designs contained in a repository and represented in a form that communicates the essential features of the design including a summary of the overall pedagogical approach. The learning design metadata (provided in the repository) assists the educator in identifying potentially appropriate designs to suit their context. For example, an educator might search for a particular pedagogical approach or learning outcome.
2. *Import the learning design into a LMS*: After choosing a design from a repository, the educator imports the design into the learning management system.

This process is supported by technical specifications that provide standardised, machine-readable ways of describing learning designs.

3. *Customise the learning design*: The educator uses their expert knowledge as a discipline specialist and teacher, drawing on knowledge of the context, customises the learning design in the LMS interface in the way they would normally work (rather than using a separate design tool). This process involves modifying the original design to introduce appropriate resources, providing specific details of tasks, and making decisions about how students will be supported to complete the tasks. Provision is also available for the addition of new tasks, resources and supports not present in the original design but deemed necessary by the educator. Over time, the educator develops the completed 'unit of study'. This is a term that refers to a contextualised learning design, that is, one that includes information specific to the implementation context, such as specific content resources, dates for assessment submission, etc., as opposed to a more generic learning design that does not include context specific information. This distinguishes between a learning design that can be adapted (a generic learning design) and a learning design adapted for a particular context (a contextualised learning design or a 'running learning design', see glossary in Dalziel et al. 2013).
4. *Implement the unit of study*: The unit of study is made available to students at the commencement of the academic session. After this point two types of teaching and learning activities occur. One type is the interactions between educator(s) and students on the site that are a normal part of the teaching and learning process. For example, the educator makes announcements, the educators(s) and students participate in online discussions, assignments are uploaded and feedback is provided. It is important to note here that the degree to which the actual interactions have been specified depends very much on the nature of the design. Some units may be highly specified prior to the commencement of the session, whereas others may adopt an open-ended design, one in which the actual activities are unspecified prior to implementation but instead are planned by the educator to unfold during implementation. This may be particularly so in project, problem, simulation, role-play or game-based designs. The second type of activity is the improvisation element of teaching, where it is desirable to make dynamic changes to adapt the design of the unit of study. For example, the educator might add major new resources, introduce a new learning support or change the nature of a task based on the responses of students. All of these possibilities highlight the potentially complex nature of learning design and demonstrate how design does not necessarily stop at the commencement of implementation (e.g. at the beginning of a teaching session), but can continue into the session such that by the end of session the design is different to that presented in the first week. Given that there can be limitations on what educators can change during a session as dictated by institutional policy, these changes may vary in significance from one institution or context to another. While significant redesign may be relatively rare, it should nevertheless be anticipated as a possibility in any learning design approach.
5. *Export a copy of the unit of study*: At any stage of the above process the educator is able to export their unit of study to archive, to store for future use (e.g. to refine in a subsequent year), to share as a coherent whole with others, or to transfer the design into another LMS.
6. *Share a revised learning design*: At the end of a teaching session, in addition to exporting the unit in its entirety, it is possible that an educator might want to share their revised design with others whereby specific content and detail is removed and additional pedagogical advice added. Technical tools would be available in the LMS to enable the educator to convert their unit of study into a 'sharable learning design' format.

This conceptualisation distinguishes a 'learning design' that is shared as something created with the intention to be customised. We propose that a shareable learning design should describe the pedagogical framework with resources, tasks and supports being abstracted somewhat from the original context so as to make it more readily adaptable and understandable both within and across disciplines. A 'unit of study' (a running learning design) is the product of the design process which is fully specified as a particular teaching experience, at first ready for students and educators to interact with and then changed through that interaction in ways that may or may not alter the underlying design. Thus, the creation of a unit of study may result in a new design or design variant that could be shared with others, rather than sharing the more fully formed unit of study which may be more unwieldy to repurpose.

The research study reported in this article explored how this process could be implemented in an LMS. The research study was comprised of three phases and each phase addressed particular aspects of the scenario explained above. The next section explains each of these three project phases.

Overview of the project and outcomes

The project was conducted as three inter-linked investigations, the nature of which and their outcomes are described below.

Investigation 1: Educator design thinking and practices

This investigation was concerned with learning more about university educators' routine design practices. The purpose of this investigation was to gain a better understanding of the context into which learning design support tools would be embedded. Specifically, we wanted to learn more about how university educators go about their

design work, what influences their decisions and what supports they draw on to identify aspects of current practice into which tools might integrate and further develop.

Institutional human research ethics approval was obtained and participants were recruited with an initial invitation distributed via electronic mailing lists through the following four Australian professional organisations with a higher education teaching and learning focus: Higher Education Research and Development Society of Australasia; the Australasian Society for Computers in Learning in Tertiary Education; the Open and Distance Learning Association of Australia; and the Australian Association for Research in Education. Those who responded were asked to provide some basic information about the discipline in which they taught, the number of years they had been a university educator, and their prior experience with online technologies. Based on this criteria a purposive sample of 30 participants across 16 Australian universities was selected. To simplify the question of discipline we used three broad discipline groups – Arts, Sciences and Professions. This approach was based on the work of Becher and Trowler (2001), and Shulman (2005) that identifies key differences between these discipline groupings.

Participants were interviewed mainly by telephone, with a small number of local participants interviewed in person. The interview was conducted according to a semi-structured protocol that ensured coverage of key questions, but also allowed for the conversation to flow and for unanticipated issues to arise and be discussed. The duration of the interviews was between 60 and 90 minutes, all were audio-recorded and then transcribed for analysis. Participants were sent a copy of their transcript for verification.

Coding of the transcripts was undertaken by all six members of the research team. Firstly a sub-set of interviews was read and annotated, each by one team member. The annotations were collated into codes, the set of codes was added to a framework developed from the research questions. The framework was constructed in a table with multiple columns that included the code name, a definition for each category and code, and example quotes. An additional category called 'emerging codes' was established to capture any further relevant but unanticipated issues. With the coding framework developed, each transcript was allocated to two team members who coded it sequentially. This ensured that all coding was checked and where discrepancies arose could be resolved by changes to coding or refinement of the coding framework. Coding was completed when all transcripts had been coded, checked and no further disagreement was detected. After coding was complete, the interview excerpts under each code were further analysed and interpreted thematically.

The study found that our participants had a high degree of freedom when designing units. Where constraints existed they consisted of specific content or types of professional experience required by accrediting bodies, or requirements governing teaching practices, such as limits on the length, weighting or timing of assessment. There was a tendency for participants to work alone on the design of a unit they coordinated, while collaboration tended to occur more at the higher level of program planning. The nature of the context suggests there are opportunities for Australian university academics to innovate in their teaching without significant restrictions on their design decisions (see Bennett et al., 2011 for a detailed explanation).

In terms of how university educators engage in the process of design, our participants began at different points depending on the context for their design. When designing a new unit, participants started from either an outcomes or content focus. When redesigning an existing unit, the starting point was based on what needed to be modified as the overall learning outcomes and content were already established. A second feature was that the process of design moves from broad to specific. The overall framework of a unit in terms of the learning outcomes, content, and assessment, is usually designed first, followed then by designing/redesigning the more specific aspects of the unit such as weekly tutorial activities. A third feature that emerged was that design is an iterative process that occurs before, during and after unit implementation. Participants explained how they engage in design before a unit is implemented in order to prepare the unit, but also how they think about design during unit implementation in terms of designing specific resources or materials for the unit and reflecting on the progress of the unit, and how they continue to design after unit implementation as part of reflecting how the unit can be modified for its next iteration. (These findings were discussed in a symposium – Goodyear et al., 2010).

Four themes emerged from discussion about the factors that influenced university educators' design practices (see Bennett et al., 2015). A desire to meet learner needs was raised as an important consideration, with participants making key design decisions based on an understanding of the nature of the learner cohort. This included considering learners' prior knowledge, their cultural backgrounds, their commitments beyond university or their need to be prepared for particular professions. Participants recognised that their designs were influenced by their past teaching experiences – particularly of successful or unsuccessful teaching strategies – but also ideas arising from formal study, professional learning and disciplinary practices. Experimentation and innovation were also drivers of design decisions, with accounts given of looking for and trying out new strategies found in the literature or shared by colleagues. All explained the need to work within the constraints of the university teaching context, which included university policies, but also the limitations of timetabling, workload, teaching spaces and resourcing.

The study also sought to identify the support mechanisms academics use to develop their teaching practice. The participants in our study accessed a range of sources to generate and develop their ideas about teaching and the design of their units, including academic literature, workshops, conferences, and informal discussions with colleagues. Overwhelmingly, participants drew support from the ideas of 'others'. This highlights the value academics place on the ideas of other educators, generally close colleagues or people they see as similar to themselves. Our participants did not limit their interest exclusively to

those within their own discipline or in closely related disciplines. However, they did place greater value on those actively engaged in teaching rather than those who may not have a direct teaching role. These findings support the concept of learning designs which provide contextualised ideas from credible others. Participants also commented on how central support units were more important early in their careers, and became less relevant as they gained experience. This suggests a preference for different types of supports depending on an educator's career stage.

Together, these findings provide insights into the context in which university educators do their design work and about their approaches, processes and influences on their decisions. The results reveal a complex process of balancing opportunity and constraint. The nature of their practice has much in common with the characteristics of design identified in the broader design studies literature (e.g. Razzouk and Shute, 2012) although important differences exist. One key difference is that university educators are participants in the teaching and learning experiences they have designed in ways specialist educational/instructional designers are usually not. While this difference is clear from personal and anecdotal accounts, it has received little attention from researchers. Furthermore, designs are rather ephemeral in nature, they exist as particular instances experienced by students and educators, but they can be re-visited and revised when used again, either by the original designer or by another educator to whom to unit has been allocated. Thus in terms of providing design support tools, the main insight from this investigation was a design support tool that could not only assist an educator in designing a unit before implementing it, but can make provision for access throughout the implementation of a unit to refine, add, change, and after unit implementation as a reflection tool to document what could be changed for the subsequent unit iteration.

Investigation 2: Review of learning design representation

The second investigation in the research project involved revisiting the learning design descriptions of the 32 exemplars developed from the AUTC Learning Design project to examine whether the way in which they are described and documented could be considered 'effective' based on more recent research about effective learning design representations. The original exemplars were presented in a four-part structure:

- A summary of the exemplar's purpose and function, details of the design team and links to any publications about implementation and evaluation.
- A detailed description of the tasks, resources and supports in graphical and text form.
- A description of the implementation context, including intended learning outcomes and assessment strategies.
- Reflections about the rationale for the pedagogical approach, development and implementation history of the exemplar, details of any evaluation research, and perceived quality of the exemplar.

Since completion of the project in 2002, international research in learning design had advanced understanding of how learning design representations could support the sharing and reuse of pedagogical ideas, particularly in higher education. Several newer learning design representations had emerged (see Agostinho, 2009 for a summary). In addition, technical developments such as the IMS-LD specification and software applications compliant with it had advanced. Given these developments, it was timely to review the literature to determine the characteristics that constituted an 'effective learning design representation' and use these characteristics as criteria to review the 32 examples to compare them with the more contemporary benchmarks of effective descriptions.

Analysis of the international research between 2002 and 2009 led to the identification of characteristics of an 'effective' learning design description. The literature drawn on included: Britain (2004); Conole, Littlejohn, Falconer and Jeffrey (2005); Falconer and Littlejohn (2006); Falconer, Beetham, Oliver, Lockyer, and Littlejohn (2007), Falconer and Littlejohn (2009), Littlejohn, Falconer, and McGill (2008) (see Agostinho et al., 2009 for full details). The following three fundamental characteristics that would support reuse were identified:

- The *pedagogy* must be clear and explicitly described;
- A *quality* rating of some form, such as evaluative findings, should be included; and
- Explicit *guidance* or advice about how the learning design could be reused should be provided.

These characteristics formed the basis of criteria for an instrument that was developed to review the 32 examples. The instrument consisted of ten elements, each of which was rated on a 5-point scale from very poor to very good and accompanied by a qualitative comment: The first six elements focused on providing clear and explicit pedagogy by summarising the learning design and explaining its pedagogy and implementation context as well as detailing the tasks, resources and supports used. The next three elements focused on evaluating the learning design's 'quality' by reviewing the description about the rationale for ICT use, the explanation of any evaluation findings, and whether any reflections on the implementation has been provided by the designer(s). The final element focussed on whether the learning design description provided any advice and or guidance about reuse.

All 32 exemplar were reviewed using this instrument and six were found to meet the criteria to be considered as effective learning design descriptions:

1. 'Environmental Decision Making' – 'role play' focus in the discipline areas of environmental science (Brierley, Hillman, Devonshire, & Funnell, 2002)
2. 'Mekong e-Sim' – 'role play focus in the discipline area of social science (McLaughlan et al., 2002)
3. 'Predict-Observe-Explain' – 'procedure development' focus in the discipline of science (Kearney, 2002)
4. 'Research Methods Online' – 'problem based learning' focus in the discipline area of education (Angus & Gray, 2002),

5. 'Real life cases in multimedia' – 'project/case based' focus in the discipline of education (Bennett, 2002),
6. 'Generic skills development' – 'collaborative' focus in the discipline are of information technology (Luca, 2002).

As a result of this investigation refinements were made to the format for learning design representations and the six exemplars identified as containing the information required were adapted to the revised format. Refinements included adding some more specific information about how the learning design could be customised and highlighting key resources and supports of the learning design. **Appendix A** illustrates the revised format for describing a learning design; Sections 4-Checklist and Section 5-Design and Implementation Tips are additional components. The revised descriptions of the six learning designs were then used in Investigation 3 to explore the possibilities for integrating learning design support tools into a learning management system. The designs themselves have also been used as resources to stimulate design ideas and discussion in workshops (e.g. Bennett, Agostinho, & Lockyer, 2014).

Investigation 3

The purpose of Investigation 3 was to explore the feasibility of integrating technical standards into a learning design support tool within a learning management system, and to develop a preliminary design for such a tool. This work was conducted in collaboration with our industry partner, Janison Solutions. The researchers worked with programmers and educational designers at Janison Solutions to develop workflows and screen mock-ups which could be underpinned by the IMS-LD specification. Additional discussions with research colleagues at the Open University of the Netherlands helped to clarify and refine the strategies tested.

Investigation 3 explored the possibility of integrating the IMS-LD specification into design tools for teaching. The thinking at the time was that specifications would make learning materials 'technically interoperable' (that is they would be readily transferrable from one compliant system to another) thereby improving reusability. There was considerable interest in this idea at the time, although there was little adoption by developers of learning management systems.

Rather than fully develop a software solution, the goal of the project was to explore the potential for integrating the IMS-LD specification and devise a strategy for how it might be achieved. In essence, the goal was 'proof of concept' rather than a developed product. The research team worked with the industry partner's technical and design staff to test a series of possible scenarios that would suit the overall philosophy of the project which was to allow for a high degree of customisation of the learning design by an educator.

The team ultimately devised the following general process that would reflect the conceptualisation developed at the commencement of the project:

1. The educator selects a learning design from those available in the repository and this appears as a partially completed unit of study in the learning management system. The technical specification allows the design to be 'read into' the system with the relevant system components appearing according to the design. The scaffold includes both pre-determined characteristics and customisable features. For example, a problem-based design may include a discussion activity as a key learning task (a pre-determined characteristic), but the educator would be given the option of offering that discussion in face-to-face, synchronously online or asynchronously online modes. Thus, the starting point for building specifications comes from what is already known about the design chosen.
2. The educator makes changes to the design within the learning management system to customise it to suit his/her own context. The flexible design tool allows an educator to start working at any point, at either a macro or micro level, to begin building a design based on the established over-arching framework. (This reflects what our interviews had revealed about the processes educators used already as part of their design practices.) The educator makes choices to specify the resources, tasks and supports to be used, and adds and removes elements as appropriate. When adding or removing new task, resources or supports that change the original design, the educator is prompted to add notes explaining the pedagogical rationale. Behind the scenes, the software builds the IMS-LD metadata for the 'unit of study' that is being created, out of sight of the educator who interacts with the learning management system interface that is already familiar. Metadata relevant to IMS-LD is recorded, while additional metadata beyond the scope of the specification but useful to future sharing of the design is captured as separate notes. This approach solves key problems by constructing the metadata record without an educator interacting directly with the technical specification and removes to need for a separate design interface because the educator is working within the LMS. This approach also facilitates updates to the 'unit of study' dynamically during the teaching session such that the metadata is also updated and changes to the design are captured.
3. At any point in the process the educator is able to 'export' their design from the learning management to back-up elsewhere or to share. IMS-LD metadata is exported and thus available for import into a compliant system, with options provided for exporting the 'unit of study' (running learning design) or the learning design. The former contains the specific detail of the unit, with options to include, for example, the content of discussion forums and student assignment submissions where desired. The latter includes only the structural

features of the design. Upon export, the system prompts the educator to add to the metadata, for example, with reflections on the implementation or results from evaluations that provide evidence of the efficacy of the design.

Full development of a learning design support tool envisaged as an outcome of this investigation was beyond the scope of this project and would require significant further funding. A key insight from this investigation was the need to include opportunities to collect additional data beyond that included in the IMS-LD specification to achieve the design supports and the outputs characteristic of the effective learning design representations identified in Investigation 2.

Discussion

The findings from this study advance our understanding of university educators' design thinking by providing insights into existing practice that are anecdotally familiar, but have garnered little empirical evidence to date. The accounts from our participants from Investigation 1 suggest that there is an existing design practice that is part of routine teaching but this is under-developed in comparison to other types of design activity such as architecture and engineering. Perhaps because educator's design work is integrated into their broader teaching practice it has been paid much less attention than more easily delineated activities such as lecturing and assessing. We currently lack the vocabulary to discuss it clearly and have only recently begun the conceptual work which is needed to underpin the further of learning design support tools.

There is much more to learn, also, about effective representations. There is a theoretical and empirical basis for providing educators with solutions to past problems that are abstracted sufficiently from the original context to promote customisation (Kolodner, Owensby, & Guzdial, 2004). Our own investigations have used a representation that combines graphical and textual information, and chooses brevity over detail. But there is still little consensus in the learning design literature over the critical characteristics of effective representations. Our findings from Investigation 2 identified the inclusion of reflective and evaluative information, together with guidance and advice within learning design representations, as a key characteristic that would support reuse. This finding from our review of the literature needs further empirical investigation. Findings from Investigations 1 and 2 suggest that developing one's own teaching practice by adapting ideas from 'respected others' is a strategy already used by educators looking to expand their repertoire. This is highlighted from interview data in Investigation 1 and the literature reviewed as part of Investigation 2, and lead to the inclusion of a 'quality' rating from evaluative findings in the revised learning design description. But how this can be fostered, particularly within institutions by central units, needs careful thinking to cater for different discipline backgrounds and different career stages.

What is clear from Investigation 1 is that tools to support design decision-making must be flexible. Flexibility is needed because design is not only about planning and preparation prior to an academic session, but occurs throughout sessions, dynamically in response to learners' emerging needs and extends beyond, as part of educators' reflections on their experiences. Flexibility is also needed because design is iterative with various starting points, depending on the nature of the changes to be made, and with attention shifting between macro to micro features. Lock-step tools that restrict the order in which a design is specified are unlikely to be successful, but at the same time tools must help an educator navigate through a developing design. Learning design support tools that include these features will act as a coach, with the goal of empowering educators in the design process with good tools rather than correcting poor design or corralling the design process to narrowly.

It is important to contextualise these interpretations and speculations within the limitations of this study. Firstly, the project was only concerned with investigating and refining the learning design representation originating from the AUTC Learning Design project. This is only one of a number of representations attempting to address the same challenge. Investigation 1 was conducted in the Australian context and attracted volunteers with an interest in teaching and learning. Members of this self-selecting group are not necessarily representative of all university educators and so their experiences must be interpreted with this in mind. The study also took place at a particular point in time, and it must be recognised that ongoing changes to higher education bring new challenges. Given the increasing importance of online pedagogies, however, this is only likely to heighten the pressure on educators to design well.

Conclusion

High quality design is critical to effective learning experiences and outcomes. The context in which university educators work is increasingly challenging with a more diverse student body than ever before and new technologies becoming integral to higher education. Effective design supports are needed and this is the challenge the field of Learning Design engages with. The findings of this project advance our thinking about the need for learning design support tools to include flexibility that enables an educator to import, adapt, revise, refine and reflect on their design before, during and after implementation. At the same time, our findings expose the magnitude of the challenge. The core concepts of Learning Design – *guidance*, *representation* and *sharing* – offer rich opportunities for further theoretical, empirical and practical work and already encompass a wide range of approaches and initiatives that can be built upon as this emerging field develops. As part of this development, the field must engage more with educators to test and refine their ideas and convince university administrators and policy-makers of the significance of this approach.

Competing Interests

The authors declare that they have no competing interests.

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Appendix A

Investigation 2 – Revised format for learning design representations.

LD title	
1. Overview	
a. Brief description	
b. Graphical representation	
2. General Information	
a. Learning Objectives	
b. Pedagogical Rationale	
c. Evidence of Quality	
3. Textual description of design sequence	
a. Resources/Tasks/Supports	
b. Suggestions for assessment	
4. Checklist	
a. Resources	☐ Critical resources listed here
b. Supports	☐ Critical supports listed here
5. Design and Implementation Tips	
a. Customising design	
b. Set-up required before implementation	
c. Implementation ideas	
6. Acknowledgements	
7. References	

Notes

[1] The term 'unit' is used generically throughout to refer to a module, session or learning activity that an educator designs for students to engage with.

[2] Italics refer to specific components of the Learning Design Conceptual Map, Figure 4 in Dalziel et al. 2013.

[3] www.learningdesigns.uow.edu.au

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