MOTIVATING AN ACTION DESIGN RESEARCH APPROACH TO IMPLEMENTING ONLINE TRAINING IN AN ORGANISATIONAL CONTEXT

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ABSTRACT

The purpose of this paper is to explore the effectiveness of Action Design Research (ADR), a combination of Action Research and Design Science Research, as a methodology to examine how the implementation of e-learning will affect the learning outcomes for staff training in an organisational context. The research involves an intervention in the finance course offerings for staff training in the workplace. The paper briefly introduces the research problem of an inflexible and inefficient finance training offering, and the proposed solution of implementing e-learning. It then describes the seven principles of ADR in detail, in a tabular format, with particular reference to their application in this study. The paper then summarises how the seven principles fit into the four stages of ADR, namely, (1) problem formulation, (2) building, intervention and evaluation, (3) reflection and learning, and (4) Formalisation of learning. After discussing the ADR principles and how they relate to the research study, the paper concludes with the suitability and advantages of adopting an ADR approach to e-learning research. These benefits appear to be meeting the challenge of IS as an applied discipline, by implementing a solution in a real world situation, whilst also adding to e-learning theory and academic knowledge.

1. INTRODUCTION

In the light of the need to accommodate the continually changing business environment, the swift dissemination of relevant, up-to-date information is essential. When using an integrated financial system, changes in the system necessitate almost instantaneous communication, and are often accompanied by training issues. Apart from system changes, there is a basic requirement that the workforce have a working knowledge of the system, and the skill to extract relevant information from it. If as a consequence of insufficient or ineffective staff training, employees are not skilled or technically capable, then a major source of competitive advantage is lost, and the organisation's workforce cannot realise its full potential as a source of intellectual capital. Additionally, there appears to be a need for more input from IS research into the practice of e-learning in the workplace, specifically its effectiveness and on-going usage.

The immediate objective of this research is to convert the current instructor-led finance training courses for employees at an organisation to computer-based courses. The long-term objective is to create a learning environment that meets both the business need for a knowledgeable, skilled body of staff, as well as the individual adult learner's need for meaningful, practical and flexible instruction (Figure 1). The current instructor-led training is rigid as the venue and the trainer need to be booked, and the training schedule is set up a year in advance. This causes problems for trainees, trainers and line-managers. Having established that there is a problem situation, the difficulty is to employ a research methodology that has a practical outcome for the organisation, whilst simultaneously meeting academic standards of credibility, dependability and transferability.

Training Intervention Research Summary

- *WHO?* Specific members of the workforce that need access to financial system
- *HOW?* Computer based training courses (e-learning)
- *WHY?* Learn and/or upgrade technical skills & financial knowledge required to operate the financial system, as well as interpret financial reports (Business need) Meaningful, practical & flexible instruction (individual adult learner's need)
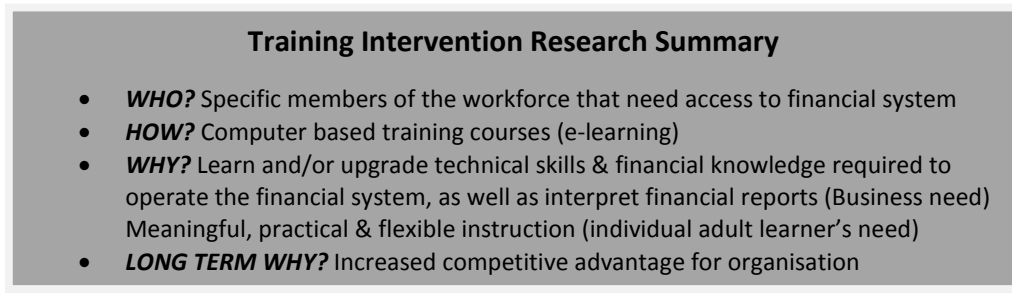- *LONG TERM WHY?* Increased competitive advantage for organisation

Figure 1. Proposed research to investigate the change from classroom based to computer-based training for compulsory finance training

There has been debate as to the nature of Information Systems (IS) research, and where it situates itself, for some time (Lee, 2010; March & Niederman, 2012; Rosemann & Vessey, 2008; Walsham, 2012). Lee (2010) examined key concepts of IS research and concluded that the future of IS research may lie in the "sciences of the artificial", as distinguished from the "sciences of the natural" by Simon (1969). The over-riding knowledge requisite for this type of discipline is "its efficiency and effectiveness for bringing into existence an artefact needed to solve a given problem, achieve a given goal, or otherwise fulfil a given need that is facing people in the real world" (Lee, 2010, p346). This is an opposite view to that of the sciences of the natural, which seek to theorise about things that are already there. As the objective of this research is to intervene in a real world setting, and to make changes based on a designed artefact, two research approaches were considered, namely Design Research (DR), also known as Design Science Research, and Action Research (AR).

Arising from the debate regarding the IS discipline and how it should differentiate itself from other disciplines, such as Computer Science, it may be suggested that the IS discipline stands at the intersection of people, organisations and technology (Hevner et al., 2004; Lee, 2010; March & Niederman, 2012). According to Iivari (2007), Design Research (DR) is problem focused and seeks to design an innovative product, or artefact, that addresses unsolved problems within an organisation. In the context of this paper, artefacts are defined as software and/or hardware that are assembled to form the object to be implemented. This "object" inscribes certain organisational structures into its form as it emerges, involving more than just technology in its conceptualisation and goals. Sein et al. (2011, p.38) describe artefacts as "ensembles emerging from design, use, and ongoing refinement in context". There is a build and evaluate process which forms a loop which is usually iterated as the design is refined, before the final artefact is produced (Hevner et al., 2004). DR must also contribute to research by making "clear and verifiable contributions in the areas of the design artefact, design foundations and/or design methodologies" (Hevner et al., 2004, p83). However, a possible limitation of design science research is that the building of the artefact is separate from the evaluation step, and the value of the research lies in its ability to solve the original problem, rather than testing it in a real life setting (Baskerville et al., 2009; Sein et al., 2011). The intervention or introduction of the artefact into the organisation is a secondary factor for much design science research, as the primary factor concerns the actual design of the artefact and testing is often not taken out of the laboratory (Cole et al., 2005).

According to Baskerville & Wood-Harper (1996, p.243), "Action research is regarded by many as the ideal post-positivist social scientific research method for IS research". They base this statement on the premise that IS, being a highly applied field, requires integration with the psychological and social facets of changing or introducing a technology into the workplace. People are directly affected by these changes, and both monitoring and evaluating their reactions should perhaps be considered an important part of the research. It seems that acting on feedback or evaluations from end-users is an important part of a successful implementation, and action research would appear to be ideally suited to allow for this. In order to increase user acceptance of the online courses, it is felt that feeding user evaluations and comments directly back into the course design would be advantageous for both the trainees and the organisation. Action research involves a strategy of formulating theory (Baskerville & Pries-Heje, 1999) and the researcher not only intervenes but participates in the study, which supports an interpretive, anti-positivist philosophy. Action research is iterative in nature, and the implemented process or object is refined during the cycles. It also includes what McKay and Marshall (2001) refer to as the duality of action research, i.e. the researcher is both participant

and observer. The researcher is required to keep both roles in mind, and separated, as the study progresses. On the one hand, the researcher is acting as the manager of the intervention, and as such is directly involved in the intervention, whilst at the same time, the researcher is required to reflect on the process in order to answer the research questions and formulate theories or themes. According to McNiff and Whitehead (2006, p13), "The purpose of action research is to generate living theories about how learning has improved practice and is informing new practices". However, action research has frequently been criticised for the occurrence of personal bias or over-involvement of the researcher, lack of rigour, and has sometimes been labelled as consulting rather than researching (Baskerville & Wood-Harper, 1996).

The purpose of this paper is to attempt to address the reported limitations of DR and AR research approaches, by adopting the research method proposed by Sein et al. (2011). It is hoped that Action Design Research (ADR) will be effective in addressing an actual problematic situation in an organisational setting. The research encompasses the building of an innovative Information Technology (IT) artefact, whilst allowing feedback from the users and the organisation to influence the construction thereof in reiterative cycles, allowing both learning from the intervention, and simultaneously producing academic theory.

This paper may be of interest to any researchers seeking a research approach that meets the need for relevance and immediacy in an organisational setting, whilst also contributing to empirical research on the effectiveness or otherwise of e-learning, and adding to the body of knowledge regarding theories of organisational learning and training. The need for this type of IS research is endorsed by Baskerville and Wood-Harper (1996) from the AR perspective, and Hevner et al. (2004) from that of the DR perspective, and Cole et al. (2005), who investigated the use of both research methodologies.

2. ACTION DESIGN RESEARCH

Cole et al. (2005) feel it would be proactive of IS researchers to consider using both design science research and action research together in order to achieve a rigorously designed artefact that is evaluated in a real life organisational context to solve or to ameliorate a perceived problem within that organisation. ADR, as described by Sein et al. (2011, p.40), "is a research method for generating prescriptive design knowledge through building and evaluating ensemble IT artefacts in an organizational setting". It has been designed to address the challenge of assisting IS practitioners by intervening in real world situations, whilst also building theory that is academically rigorous. This also serves to answer the call of making IS research relevant to practitioners and other IS professionals, and "promoting engaged scholarship through action and design" (Conboy et al., 2012, p114). It seeks to overcome the perceived limitations of design science research (DR) and action research (AR), as well as addressing Iivari's (2007) concerns regarding the differences between the two methods. By placing the IT artefact at the centre, this methodology also addresses Orlikowski and Iacono's (2001, p.130) call to "increase attention and explicit consideration of IT artifacts in all (IS) studies". ADR has strict, explicit principles which are sometimes lacking in AR, whilst the iterations and simultaneous building, intervention and evaluation address the sequencing difficulties of DR, when attempting to use the designed artefacts in organisational settings. By not taking the setting or context of the organisation into account, whilst designing the artefact, DR does not usually capture its emergent nature. There is interdependence between design and use in the organisation, which needs to be captured or inscribed into the artefact. This interdependence is highlighted by ADR.

There are four stages in the ADR method. These are (1) problem formulation; (2) building, intervention and evaluation; (3) reflection and learning, and finally, (4) formalisation of learning. It is important to note that the four stages are not engaged within a step or waterfall sequence, but are cyclical and reiterative. Sein et al. (2011) also describe seven principles of ADR. These principles are detailed in Table 1 below, with particular application to this research.

Table 1. The seven principles of ADR, as applied to this research

	Principle	Description (Sein et al., 2011)	Application
1	Practice-inspired research	The problem is drawn from the real-world and is used to create knowledge regarding a class of problems, which are typified by this particular problem.	Real world problem: Need to accommodate continually changing business environment by swift dissemination of relevant, up-to-date information. Class of problem – effective, efficient use of e-learning as a tool that is accepted by both the business and the trainees. This problem – converting current instructor-led training to online training that continues to meet business need for knowledgeable, skilled workforce, whilst accommodating trainee's need for practical and flexible instruction.
2	Theory-ingrained artefact	The original design of the artefact is based on existing theories and technologies, but the design may change once it is evaluated within the organisation.	Extensive literature review of current e-learning body of knowledge resulting in an artefact (the online training module) that encompasses many success factors identified, and allows for learner feedback and evaluation. Review covers system design, system delivery and system outcome; learning approaches and strategies.
3	Reciprocal shaping	This is where the IT artefact and the organisational domain influence each other, causing an iterative cycle to be set in motion. The design of the artefact will change as it is used in the organisational setting, and the organisation may be changed by the use of the artefact.	Alpha version of artefact tested by other trainers, changes to module made based on feedback. Beta version launched in controlled conditions (i.e. in lab, with instructor present, but all other conditions of online environment met – duration, test taken at learner's discretion). Further changes made to module based on learner feedback. Appropriately trained, motivated and enabled workforce has positive effect on organisation's financial reporting, leading to more modules, with targeted objectives, being offered online.
4	Mutually influential roles	This refers to how the multiple participants in the ADR project share their specialised knowledge and learn from each other. The researchers bring in the theory and the practitioners bring in the work practices.	Researcher designs course module using knowledge of best practices gained from literature on e-learning, with input from practitioners regarding course content, and specific working environment. With reiterative cycles, workforce input also influences shaping of module.
5	Authentic and concurrent evaluation	This means that the process of evaluation is never separated from the building and intervention, but is an integral part of both. Depending on the form of the artefact, evaluation can be either formative or summative, but must always be allowed to occur spontaneously in the organisational context, rather than in a controlled setting.	The initial course module is built and offered to trainees, in working environment. Feedback and comments are discussed by researcher and trainers, and changes made to artefact as appropriate. Unexpected consequences are immediately visible, and can be acted upon promptly. The artefact is continuously being evaluated and implemented in on-going wave in dynamic environment.
6	Guided emergence	This highlights the interaction between the initial design and how its implementation in the organisational setting causes a continuous evolvement and re-working of the emerging artefact.	The artefact is rolled out into the real life situation, and feedback from participants and assisting practitioners is immediately acted on by course designer/researcher, with re-designed module being offered almost immediately. Feedback will arise from course content and organisational environment, i.e. equipment, setting, timing, control. Each cycle will result in a re-working of the artefact (course module) as required by the evaluations.
7	Generalized outcomes	This ensures that the learning that has occurred during the iterations is developed so that the solution of the specific problem can be generalised to a class of problems.	The researcher will describe the learning and re-design of artefact based on user feedback and practitioner evaluation. This learning will in turn be linked back to current literature on best practices of e-learning in organisational environment.

The seven principles, detailed in Table 1, are aligned with the ADR method stages, and should be realised during the relevant stage. Thus, the first stage of problem formulation is addressed by the principles of "practice-inspired research" and "theory-ingrained artefact", the second stage of building, intervention and evaluation is addressed by the principles of "reciprocal shaping", "mutually influential roles" and "authentic and concurrent evaluation". The third stage of reflection and learning is addressed by the principle of "guided emergence", and the fourth stage, formalization of learning, is addressed by the principle of "generalized outcomes" (Figure 2, Sein et al., 2011).
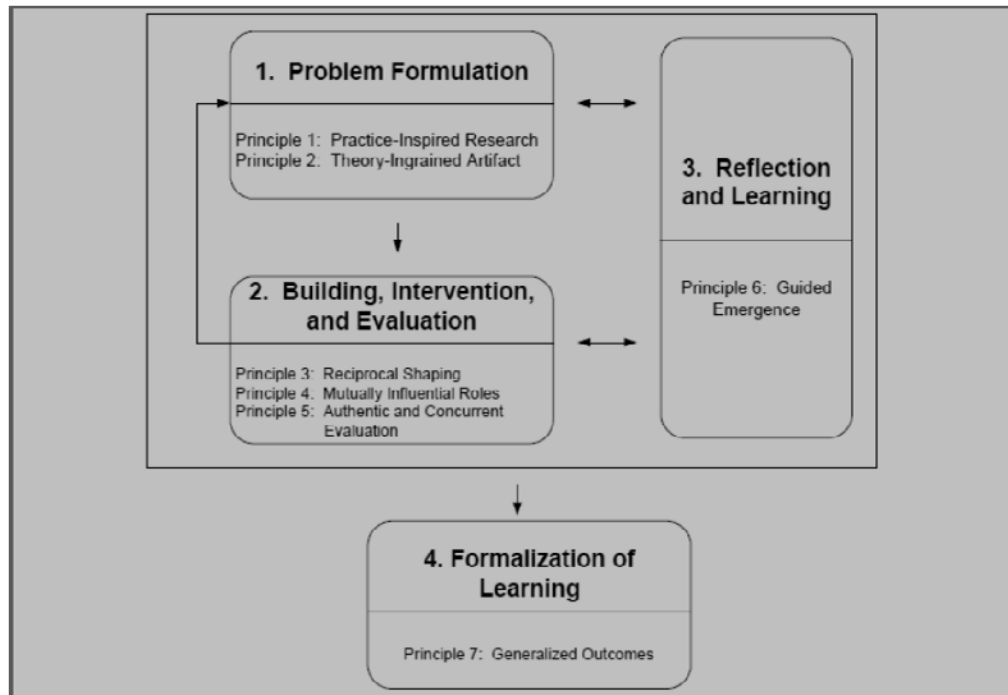

Figure 2. The ADR method: Stages and principles (Sein et al., 2011)
[Figure 2 from M. K. Sein, O. Henfridsson, S. Purao, M. Rossi, and R. Lindgren, "Action Design Research," *MIS Quarterly* (35:1), 2011, p. 41. Copyright © 2011, Regents of the University of Minnesota. Reprinted by permission]

The perceived problem which is to be investigated can arise from many sources within the organisation, such as practitioners, end-users, and the existing technology. In this research, the problems with the current classroom based training have been remarked on by trainees, trainers, line-managers and financial managers. To summarise the four stages, with the inherent principle(s), the first stage of ADR, "problem formulation", requires that the researcher identifies and conceptualises the research opportunity; formulates initial research questions; casts the problem as an instance of a class of problems; identifies contributing theoretical bases and prior technological advances; secures long-term organisational commitment; and sets up roles and responsibilities (Sein et al., 2011, p.41). The aim of the principle of practice-inspired research is that the researcher produces "knowledge that can be applied to the class of problems that the specific problem exemplifies" (p.40). The principle of a theory-ingrained artefact, which is also aligned to this stage, ensures that the artefact to be designed and tested within the organisation is based on current theory, or theories.

These theories should assist with the problem formulation, the identification of possible solutions and the initially created artefact, which is then introduced into the organisation for evaluation, as part of the second stage, "building, intervention and evaluation" (BIE). This introduction of the artefact into the real world situation should result in further cycles of re-designing or re-shaping, and re-evaluation of the artefact. Where the IT artefact is the focus of the research, Sein et al., (2011) suggest that alpha versions of the emerging artefact are tested and evaluated by the practitioners. After this strongly participatory process, a beta version of the artefact is introduced to the end-users themselves, and again, the resulting evaluations refine and shape the artefact (Figure 3).
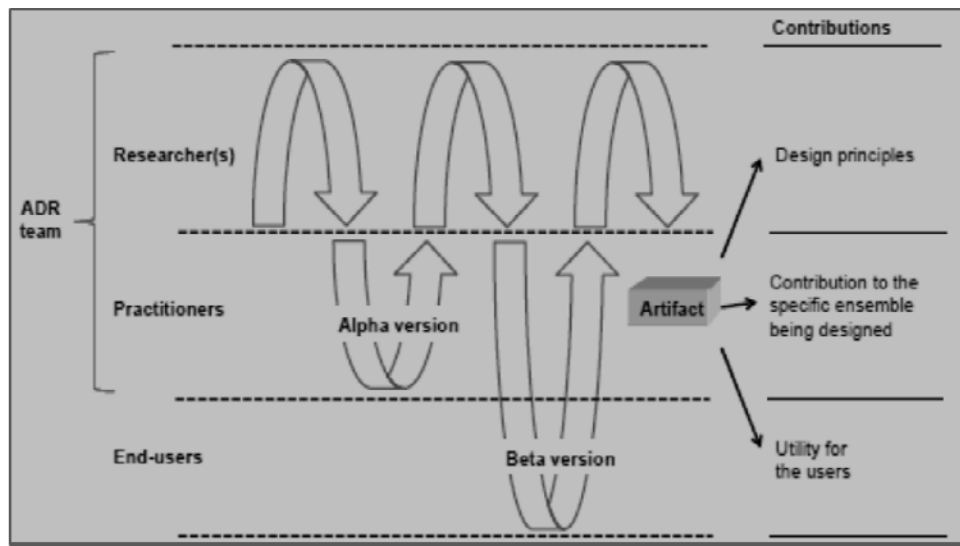
Figure 3. ADR generic schema for IT-Dominant Building, Intervention and Evaluation (Sein et al., 2011)
[Figure 3 from M. K. Sein, O. Henfridsson, S. Purao, M. Rossi, and R. Lindgren, "Action Design Research," MIS Quarterly (35:1), 2011, p. 42. Copyright © 2011, Regents of the University of Minnesota. Reprinted by permission]

The principles of "reciprocal shaping", "mutually influential roles" and "authentic and concurrent evaluation" are addressed during the BIE stage. ADR suggests that the influence of the IT artefact and the organisational context are mutual and inseparable. This may result in the original stance of the researcher being changed by the feedback from the organisation, and the ultimate version of the IT artefact quite different from the original version. Additionally, the researcher and the practitioner also influence each other. The different insights offered by these ADR team members into the creation of the artefact, mean that the end result should be more effective being a combination of both theory and practice. It should be noted that individuals in ADR can perform multiple roles, but that these roles are clearly identified and responsibilities assigned in Stage 1. It should be clearly visible from figure 3, the generic schema for IT-Dominant BIE, that ADR does not separate evaluation from building. It is hoped that any unanticipated consequences are surfaced during the evaluation of the alpha version, which then allows for refinement of the artefact, before the beta version is introduced to the end user. The decisions regarding the shape of the IT artefact and the intervention in the real organisational setting should be entwined with constant evaluation. Sein et al. (2011) emphasise that due to the emergent nature of the artefact, the setting is not controlled. It is their belief is that achieving authenticity in a natural setting is more important for ADR. The tasks in Stage 2 are therefore to (1) discover the initial knowledge-creation target, (2) select or customise the BIE form; (3) execute the BIE cycle(s); and (4) assess the need for additional cycles (Sein et al., 2011, p43).

Stage 3, "Reflection and learning", is continuous, and runs alongside both Stages 1 and 2. This is where the contributions to theory arise, and as the artefact emerges, adjustments to the research process need to be made as the researcher's understanding of it increases. The principle that is attached to this stage is "guided emergence". Stage 3 tasks are (1) reflect on the design and redesign during the project; (2) evaluate adherence to principles, and (3) analyse the intervention results according to the state goals (Sein et al, 2011, p44). The last stage of ADR is the "Formalisation of learning". The effect of the artefact on the organisation should be described as formalised learning, and it is hoped that the changes that were made during the BIE stage, will now be able to be explicated in order to enhance the original theories that were used to create the initial alpha version of the artefact. During this stage, the principle of "generalised outcomes" should be applied. Sein et al. (2011, p44) suggest this implies a shift from "the specific and unique" to "generic and abstract", and that three levels are involved, the "generalisation of the problem instance, the generalisation of the solution instance, and the derivation of the design principles from the design research outcomes". The tasks that should be accomplished during this stage are (1) abstract the learning into concepts for a class of field problems; (2) share outcomes and assessment with practitioners; (3) articulate outcomes as design principles; (4) articulate learning in light of theories selected; and (5) formalise results for dissemination (Sein et al., 2011, p45).

According to Sein et al. (2011), ADR has been developed with the ultimate goal of innovative design knowledge for the particular class of problems. The method acknowledges that the artefact being designed emerges from the meeting of IT and the organisation, and that any unanticipated consequences of implementing the artefact, can be addressed immediately, and to the benefit of both IT, from a theory perspective, and the organisation, from a practice perspective. It is felt that this approach, which combines AR with DR will be the best approach to realising the objectives of this research, as well as delivering research that is "efficacious for solving the practical problems at hand" (Lee, 2010, p345). The performance of the final versions of the implemented modules will be measured using the criteria of efficacy, efficiency and effectiveness (Figure 4), as defined by Checkland & Poulter (2006).

MEASURES:

- *Efficacy:*
  - *Measure 1*: Trainees able to extract relevant financial reports & accurate inputs in financial system
    Tool: Extracted financial reports, interviews with line managers
  - *Measure 2*: Trainee satisfaction with training
    Tool: Evaluation form
- *Efficiency:*
  Measure: number of freed trainer hours
  Tool: Report comparing classroom & e-learning trainer hours
- **Effectiveness:**
  - *Measure 1*: Improved Quarterly financial reporting submissions
    Tool: Report comparing quarterly financial reports
  - *Measure 2:* Improved financial job performance as rated by Financial Managers
    Tool: Interviews
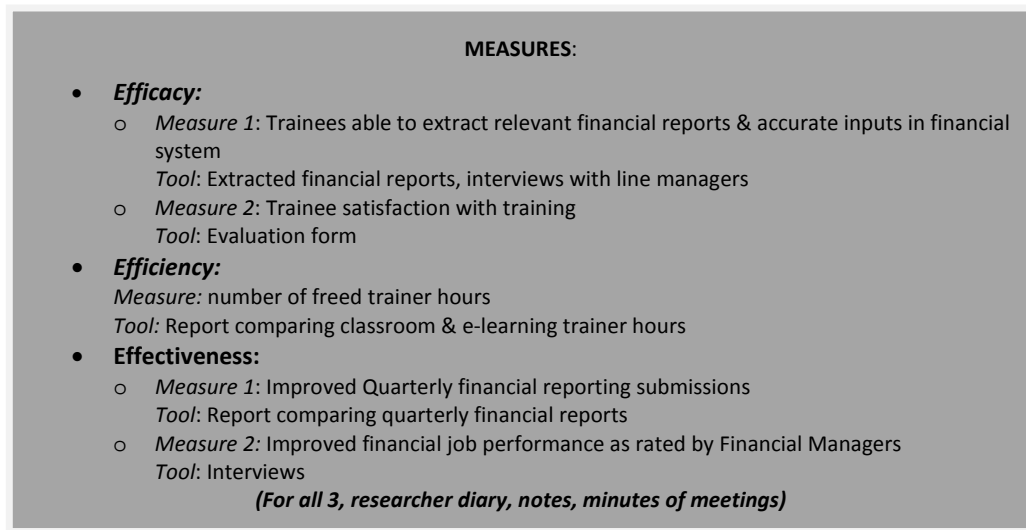   *(For all 3, researcher diary, notes, minutes of meetings)*

Figure 4. Proposed research measures to investigate the efficacy, efficiency and effectiveness of the computer-based training for compulsory finance training

3. CONCLUSION

When implementing e-learning in the context of the workplace, it is the personal experiences of the participants that is important. Whether the implementation is a success or not will depend on the subjective reaction that the trainees have when exposed to this method of training. It would seem that a good approach to ensure that the users of the system are involved is to use their own feedback to adjust the modules so that the final experience is both enabling and positive. Having researched both Action Research and Design Research as possible research approaches that are suitable for e-learning research, it appears that both approaches have their critics and limitations. Therefore, using a combination approach, designated by Sein et al. (2011) as Action Design Research, would seem advantageous. It is felt that this would be the most suitable way of solving the specific training concern, whilst at the same time, attempting to contribute towards improving knowledge in respect of e-learning implementations in the workplace and how to measure the efficacy, efficiency and effectiveness of such training (Iversen et al., 2004). It is also hoped that this approach will address the IS issue of being an applied discipline which needs to consider assisting practitioners, as well as adding to theory about IT and organisations, and the human resources within the organisations that use the IT.

As this study attempts to contribute to practice by intervening in a real world situation, the study is limited to the compulsory training of the workforce at a single institution. The training modules affected are run by the finance department systems and user support team. Therefore, it would be questionable to make statistical generalisation from the findings. However, according to Lee and Baskerville (2003, p230), "In interpretivism, a theory's pertaining only to the setting where it was developed would not detract from its validity or scientific status". Therefore, as this a qualitative study, the objective is to generalise from the

individual findings to a theory within a particular setting, rather than to generalise from the sample to the population (Conboy et al., 2012; Lee & Baskerville, 2003, Merriam, 1988). This study is set within the workforce of a particular organisation that employs a sophisticated, integrated financial system. Whether the findings may be applied to other organisations, both in Africa and abroad, is uncertain due to the composition of the workforce and the nature of the system, but the descriptive and practical nature of the research may enable other researchers facing a similar problematic situation within other organisations to use the theory and findings as a base to develop additional theories, or to compare and contrast interpretations.

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