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Abstract

The purpose of this research is to design an effective knowledge management system within the Catholic Education Wollongong system of schools. This study will examine "how can a knowledge based information system support teachers in their learning and pedagogical practice?" A research design approach is used as it allows the construction of the technology to support a knowledge management system, having regard to the users of the system and theoretical frameworks regarding on-line learning and knowledge transfer. The study will be conducted in four discrete phases as described by Reeves (2000) and will utilise a sequential mixed method design, (Creswell, 2003). The contribution of this research to the field will be in the development of design principles that can be applied to knowledge management system design in education.

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Development of a knowledge management system within the system of schools comprising the Catholic Education Office Diocese of Wollongong

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Abstract:

The purpose of this research is to design an effective knowledge management system within the Catholic Education Wollongong system of schools. This study will examine “how can a knowledge based information system support teachers in their learning and pedagogical practice?” A research design approach is used as it allows the construction of the technology to support a knowledge management system, having regard to the users of the system and theoretical frameworks regarding on-line learning and knowledge transfer. The study will be conducted in four discrete phases as described by Reeves (2000) and will utilise a sequential mixed method design, (Creswell, 2003). The contribution of this research to the field will be in the development of design principles that can be applied to knowledge management system design in education.

Introduction

Within the Catholic Education Office (CEO) of the Diocese of Wollongong, information that resides with teachers and in the boundaries between levels of schooling, clusters of schools, and the school system as a whole is lost due to the lack of an integrated knowledge management system. Knowledge management, a systematic way to identify, create, represent and distribute knowledge, offers a mechanism for the transfer of learning and development of collaborative practices. The development of such a system offers the advantages of time saving, quality improvement, practical knowledge made applicable, replication, consistency, ability to update knowledge, learning tools, cost savings and productivity, (Abdullah, Kimble, Benest and Paige, 2006)

The CEO is a system of schools that employs around 1,400 permanent staff across twenty nine primary schools and seven secondary schools. For several years it has strategically supported whole school initiatives to improve locally identified areas of pedagogy. Experience of these initiatives has been shared at forums and cross-school meetings but direct sharing of learning remains limited due to the geographic isolation of schools, the limited opportunities for whole-school exchanges and the continued pressure to not have teachers absent from classes.

In 2004 the CEO introduced an information technology (IT) tool known as *myclasses* that provides a virtual learning environment with capacity for class pages, a learning object repository, e-learning folios and discussion forums. Primarily used as a tool for individual teachers in the classroom, there has been an increasing use of *myclasses* by groups of teachers within a school and to a lesser extent by teachers across several schools who have formed special interest groups such as reading recovery and hearing support. However there has not been widespread use of *myclasses* to share experiences between teachers or to share knowledge gained from learning community project implementation. In 2007 the CEO introduced a new process of School Review and Improvement whereby schools, over a five year period rate themselves across thirty indicators for school effectiveness and

put in place annual plans for improvement. School leadership teams are asking for a mechanism by which, through an IT solution, they can link with other schools to identify common strategies, to share knowledge that will avoid each school acting in isolation, and to support teacher learning and pedagogical practice.

Using *myclasses* as a case study, this study will involve users in the design of a knowledge management system that is purposeful in meeting their needs. The research question “how can a knowledge based information system support teachers in their learning and pedagogical practice?” will be examined under four sub-questions:

1. What are currently the key practices for on-line knowledge management and retrieval, and what other knowledge management practices do teachers engage in?
2. How do different forms of knowledge representation support teacher learning and pedagogical practice?
3. What are the functionalities of the knowledge management system that support teacher learning and pedagogical practice?
4. What are the attributes of a knowledge management system that support organisational or expansive learning?

Studies of existing knowledge management systems developed for education indicate the ‘learning object repository’ is the prevalent model. In both education and more broadly in business, this approach has proven to have limitations in application (Huysman, 2005; Garcia, 2006; Schonstrom, 2005; Walsham, 2001; Friessen, 2003; Koppi, Bogle and Bogle, 2005; Kato, Hatano, Sakamoto, Morimoto, Komika and Matsuda, 2003). In education, these limitations include perceived irrelevance to the circumstances of the knowledge user; teaching materials considered personal to the teacher, private and requiring protection; resistance to the re-use of someone else’s work and resistance to having own work re-used. Parr and Ward (2006) in a study of a teacher on-line community determined that similar concerns prevented teacher participation in an on-line site established for their use.

Several studies have noted a convergence between e-learning and knowledge management (Lytras & Pouloudi, 2002a; Lytras & Pouloudi, 2001; Lytras, Pouloudi & Pouloumenakou, 2002). These studies focused on the use of flexible learning scenarios and the ability for learners to dynamically construct the knowledge required. Liaw and Huang (2000) and Bibeau (2001) analysed the role of discussion in on-line learning environments as a medium for learners to interact with one another to allow learners to build their own knowledge. Whilst there are significant differences between a knowledge management system and on-line e-learning, the implication of studies on e-learning is that the actual experience of the learner is dependent on how the interface is designed, managed, and developed, with greater learning occurring where there is interaction by the learner in the material being presented. Case-based learning in education as described by Schulman (1986) and Ackerman, Maslin-Ostrowski, & Christensen (1996) and problem-based learning, Robinson (1995) also offer potential frameworks for engaging users in knowledge creation and application.

Research on characteristics that support or inhibit information flow within a knowledge community will be critical in the design of an effective knowledge management system. Andrews and Delahaye (2000) suggested that the process of knowledge sharing and learning within communities is mediated by factors such as individual perceptions of approachability, credibility and trustworthiness. Contractor and Monge (2002) concluded that transactive memory theory, social exchange, and proximity theory explain much of the behaviour evidenced in information retrieval among scientific communities. Research has demonstrated that people will not use knowledge management systems simply because they exist (Hall, 2006; Parr & Ward, 2006; Santo, 2005). The issues of ease of use, the self-interest of network members and willingness to share knowledge are likely to be major issues to resolve in the design of an educational knowledge management system.

The literature on knowledge management systems in education demonstrates that mechanisms to capture and use the wisdom and experience of contributing teachers have not been well developed. This study will contribute to the knowledge base by working with users to determine the forms of knowledge representation, and the functionalities and attributes of a knowledge management system which support teacher learning and pedagogical practice. A prototype knowledge management system will be designed and tested and design principles developed that can be applied more generally to effective knowledge management systems for education.

Methodological framework

Knowledge management is essentially a human related process that uses technology as an enabler. A research design approach will be used as it allows the construction of the technology to support a knowledge management system in education, having regard to the users of the system and theoretical frameworks regarding on-line learning and knowledge transfer. This study satisfies criteria for a design research approach identified by Reeves, Herrington and Oliver (2005), with reference to the work of Bannan-Ritland (2003), Design-Based Research Collective (2003) and Kelly (2003).

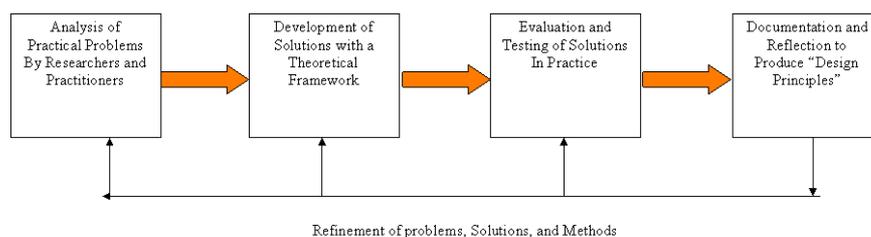
- Knowledge management is a broad-based complex area and as outlined by the literature review, is an inter-disciplinary field focused on the nature of knowledge, theories of learning and collaborative knowledge building, and uses of technology.
- It involves the integration of known design principles derived from literature and hypothetical principles developed from user feedback with “technical affordances to render possible solutions to this complex problem”.
- Inquiry processes will be used to test and refine innovations and reveal new design principles. A mixed method approach, described later in this paper, will be employed to collect and validate data.
- Prototype development requires ongoing engagement with users to refine the protocols for the system.

- The study will require intensive collaboration with teacher practitioners and IT specialists.
- Grounded in the need to solve a real-life problem of how, within education, knowledge management and exchange to support learning communities can be best supported by technology, this study will reveal design principles that can inform future design of knowledge management systems in education.

Design research methodology has not previously been used in the area of knowledge management, although action research, closely aligned, was used in a study of formal knowledge sharing networks in a corporation (Schonstrom, 2005). Cobb *et. al.* (2003, p.9) examine the purpose of design research in education and state that design research is used because of its focus on learning ecology. This purpose aligns well with the purpose of knowledge management systems i.e. to support individual and organisational learning.

The study will be conducted in four discrete phases as described by Reeves (2000) and illustrated in Figure 1. The outcomes of the first three phases will be applied iteratively to refine the overall design principles of phase four.

Figure 1 Development approaches to IT research



This study will utilise a sequential mixed method design, Creswell (2003). A qualitative exploration of research sub-questions one and two will be undertaken utilising teacher focus groups and one-on-one interviews as a first level validation step of emerging design. A user reference group comprising ten teachers from the system will be utilised during phase three of the study and feedback from the reference group will inform the iterative design changes that occur. Themes from the qualitative data will be developed into a survey instrument to be distributed to all teachers in the system once the prototype has been distributed and in use. The survey instrument will test the veracity of design principles used and will validate design items relating to: users' willingness to learn; motivation of the user to contribute to, or use the site; whether the knowledge representation chosen helped develop knowledge about a particular area; and whether there was a change in practice as an outcome of using the site. With its pragmatic underpinning, the mixed method approach is applied because of its focus on application, what works, and solutions to problems (Patton, 1990). The methodology used within each of the phases is now described.

Phase 1: Analysis of Practical Problems

Focus group discussions will be conducted with groups of teachers regarding their current use of *myclasses*. The focus groups will broadly reflect the demographics of the general staff population for

age and years of service. Within the primary environment, staff from nine, one - stream schools will be invited to participate. Each group will comprise around twelve teachers and the school Principal. The groups will essentially be a randomised cross section of the school system. A check will be made of the age and years of service represented within the group and if necessary, the primary sample will be augmented with a further focus group to ensure balanced representation. In the secondary environment, a focus group will be conducted at each of the seven secondary high schools. Each group will comprise ten cross-faculty teachers and a member of the school leadership team. Within the focus group participants will be asked to describe:

- their use of *myclasses*,
- the extent to which it is used for inter teacher and inter school sharing of knowledge
- the features that are useful
- the features not currently available that would facilitate teacher learning
- other sites or forums that are accessed for teacher learning, and if so, what features of those sites meet teacher needs.

Focus groups will be recorded and an observer will be present taking notes. Key themes will be identified and a convergence method used to narrow the data to concepts for analysis in conjunction with principles identified through the literature review. The data will be used to develop a preliminary design framework for functionality of the knowledge management system.

Phase 2: Development of Solutions

Teacher knowledge, its representation, and the ways in which it is stored in the system will be critical in the development of design solutions. Multiple elements impact these design stages including the willingness of teachers to contribute knowledge, the way knowledge is stored and shared, availability of tools and related materials, motivation of the user, the practical way the user relates to these elements, and ultimately the application of the learning in the classroom.

Three teacher focus group each comprising five volunteers from across the system will be used to assess participant response to the ways in which knowledge is represented for learning. During this phase, classroom management will be used as the exemplar and the researcher will present participants with a variety of formats in which material regarding teacher practice in classroom management is embedded. This would include case study, narrative, problem based scenarios and best practice statements. Participants will engage in a structured discussion inviting them to identify the features of the format that they find easiest to use/apply, the features that do not support learning, what formats would appeal to them as contributors of knowledge, and whether there are any other representations that they have used/been exposed to that have facilitated their own learning eg. Video clips. From this process and having regard to

literature, a set of design principles for knowledge capture and representation will be derived.

Three teacher focus groups each comprising five volunteers will be used to generate the initial knowledge base for use in the design and analysis. Participants will be asked to share stories in response to the question “What story from your experience would you share to describe things that you wished you had known about in a situation you faced in teaching.” Participants will be invited to capture their experience using the design principles for knowledge capture and representation and will later be interviewed to determine how the principles facilitated their ability to share experience and knowledge and whether each participant would be likely to contribute within a school setting. If not, participants will identify further modifications required to facilitate their contribution.

Key themes will be identified and a convergence method used to narrow the data to concepts and key words for structuring of materials and links in the knowledge management system.

A proto-type on-line knowledge management system will then be constructed through modification of the existing *myclasses* site. The initial design would incorporate outcomes derived from Phase 1 and phase 2 having regard to identified functionality requirements, key words/themes used for knowledge generation and codification, teacher knowledge generated in a format useful to both contributor and user, and capability informed through the literature review such as ability to link searchers with credible individuals in the system; capability to run mediated discussions; and capability for fluid knowledge transfer through blogs etc. A user reference group would assist in refining the form and final functionality of these features. The group will comprise ten volunteer teachers selected to ensure age, service, and primary and secondary experience representation. Development of a final prototype will signal the completion of the development phase.

Phase 3: Evaluation and testing of solutions

A link to the prototype site will be made available to all schools in the CEO, the site demonstrated, and teachers invited over a four month period to access and contribute to the site. Analysis of use of the knowledge will be a fundamental measure of the success of the system, (Cook and Brown,1999, p.389). A survey with Likert-type items and open questions will be issued to all teachers within the system. The survey will include:

- items relating to users: willingness to learn, motivation to contribute or use the site, whether the knowledge representation supported learning, and whether a change in practice was an outcome
- items related to use of the site: access levels, ease of use of the data base, perceived quality of the codified knowledge.
- demographic data to allow responses to be correlated with particular participant profiles: age range, experience, and primary/secondary experience will. This will be used in the final analysis to determine whether the design principles can be generalised to all teachers or whether there are significant differences based on demographics

The survey will be constructed for validation of the design principles, and will therefore be tested prior to use by distributing to a sample of thirty teachers for completion. Participants will be engaged in a discussion regarding clarity of survey language and meaning. The trial survey will also enable a critical analysis of whether the questions, as trialled, are eliciting the information required. Open questions will be analysed by themes.

Previous staff surveys in the Diocese have return rates of 63% (633 responses). With the anticipated level of interest from teachers in this study, it will be critical that the survey can be easily administered and analysed. Sharepoint, a program extensively used within the System, will be used this will allow survey delivery to be on-line, individually to each teacher. Given the anticipated survey population, the number of open questions will be limited.

Phase 4: Documentation and Reflection

The final phase requires that the data and outcomes be reviewed, analysed, and used to inform and construct design principles and explanations that can be applied to the construction of knowledge management systems in education.

Potential Ethical Issues

In this study, the researcher has a formal role in the organisation being studied, and is responsible for the selection, performance management and disciplinary processes of staff. The researcher will give formal undertakings and commitments to participants that there will be no adverse consequences for participation. All letters of invitation and consent issued to participants will make clear that the researcher is working in a private capacity and not in an organisational capacity, and stipulate very clearly that participation is voluntary. All data will be amalgamated and generalised to protect identification of participants. The researcher will invite key stakeholders in the organisation within the IT group and the school Heads of Service to act as a critical panel to ensure that the researcher is maintaining positional independence in the process. Participants will be required to adhere to a code of confidentiality that stipulates:

- Names of students cannot be used
- Names of colleagues should not be used without their permission
- Information about individual practitioners and practice areas other than the participants own should not be used

Conclusion

Sallis and Jones (2002, p5) describe the challenge:

Despite recognition of the need to manage knowledge resources properly, the understanding of how to go about doing it is still in its infancy...and in some sectors, such as education, there have been few attempts at taking it on.

This study will examine the knowledge sharing activities of teachers within a bounded system, the CEO Wollongong, and through an

examination of their use of the digital resource, *myclasses*, and through targeted engagement with users, a set of design principles will be developed that can inform the design of a system pertinent to the educational setting.

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