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## Training for ERP: Does the IS Training Literature Have Value?

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### Abstract

*This paper examines end-user training (EUT) in enterprise resource planning (ERP) systems, with the aim of identifying whether current EUT research is applicable to ERP systems. An extensive review and analysis of EUT research in mainstream IS journals was undertaken. The findings of this analysis were compared to views expressed by a leading ERP trainer in a large Australian company. The principles outlined in the EUT literature were used to construct the Training, Education and Learning Strategy model for an ERP environment. Our analysis found very few high-quality empirical studies involving EUT training in such an environment. Moreover, we argue that while the extensive EUT literature provides a rich source of ideas about ERP training, the findings of many studies cannot be transferred to ERP systems, as these systems are inherently more complex than the office-based, non-mandatory applications upon which most IS EUT research is based.*

### Keywords

End-user training, enterprise systems, enterprise resource planning, learning strategies

### INTRODUCTION

Enterprise resource planning (ERP) systems are large-scale software applications that integrate processes, information and people across complex organisations. They fall under the umbrella of enterprise systems that also includes applications such as customer relationship management, supply chain management, and the software platforms on which these applications operate. AMR research (2004) predicted that in 2004 the investment in the enterprise applications market would be around US\$50 billion and ERP will remain the largest component of companies' application budget. In a study of 13 industrial firms, ERP implementation budgets ranged from US\$2.5 million to US\$400 million, with an average budget of US\$80 million (Robey, Ross and Boudreau 2002).

There is little doubt that ERP is a high-risk investment. The software can take several years to implement, often the project budget escalates and many organisations adjust slowly to the complex software (Robey et al. 2002). Unfortunately, a significant number of ERP implementations fail to meet expectations (Davenport 2002). End-user training is often cited as one of the leading critical success factors of an ERP implementation (Yang and Seddon 2004). Studies report that the amount spent on ERP training could vary from as little as 1% (Wheatley 2000) to as much as 50% (Davenport 2000); with the average said to be about 12% (Wheatley 2000). In a recent study of 30 manufacturing firms, user training was the highest ranked ERP problem (Duplaga and Astani 2003). Wheatley (2000) writes that training is the 'smoking gun' of many failed ERP implementations.

Over the past three decades there has been a plethora of end-user training (EUT) research published in IS and non-IS journals. While this research covers the full training lifecycle from pre-training planning to post-training evaluation, most of the research is concentrated on the effect of individual differences on learning outcomes and the design of training materials. Given the importance of training to successful ERP implementations and the extent of published EUT research, in this study we address the following question:

*Are the findings of IS EUT research transferable to EUT in an ERP environment?*

To answer this question, we undertook an extensive review of end-user training research published in mainstream IS journals; and we also searched the ACM Digital Library for conference papers over the last ten

years. While over 80 journal and conference papers on EUT were collected, we retained 40 journal papers and two conference papers. These were rated ‘quality’ publications due to a sound theoretical foundation, a well-developed methodology, as well as clearly defined outcomes. Furthermore, we also supported the findings of our research through a personal interview with the lead ERP trainer of a large Australian company.

This paper is organised as follows. First, IS literature on EUT strategies is outlined and the *Training, Education and Learning Strategy Model* (TELS) is proposed. Second, we provide an overview of the 42 EUT studies and review the relevant EUT research within the context of the proposed model. Third, we discuss the transferability of EUT studies to ERP systems. This paper then concludes with a suggested research program that includes examining EUT for ERP systems, comparing current practices with the TELS model and identifying areas for improvement.

## TRAINING STRATEGY

Many researchers of EUT<sup>1</sup> recognise the importance of a training strategy, which is the framework to guide trainers in determining how to deliver training appropriately and effectively (Sein, Bostrom and Olfman 1999). Having such a strategy is crucial otherwise money and effort will be wasted on programs that reflect precarious and ineffective training approaches (Nelson, Whitener and Philcox 1995).

Various training strategies have been suggested in the literature (see Compeau et al. 1995; Bostrom et al. 1990; and Sein et al. 1987). Compeau et al. (1995) presented a framework of the training process that included three phases: initiation, training and learning, and post-training. This framework takes a narrow view of end-user training as it does not conceptualise where training fits within organisational learning; nor does the framework specify any training outcomes.

Sein et al. (1987) presented a more complex framework of the training/learning process. This showed that the characteristics of the trainee, the software to be learned and the environment, all affect training outcomes. Outcomes were expressed in terms of the trainee’s mental model of the system (knowledge) and their motivation to use it. Sein et al. (1999) later criticised their earlier work for falling short in defining appropriate knowledge. Sein et al. (1999) believed that while training research provides a source of information and ideas, no prior studies provided guidelines that could be used to establish a comprehensive training strategy. Consequently, they undertook a reconceptualisation of their earlier work and proposed the *Training Strategy Framework*. This framework consists of four major components: (1) types of IT tools, (2) types of trainees, (3) training methods, and (4) level of knowledge achieved. In brief, the framework seeks to develop specific training approaches and methods to impart specific levels of knowledge, ultimately to be integrated into an end-user’s mental model.

The main benefit of the Training Strategy Framework is the emphasis on levels of knowledge outcomes, as opposed to software skills and motivation to use. The six levels of software knowledge defined by Sein et al. (1999) are: command-based syntax and semantics, tool procedural, business procedural, tool conceptual, business motivational, and meta-condition. It was argued that training often focussed on equipping end-users with software task and procedural skills (the first three levels) yet essentially ignored the last three ‘higher’, conceptual levels of software learning. Citing Carnegie Mellon University’s failed implementation of client/server architecture due to skills-focused training, Sein et al. (1999) argued that the traditional approach to training “is not truly effective and inadequate for training the workforce of the future” (p.32). They recommended that the research community extend and validate the Training Strategy Framework, however, to-date little research has been conducted (see exceptions Coulson et al. 2003; Olfman, Bostrom and Sein 2003). The model, consequently, does not currently provide guidelines for building a comprehensive training strategy. For example, it does not provide guidance on how to classify user types, classify IT tools, and match training methods to user types.

Olfman et al. (2003) extended the Training Strategy Framework to include consideration of IT learning strategies and organisational learning strategies. An IT learning strategy was defined as “the pattern of IT actions for deploying resources to develop the repository of computer knowledge and skills in an organisation’s workforce” (p.75). Olfman et al. (2003) believed that there was a lack of business focus in terms of applying of IT skills to business processes and in understanding the ‘bigger picture’ in terms of what the skills and systems can do for the individual and the organisation. To resolve this issue, they proposed that creating and implementing an effective IT learning strategy would provide an integrative link between organisational strategies and application training strategies.

We propose the following *Training, Education and Learning Strategy Model* in order to capitalise on the strengths and overcome the limitations of the existing frameworks:

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<sup>1</sup> In this study, end-user is defined as any organisational unit or person who has an interaction with the computer-based IS as a consumer or producer/consumer of information (Cotterman and Kumar 1989). End user training (EUT) is the process of transferring required IS skills and knowledge to end-users (Huang 2002).

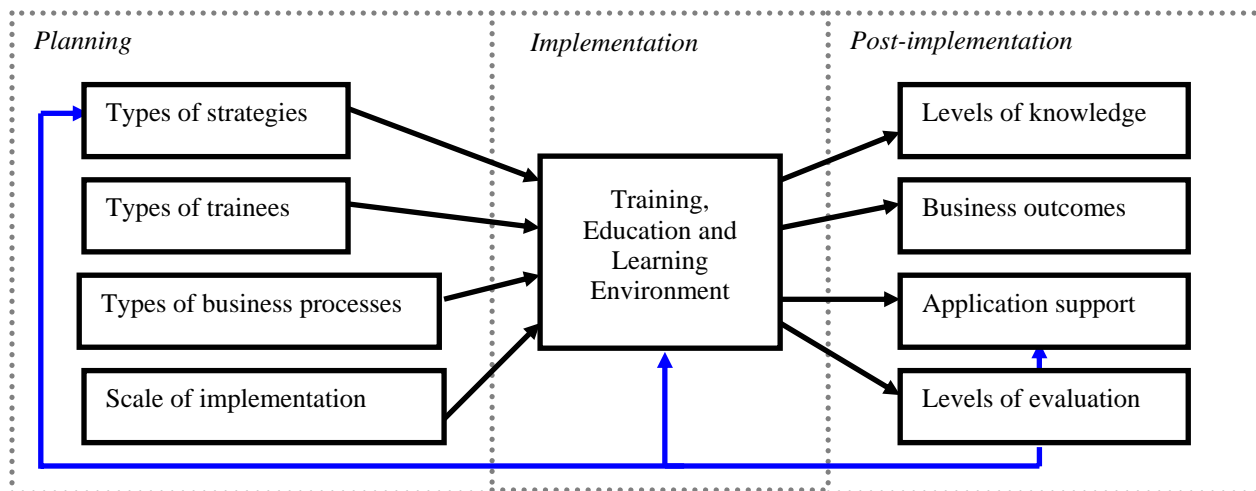


Figure 1 Training, Education and Learning Strategy Model - in an ERP Environment

The *Training, Education and Learning Strategy (TELS) Model* (Figure 1) is a synthesis and extension of the training strategy frameworks proposed by Olfman et al. (2003), Sein et al. (1999) and Compeau et al. (1995). This model specifically focuses on training, education and learning in an ERP environment. The distinction between education and training is that education provides the ‘bigger picture’ i.e. it addresses the higher conceptual levels of learning; whereas training provides the ‘how-to’ for using the software (Wheatley 2000). It was noted that the traditional approach to training is too software specific and end-users need broader-based, conceptual education about the ERP system and its effects on business processes (Wheatley 2000; Sein et al. 1999). Sein et al. (1999) argued that conceptual knowledge was a critical factor in the success of ERP systems and included it in their outcomes of levels of knowledge; yet, their model does not explicitly recognise conceptual knowledge as an input to the overall learning process. Consequently, we thought it important to highlight conceptual knowledge in the proposed model by making the distinction between education and training. Moreover, consistent with Compeau et al. (1995), we also draw the distinction between training and learning; the former is the input and the latter is the output of the training process. The Sein et al. model, however, implicitly recognises learning in the outcomes of their model, that is, in order to achieve a certain level of knowledge, end-users must have ‘learned’ something.

The TELS model represents training, education and learning as a lifecycle involving three ‘broadly’ classified stages: planning, implementation and post-implementation. Planning activities include formulating strategies after consideration of the different types of users, changed business processes and the scale of the project. During the planning phase, appropriate training materials, methods and media are decided. The implementation phase involves the conduct of the education and training to facilitate end-user learning. Post-implementation involves activities that help consolidate end-user learning and the evaluation of the training process. In general, most ERP training/education programs follow the suggested sequence, however, we are not precluding that other sequences are possible. By emphasising stages, we endeavour to capture the concept that the stages within the training project must have a logical relationship with the stages of the implementation project. In other words, the timing of stages during the implementation project has an impact on the timing and scope of training. For examples, training is often the first to be cut if the implementation project runs over time (Scott 2005) and the timing of the implementation is an important consideration in determining training materials and methods. An explanation of the variables within the TELS model follows.

**Types of Strategies** - the four types of strategies proposed in the above model are organisational (Olfman et al. 2003), IT (Olfman et al. 2003), change management and project management. Change management, which replaces Olfman et al.’s ‘training strategy,’ is a more appropriate term because it takes a holistic view of training in an ERP environment. Not only do employees need to learn a new system, they may also need to learn new business processes, new role relationships and perhaps new business structures. Furthermore, many will require motivating to embrace the overall change. Change management strategies must be aligned with organisational learning, IT, and project management strategies, hence the need to consider change management within the context of other business strategies.

**Types of Trainees** - refers to categorising users, defining their needs and matching training approaches that will satisfy those needs (Sein et al. 1999). Sein et al. suggested a classification that addressed end users’ job features and functional levels and recommended the following categories of trainees: top management, middle management, staff, clerical and operational. They also outlined SAP’s recommendations for classifying user types: transactional, casual and power-user. While we acknowledge that different trainees require different

training, a robust and well-tested classification scheme has not yet been identified. This is a topic for future research.

**Types of Business Processes** - refers to the different business processes that end-users must perform in their job function. A consideration of business processes was not included as an independent variable in prior training strategy research. In an ERP environment, types of business processes are an important consideration in determining training needs and methods. For example, a warehouse clerk involved in the shipping process will need different training than say a top manager involved in the production of accounting reports process. Moreover, many ERP implementations are associated with major business process reengineering efforts, therefore, most trainees must learn new business processes as well as learn how to use the new system.

**Scale of Implementation** - refers to the number, complexity and timing of the ERP modules implemented. It is evident that ERP implementations are heterogeneous - some companies, for example, undertake a phased rollout while others utilise a 'big-bang' approach (Brown and Vessey 2000). Some companies may implement one module that involves only a single corporate function (such as financials) as opposed to projects that involve multiple cross-functional modules such as logistics, manufacturing and financials (Brown and Vessey 2003). It is proposed that the scale of implementation impacts upon change and project management strategies; as such, it is an important variable in the TELS model. Sein et al. (1999) referred to this variable as 'types of IT tools' in their generic software-training model.

**Training, Education and Learning Environment** - is comprised of the training methods, materials, media and trainers employed to train end users. We felt that Sein et al. (1999) variable 'method' was an over-simplification of the overall training environment and may lead to confusion in IS studies. Method, therefore, was replaced with training, education and learning environment, however, method was retained as one element within this environment. Method is defined as the instructional design principles that underpin the training materials. Examples of instructional design principles may include: conceptual versus procedural, structured versus exploration, minimal versus comprehensive, and self-paced versus instructor-led. Materials are the physical training medium and may be in the form of items such as books, booklets, face-to-face interchange, diagrams, CD-Rom and reading packs. Media is the method used to communicate training to end users, examples include classroom, lectures, self-study, video, audio and the Internet. The selection of methods, materials and media are underpinned by an educational philosophy of how people learn; this philosophy may be either explicit or tacit. Finally, trainers are the people conducting the training who are either external consultants or internal employees.

**Levels of Knowledge** - we have retained Sein et al (1999) six levels of knowledge: command-based syntax and semantics, tool procedural, business procedural, tool conceptual, business motivational, and meta-condition. The first three levels are focused on skills in using the application, while the last three levels involve higher conceptual learning about why the system is important and encourages continuous learning of the application.

**Business Outcomes** - according to Robey et al. (2002), business outcomes may be defined in terms of traditional project management metrics (project deadline, project scope, project budget) or business benefits (such as reduced inventory, faster order processing time, and reduction in labour costs). The immediate nature of project management outcomes makes them easier to measure than business benefits where the outcomes are often mixed (Robey et al. 2002). Research into ERP critical success factors often point to change management and training as among the top critical factors (Nah et al. 2003; Yang and Seddon 2004); while research into failed implementations cite lack of training/education as the main contributor to failure (Wheatley 2000). Despite these hypothesised links between training and business outcomes, prior training strategy models do not explicitly acknowledge the business outcomes of training; rather, the dependent variable is typically knowledge about the target system (see for example Sein et al. 1999). Earlier work by Sein et al. (1987) and Bostrom et al. (1990) also included motivation to use the system as a dependent variable in their frameworks. Since the proposed model focuses on a mandatory-use system, motivation to use is not a relevant dependent variable in the TELS model. The TELS model, therefore, incorporates business outcomes to explicitly recognise the longer-term effects of training and education, and the need to explicitly evaluate and improve the outcomes from training and education.

**Types of Application Support** - includes mechanisms such as help desk, online help, knowledge management systems, communities of practice, establishment of power-users, etc. The Sein et al. (1999) model suggests that knowledge about a system is derived from training, but we know that this is not always the case, as application support is fundamental in filling gaps in end-user's existing knowledge. In other words, formal training is supplemented by other mechanisms that affect end-users' levels of knowledge. Application support, therefore, is recognised as an element in the TELS model.

**Types of Evaluation** - encompasses evaluation of the training, trainer, learning, learning transfer and business benefits. Like Compeau et al. (1995), evaluation has been included in the TELS model, although it was omitted from the Sein et al. (1999) model. In Compeau et al., evaluation was viewed as a post-training exercise while we believe that evaluation is an iterative process that should occur throughout the training process. Moreover,

Compeau et al. did not incorporate ways that training and learning evaluation might provide feedback into the development of future training strategies, the design of the training environment, the selection of application support, and so on. This is an important issue for establishing and improving the quality of any training strategy. Therefore, we have explicitly recognised evaluation feedback in the proposed model. The TELS model shows that the outcomes from evaluation are fed back into strategy, the training, education and learning environment, and application support. A common criticism of IS training evaluation practice is that it is often limited to administering a test following a course (Mahapatra and Lai 2005) and that the lack of effective measurement of end-user training outcomes leads to 'random-in-random-out' training processes (Nelson et al. 1995). We acknowledge, therefore, that different types of evaluation should be made explicit in the model. In particular, training evaluation refers to end-users' reactions to the training program; trainer evaluation refers to end-users' reactions to the trainer; learning evaluation refers to an assessment of the knowledge acquired during the training program; learning transfer refers to an evaluation of how effectively knowledge is applied once the application is in use; and business benefits is an assessment of how training contributed to the success of the project and/or impacted on business outcomes.

### Summary of TELS model

In summary, the TELS model is a process model for educating users on ERP. It shows that for different types of trainees, types of business processes and the scale of the implementation, training strategies are devised that aim to satisfy desired knowledge and business outcomes. These strategies must be aligned with other business and IT strategies. The intermediary between training inputs and outputs is the training, education and learning environment, which encompasses materials, methods, media and trainers. This environment is manipulated to encourage the most efficient and effective outcomes. Evaluation is undertaken throughout this process and results are fed back to ensure continuous improvement of the process. The major contribution of the TELS model are that it is focussed on training, education and learning in an ERP environment. Other training models take a 'one-model-fits-all' approach although the complexity of ERP systems makes it difficult to apply these generic models. The ERP focussed model takes into consideration business process reengineering, change management, the scale of the application, and the alignment of training strategies with other business and IT strategies. Moreover, the model explicitly recognises evaluation and the importance of evaluation feedback to continual improvement.

### EUT TRAINING RESEARCH

Appendix A shows a summary of the 38 empirical EUT studies and the 4 conceptual papers analysed in this paper. In the empirical studies, the third column titled '*Element*' highlights where the research fits within the proposed TELS model. The fourth column '*Target System*' specifies the type of application (business, office or software development tool) that subjects learned during the empirical study. The fifth column labelled W for '*Workers*' specifies whether research subjects were employees of organisations (workers), as opposed to students. Finally, the last column labelled M for '*Mandatory*' denotes whether it was mandatory to use the target system post-training, compared to voluntary use.

A major emphasis of EUT research has been on evaluating the effect of individual differences on knowledge outcomes and motivation to use. Seventeen EUT studies analysed variables such as: age, gender, motivation, anxiety, learning style, computer attitude, referent experiences and self-esteem. While the construct 'individual differences' cannot be mapped directly to the TELS model, individual differences would be taken into consideration in ascertaining the types of trainees and the types of methods, materials and media used. With a mandatory ERP system, the main issue for training strategy is establishing the most efficient and effective training environment, given that individuals are apt to learn differently. This simply may mean offering a range of methods, material and media to cater to a range of individual differences.

Nineteen empirical studies focused on elements within the training environment: methods (7), materials (7) and media (5). Unfortunately, the terms methods, materials and media were used interchangeably in the EUT studies, therefore, we had to make several judgements in categorising the research. Nonetheless, the definitions of methods, materials and media described in the TELS model were applied, irrespective of how the authors described their study. Drawing the distinction between materials, methods and media is important because it enables more effective evaluation of training strategy. That is, researchers and practitioners can isolate the individual effects of materials, methods or media on knowledge outcomes; rather than treat these variables as homogenous (for example, as per the Sein et al. 1999 model).

Training strategy was the subject of five studies while a further three studies focussed on evaluation. Only one study analysed 'types of trainees' (Nelson, Whitener and Philcox 1995) via a suggested program of training needs assessment; and only one study considered the characteristics of the target application (Davis and Bostrom 1993) via an investigation of the nature of the interface. In terms of the TELS model, very little is empirically known about the effects on training strategy of business process reengineering, scale of ERP implementation,

types of trainees, trainers, and application support. Furthermore, there is scant guidance on how to evaluate the overall training and learning process.

With respect to ‘target system’ in the summary of EUT empirical studies (Appendix A), the topology of software systems suggested by Legris et al. (2003) was adopted. Legris et al. identify three classes of software systems: (1) an office automation system is the software used in the automation of an office environment, for example Microsoft Office; (2) a software development tool is used in application development, for example Java programming language; and (3) a business application tool is used in core business processes, for example an ERP system.

In using the Legris et al. topology, some judgements were necessary because several researchers did not clearly specify the target application, the focus was on general rather than specific information systems, or the application straddled the characteristics of both an office application and a business application (for example, a database management system). To help clarify the distinctions, we further defined a business application as requiring the entry of data for major business process purposes. The outcome of this analysis revealed that just over one-half (20) of the empirical studies used office applications in the research design, seven used business applications and a further four employed software development tools. Nearly one-quarter (9) used various IS applications which we termed ‘unspecified’ (although they were probably office-based applications) or the IS of interest involved a hypothetical scenario. This supports Olikowski and Iacono (2001) contention that IS researchers tend to give central theoretical significance to the context of their study (in this case training), and little significance to the actual IS system on which the study is focussed. We argue that a shift in significance is required, from training to ERP systems, in order for IS researchers and practitioners to better understand the dynamics of training in such an environment.

### **Are the findings of IS EUT research transferable to EUT in an ERP environment?**

To answer this research question, we needed to determine whether the following EUT research are applicable to ERP systems: (1) studies involving office-based applications; (2) studies involving students in the research design; (3) studies utilising knowledge and/or motivation to use as the dependent variable; and (4) studies involving business applications.

#### **1. Studies involving office-based applications**

As mentioned, the majority of EUT studies involved office applications in the research design, therefore, it is important to analyse further the distinctions between ERP systems and office applications (see Table 1).

<b>ERP</b>	<b>Office Applications</b>
Complex system	Simple system
Integrated processes	Limited integration
Major business process reengineering	Negligible change to business processes
Lengthy implementation timeframe	Short implementation timeframe
Centralised database	Decentralised data storage
Data validity critical	Non-critical data
Business process oriented	Task oriented
Mandatory use	Voluntary use

Table 1: Comparison of the characteristics of ERP systems and office applications

ERP systems are complex systems involving integrated business processes and systems. Typically, implementation of an ERP system is a lengthy process involving major business process reengineering. ERP systems utilise a centralised database, consequently, data entered by one functional unit may be relied upon by other functional units throughout the organisation. Data integrity, therefore, is critical to the organisation. End-users usually interact with the ERP system to complete business processes and for knowledge management purposes. This interaction is mandatory. Contrast this with office applications such as MS Office, Windows, and various email systems. While these applications make it easier to perform work tasks, they typically are simple and non-critical applications involving limited integration and decentralised data storage. Office applications, in most instances, are relatively easy to implement concerning only minor change to existing business processes. Office applications are also task oriented in that they are designed to complete a limited number of tasks such as: create a document, create a spreadsheet, access the Internet, and so on. In general, use of office applications is voluntary.

Moreover, software development tools (such as programming tools, case tools, debugging tools and software maintenance tools) are also quite distinct from the concept of ERP systems. Software development tools lay the foundation upon which ERP systems are built, however, ERP systems are broader in concept encapsulating the execution of business processes and the production of information for decision making.

Given the distinctiveness of ERP systems from office applications and software development tools, it is unlikely that much EUT research can provide concrete practical examples useful for guiding training strategy. The predominant literature, however, may be useful for outlining principles and concepts for the development of training strategy. That is, most research is useful for providing a higher-level abstraction of training concepts rather than practical prescriptions for training strategy in an ERP environment.

## 2. Studies involving students

Fifteen of the empirical studies used students as subjects, while a further four involved university workers. In other words, one-half of the EUT empirical studies were conducted in a university environment; therefore, further EUT research outside of the university sector is warranted. There has been some criticism of the use of students in IS research, for example, Szajna (1996) argued that the findings of TAM-based studies only converged for student participants and software; concluding that the student environment is not representative of the complexity of real world situations. Furthermore, applications are non-mandatory when students are employed in the research design, even in those studies involving ERP systems (such as Coulson et al. 2003). That is, students are not compelled to use the ERP system after they finish the relevant subject. Students have a different value system than employees tending to be grade-focused rather than business task oriented. Consequently, it is unlikely that studies utilising students will provide practical guidance for ERP in a business environment; however, may be useful for guiding the design of university curriculum.

## 3. Studies utilising knowledge and/or motivation to use as the dependent variable

In virtually all studies that analysed individual characteristics and the training environment (methods, materials or media), the dependent variables were post-test training scores and/or intention to use the system. Yet, post-test training scores and intentions are not necessarily relevant for ERP systems; particularly intentions as ERP systems are mandatory. Even post-test training scores, when applied to ERP systems, are problematic. First, ERP systems require a high degree of user accuracy compared to office-based applications. During training, it is not sufficient that users simply develop an initial mental model of the system, which is post-training reinforced and extended as the user engages with the system. Due to the critical nature of ERP systems, it is important that the user develops a reasonably accurate mental model of the system *during* the training process. Moreover, this mental model must be retained until the software is implemented. The lead ERP trainer we interviewed, for example, stated that their training goal was at least 80% retention of the training material. It is important to note that none of the EUT studies in this paper set a benchmark level of accuracy to evaluate performance. Most studies compared two or more training interventions and concluded that one (or several) performed better (see for examples, Venkatesh 1999; Davis and Bostrom, 1993; Carroll et al. 1987-88). This does not preclude the notion, however, that none of these training interventions satisfy the exacting training requirements of an ERP system.

## 4. Studies involving business applications

The findings of studies involving business applications are more applicable to ERP situations than studies involving office applications and software development tools. This degree of applicability, however, is also influenced by whether the system involved mandatory use, or otherwise. That is, studies involving business applications and mandatory use, are more applicable with respect to ERP systems than business applications and voluntary use. Of the seven studies that utilised a business application as the target system, only three involved mandatory use of the software post training. A discussion of the three studies involving a business application and mandatory use follows, beginning with the ERP focussed research.

Two EUT studies (Scott 2005; Mahapatra and Lai 2005) used an ERP system in the research design. In particular, Scott (2005) analysed users' perceptions of training manuals two years after the University of Colorado implemented PeopleSoft's ERP system. Arguably, the long timeframe between training and measurement of users' perceptions of the training materials is a limitation of this study, as users' two-year interaction with the system will most likely influence their impressions of the training material. Nonetheless, the paper provides some interesting insights into EUT in that training materials should be customised to user roles, and that users viewed task support, more important than presentation, navigation and learnability (probably because several years after training, task support is more important than the design of the training materials!). The most significant aspect of task support was the need for reference, step-by-step guides for carrying out a specific task.

Mahapatra and Lai (2005) undertook a case study of a large US manufacturer<sup>2</sup> to test their framework for evaluating EUT. This five-level framework specifies the different targets of evaluation: technology, reaction, skill acquisition, skill transfer and organisational effect. Mahapatra and Lai (2005) provided only limited information about their research design, therefore, it is difficult to gauge the robustness of their study. Their findings, however, indicated that trainees preferred hands-on exercises involving real-world applications during

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<sup>2</sup> The manufacturer had recently implemented an ERP system - the vendor was not specified



training; and that trainees rarely accessed web-based training materials. They also found that linking training goals to organisational goals is especially important in measuring the organisational effect of training. Ultimately, they considered their evaluation framework useful for guiding training evaluation.

Nelson, Whitener and Philcox (1995) developed a Contents Level Framework for user needs analysis and tested this framework in the US Internal Revenue Service (IRS). The target application was an automated under-reporting system developed specifically for the IRS. The framework worked well for a specific business process, but is unlikely to be useful when applied to complex, integrated ERP systems involving multiple cross-functional business processes. In sum, even though the above three studies involve the mandatory use of business applications, they provide limited practical guidance in developing training strategy in an ERP environment.

#### 5. Application to ERP EUT

Most of the current empirical EUT research is not transferable to ERP systems; that is, the literature provides only limited guidance for developing concrete, practical training, education and learning strategies. The major value of the EUT research is in articulating the principles and concepts that underpin training and learning. Therefore, the principles and concepts that were identified in the review of existing EUT research were used to construct the TELS model.

## CONCLUSION

EUT for ERP systems is a significant area of research, and the importance of training for the successful implementation and use of ERP systems has been identified in the IS literature. This paper has noted several gaps in the IS EUT literature and particularly the shortage of research that is transferable to ERP systems. The Teaching, Education and Learning Strategy model presented a desirable framework for education and training in an ERP environment. The TELS model is specifically tailored for ERP systems and so makes three contributions to IS research. It acknowledges that education and learning, rather than just training, are important in successful use of ERP systems. It accommodates the significant process change across functional units in ERP-related transformations and includes the need to align training, IT and corporate strategies. It also acknowledges the importance of evaluation and feeding-back evaluation outcomes into future training strategies and implementations.

In terms of the TELS model, it is clear that very little ERP focussed EUT research captures the breadth and depth of this model; consequently, not much is empirically known about the most efficient and effective mechanisms conducive for training, education and learning in an ERP environment. There are many gaps in the literature and these give rise to a number of possible research questions that may include:

- (1) How the extent of business process reengineering effects EUT?;
- (2) How to best categorise different types of trainees and target training to suit users' task requirements?;
- (3) What is the appropriate mix of internal versus external training and how trainers influence learning outcomes?;
- (4) How various types of application support can extend and consolidate users' knowledge of the ERP system?;
- (5) How the scale of ERP and the project implementation timeframe influences the training environment?;
- (6) How to design the education and training environment to maximise knowledge and business outcomes?; and
- (7) How various types of evaluation can be used to improve future ERP training?

Given the shortage of research that applies to the specific needs of enterprise-wide, mandatory systems such as ERP, this model will provide the foundation for an empirical program to improve ERP training, education and learning and evaluation. In the first stage of this research program, current ERP training practices will be examined and compared to the TELS model. During the second stage, a framework for more comprehensive ERP training strategy will be developed.

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## APPENDIX A SUMMARY OF EMPIRICAL AND CONCEPTUAL EUT STUDIES

(Available on request)

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