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Applying a design-based research approach to the determination and application of the critical elements of an authentic assessment

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Abstract

This paper describes the research approach and methodology used to conduct a doctoral study to determine and apply the critical elements of an authentic assessment. It begins with a description of the design-based research approach that was used as an overall framework for the research study, followed by a description of the methodology used to collect the data required to answer the research questions, and concludes by briefly describing the four phases applied in the use of design-based research. The intention of this paper is to outline the application of this research process in a design-based context, and not to engage in a more detailed consideration as to the relative value of design-based research itself.

Publication Details

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This paper describes the research approach and methodology used to conduct a doctoral study to determine and apply the critical elements of an authentic assessment. It begins with a description of the design-based research approach that was used as an overall framework for the research study, followed by a description of the methodology used to collect the data required to answer the research questions, and concludes by briefly describing the four phases applied in the use of design-based research. The intention of this paper is to outline the application of this research process in a design-based context, and not to engage in a more detailed consideration as to the relative value of design-based research itself.

Introduction

The specific problem under consideration related principally to the field of vocational education, more specifically, to the outcome of a number of post course evaluations of the Australian Army's *Computer Based Learning Practitioners course* where it had increasingly becoming apparent that students transitioning from this course and into the workplace seemed to consistently present either without the necessary pre-requisite skills required to perform the role successfully from the outset, or with insufficient confidence in applying the skills that they had obtained from this course.

As one means of seeking to address this problem it was decided to review, revise and re-design the final module of this course, *Evaluating Educational Multimedia*, to seek to develop a more authentic approach to the educational design of the course itself, and specifically to ensure that the summative assessment activity that was used as a determinant of workplace competence, was actually providing an accurate indication of the student's ability to perform in this role in the workplace. In this respect design-based research, with its focus upon an iterative and reflective design and development process, was selected as the most appropriate mechanism by which this very real educational or training problem could be addressed by iterative stages of design and re-development based upon the gathering of feedback at each of the stages from expert practitioners in the field, prior to the delivery of the revised solution in the classroom. In the most simple of terms, the application of this research process, particularly in the educational design stage, enabled the assessment activity itself to undergo a process of transformation from being a theoretical to an applied activity that sought to situate the context for the learner from classroom to workplace.

At the outset, and to establish whether it possible to provide such an improvement in performance, and at the same time inform the broad education field situated as it is in an increasingly technologically literate communication environment, the question for the researcher became that of determining whether it would be possible to harness the principles of authentic activity to guide the design, development and application of more meaningful, more authentic, assessment
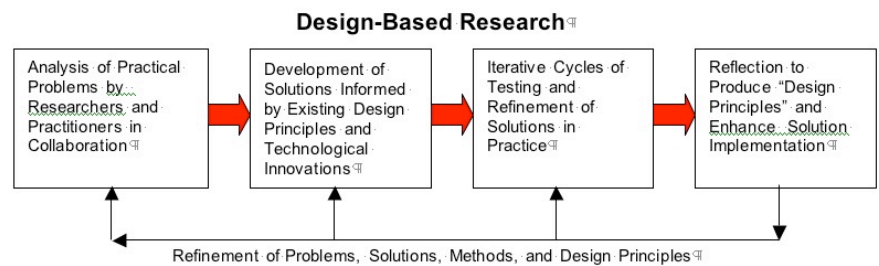
activities and thus seek to establish the extent to which authentic assessment might provide an effective model for task design and assessment in a more situated and flexible learning environment.

To determine an answer to this question, it became necessary to address the following:

1. What are the specific characteristics of authentic assessment that facilitate design and assessment of complex and authentic tasks?

2. How do students respond to tasks designed to incorporate the characteristics of authentic assessment?

A design-based research approach

Figure 1: Design-based research (Reeves, 2006, p. 59)

Design-Based Research

| Analysis of Practical Problems by Researchers and Practitioners in Collaboration | → | Development of Solutions Informed by Existing Design Principles and Technological Innovations | → | Iterative Cycles of Testing and Refinement of Solutions in Practice | → | Reflection to Produce "Design Principles" and Enhance Solution Implementation |

Refinement of Problems, Solutions, Methods, and Design Principles

Research methodology

The framework for this research was based upon the design-based research approach conceptualised by Reeves at Figure 1 (2006, p. 59), and the problem itself was examined in the four inter-related and iterative phases as set out in Figure 1. What follows is a brief consideration of what occurred within each of these phases with a consideration as to how design-based research served the overall objective of establishing a more authentic means of assessing the competence of these staff, from within the training environment.

PHASE 1: Analysis of practical problems by researchers and practitioners in collaboration

The initial exploration of this problem required that a series of conversations and discussions be held with a numbers of colleagues and fellow educators from both the defence and civilian sectors, over a period of several months. In all, 13 practioners (three teachers, one course coordinator, four tutors, and five instructional designers) were consulted for their views and insights into the problem. These conversations were exploratory and they were not recorded, but extensive notes were kept by the researcher on the nature and extent of their problems. However, what was noteworthy from these discussions was the extent to which each had acknowledged an evolving desire to find better ways in which to embed the practical application of the subject matter that they were teaching, coordinating or designing into more relevant or authentic situations. At the same time, some were also starting to express concern more broadly as to the validity of the assessment activities that they were developing as determinants of more situated or performance-based, educational outcomes.

The next step in this research process required a detailed analysis of the literature to determine the extent to which current educational designers had been able to gauge the degree of authenticity within an assessment activity. In this respect a number of models and frameworks from current researchers were considered, reviewed and collated. Once collected, the elements within these models and frameworks were reviewed and placed into a series of themes from which the initial list of critical elements was evolved.

Next an extensive review of current literature was undertaken to determine whether there were additional criteria that should be applied to the design and implementation of assessment tasks to provide a solution to these problems.

The next step in the application of the research-based design process was Phase 2, that of seeking to develop a solution that was informed by these existing principles.

PHASE 2: Development of solutions informed by existing design principles and technological innovations

Phase 2 of this research process consisted of three key activities:

1. The development of draft principles to guide a solution to the problem

2. An expert review of the draft principles, and

3. The design and development of a technology-based solution to the problem, including the iterative cycles of testing and refinement to the solution in practice by means of the informal evaluation and testing of the prototype during the design and development phase by the researcher as educational designer.

Each of these activities is described in more detail below.

Development of draft principles to guide a solution to the problem

As noted above, the literature was reviewed in detail with a focus to identify those research studies that had nominated lists of principles and relevant criteria to address the problem. Using this grounded approach a number of critical elements were determined and ultimately used to construct the initial framework. Refereed papers, research studies and reports were identified from the literature that had addressed a similar or parallel issue in assessment. These papers were reviewed in detail and models, frameworks and principles and guidelines from each that related to the problem were listed and grouped. From these groups, a list of eight draft principles was extracted to form a guiding framework for the commencement of the current study. These elements were based around the following areas: degree of challenge: the role of performance or product; the requirement for transfer of learning; the use of reflection and self-assessment; the requirement for accuracy of product or in performance; the fidelity of the environment and tools; the need to include discussion and feedback; and, collaboration.

Expert review of the draft principles

Expert review of the critical elements was sought in a number of ways. Firstly, as noted previously, during the initial development of the principles, a process of discussion of each as it was evolved was established with a number of practitioners in the field of education. It

was by means of this iterative process that the original list of critical elements was determined and evolved. Once the list of elements had evolved to a sufficient stage of maturity dialogue was sought with each of three selected experts.

Each expert reviewer was selected on the basis of their extensive experience of working in the field of authentic assessment. They were carefully chosen from both representations within the literature, as well as by recommendation.

Initially, the experts were asked to consider whether, in their opinion, the critical elements that they had been presented with made sense when considered overall as a framework. Next, they were asked to consider and discuss each of the individual elements set out in turn, in order to determine whether, on an individual basis, they were reflective of what should be considered to be critical to the determination of authenticity within an assessment. Following on from this, the experts were asked whether they would be able to provide any feedback or information that might be used to enhance the suitability or applicability of any of the critical elements.

Design and development of a technology based solution to the problem
Next the selected module was redesigned and developed according to the draft guidelines and the research was ready to move into Phase 3 where the module was to be implemented and evaluated in practice.

PHASE 3: Iterative cycles of testing and refinement of solutions in practice

A fundamental part of the design and development process for this module was the requirement to ensure that iterative cycles of testing and refinement of the development solution in practice occurred, by means of the informal evaluation of the prototype during its design and development phase by fellow educational designers. This iterative part of this process is consistent with the third stage of the Reeves' design based research model (Reeves, 2006, p. 59) where there is a requirement to ensure that iterative cycle of refinement of a solution occurs in practice.

Module delivery and the learning environment
The training session was divided into four periods of approximately one hour and thirty minutes, with a half hour allocated for morning and afternoon tea and an hour for lunch. It was intended from the outset that the method of implementation of this module of training would, as far as it was possible, seek to reflect the likely work environment within which the students would subsequently find themselves employed.

The learning environment was comprised of a classroom, with individual personal computers arranged around three of the four walls within the room. In addition, each of the students was provided with an individual desk set in the middle of the room facing towards the front of the classroom, in a more traditional classroom design and each student also brought with them an individual laptop computer with which they had been issued at the commencement of the course.

The room was set up initially with the desks presented individually in three rows of two desks per row, and each student selected where they wanted to sit. Whilst the room was pre-set up for the initial

introductory parts of the module's delivery, students were able to subsequently move furniture if they desired to better accommodate their work practices.

It was intended from the outset that the method of implementation of this module of training would as far as it was possible, seek to provide a high degree of fidelity in terms of both the environment and the tools that the students used, to reflect the likely work environment within which they would subsequently find themselves employed.

Data collection and analysis
A range of data formats were collected for subsequent analysis for the purpose of this study to enable the student response to be determined. Initially, whilst the training was being conducted the students themselves were observed by the researcher and extensive notes were made as to the ways in which they interacted with both the material as well as each other. Subsequently, these notes were collected, collated and analysed. Concurrently, various parts of the activity were filmed using a video camera. On completion of this activity a transcript was made for the purpose of subsequent analysis. At the completion of the activity the students completed a written questionnaire and were interviewed by the researcher.

By the use of these approaches the students were able to respond to the ways in which they felt that the critical elements had been used, and made comment as to whether they thought that they could have been better, more clearly or more concisely phrased in order to clarify their meaning to potential future instructional designers who might use them. The students also commented on whether they believed that these elements could have been more fully applied to further enhance the authenticity of this particular assessment activity.

PHASE 4: Reflection to produce revised design principles and enhance solution implementation
The fourth and final phase was that of developing a set of critical elements into a revised framework based upon the data received at the conclusion of phase three. In reflecting upon the relative value of the critical elements used in the design of this module, as determinants of authentic assessment activity, it had been important to establish the value of each of those elements in determining the extent to which authentic assessment provided an effective model for task design and assessment in flexible learning environments. This has been achieved by means of recognising the importance of specifying the characteristics of authentic assessment that facilitate the design and assessment of complex and authentic tasks, and evaluating how students responded to the tasks designed to incorporate the characteristics of authentic assessment

Discussion

The use of this design-based approach has enabled the researcher, in the words of Brown (1992) and Collins (1992) to:

- Address a complex problem in a real context in collaboration with practitioners;

- Integrate known and hypothetical design principles with technological affordances to render plausible solutions to these complex problems; and

- Conduct rigorous and reflective inquiry to test and refine innovative learning environments;

Design-based research is also distinguished from straight forward design, development and evaluation approaches as a professional activity in other ways. For van den Akker (1999, p. 7), design-based research is often initiated 'for complex, innovative tasks for which very few validated principles are available to structure and support the design and development activity'. In this respect, this approach to the research, as an iterative one leading to a range of prototypes, enabled the researcher to evolve a solution that could, as van den Akker (1999, p.8) describes, 'increasingly meet the innovative aspirations and requirements'. For the purpose of this research then the intention was that of seeking to determine an outcome with an applicable value, as supported by Reeves (2000, p. 24) where he asserts that, 'if educational technologists want to be more socially responsible, they should pursue development goals'.

Van den Akker (1999, p.5) informs us that the purpose of a design-based research activity is to reduce, 'uncertainty in decision making in designing and developing educational interventions'. This, in turn, translates to suggesting ways of optimizing the quality of the educational interventions, thus assisting in the design and development of principles that can be applied, tested and evaluated, and improved. The appeal of a design-based approach to this research was in that it enabled a focus upon the design of a practical solution to an actual training problem, in support of what Reeves (2000, p.19) notes as, 'a growing demand for educational researchers to be more relevant to practitioners such as teachers and corporate trainers'. It is this requirement for relevance and the application of the research outcomes to the improvement of practice that determined the adoption of the design-based research approach as the most appropriate for this research problem.

Conclusion

This study followed a design-based research approach, as illustrated in Figures 1, consisting of four distinct phases, each of which had a separate intent. The rationale of the first phase of the research had been to determine and define the problem under consideration by means of a review of the literature and consultation with expert practitioners. In the second phase, the rationale was that of defining those elements that appeared as critical in the design of an authentic assessment and then synthesizing them into a single cogent draft framework. This had been achieved by an intensive review of the literature to establish existing principles and guidelines, and from this the creation of an initial framework, which after subsequent review by acknowledged experts, was applied to the design and development of a module of learning.

The third phase was the implementation of that learning environment and the collection and analysis of the data that arose from it, in order to investigate the effectiveness of the framework itself, as defined in the second phase, in the provision of an alternative model for the

development of tasks in a flexible learning environment. This phase also sought to both isolate the specific design characteristics of the assessment activity, at least in so far as they reflected authentic assessment practice, and to assess both the importance of, and relationship between the defined elements.

The fourth phase was that of evolving a final set of critical elements into a revised framework based upon the data received at the conclusion of phase three. It was in the reflection upon the relative value of the critical elements used in the design of this module, as determinants of authentic assessment activity, that it became possible to consider the value of each of those elements in determining the extent to which authentic assessment could provide an effective model for task design and assessment in a flexible learning environment.

The design-based approach to this research activity provided an appropriate and useful means of seeking to resolve a practical education problem in the context of the learning environment itself. In this respect, and in so far as the outcomes of the research are applicable in practice, this has ensured that the researcher has been able to both evolve a solution and then test and revise it in practice.

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