INVESTIGATING ONLINE TRAINING IN GOVERNMENT AGENCIES: DESIGNING ADAPTIVE WEB-BASED INSTRUCTIONAL PROGRAMMES TO RESKILL THE WORKFORCE

Elspeth McKay, RMIT University, School of Business IT and Logistics, Melbourne, Australia
John Izard, RMIT University, School of Education, Melbourne, Australia

ABSTRACT

The government sector relies on continual employee reskilling. This journal paper discusses a three year Australian Research Council (ARC) funded project, which seeks to facilitate cost effective online-learning, using advanced information and communications technology (ICT) tools to enhance workforce training, with assured predictable outcomes. There is a perception from the educational technologists that the most desirable approach to promote positive eLearning outcomes is to personalize knowledge development through adaptive online training programmes. This research shows whether improved information technology (IT) governance motivates disinterested trainees and energizes frustrated management. Far too often, multi-disciplined specialists are required to resolve the factional dilemmas of governmental IT resource ownership. The timeliness of our project will highlight desirable change management issues to improve efficiencies and effectiveness of existing IT training resources. To this, the preliminary Pilot Study results are presented in this paper.

Keywords: *adaptive online training, eLearning, government training, workforce reskilling, social networking, social context of learning, collaborative work space, collaborative learning, eCommunities*

1. INTRODUCTION

Globally, government agencies employ a wide range of people with diverse skills across their provider network. Therefore we are interested to investigate current government workforce reskilling/training practice; although it is nearly impossible to locate published metrics on such data. Instead, we refer to the Australian Bureau of Statistics 2003 Survey, which identified that in 2001-02, 41% of employers provided structured training programmes. Yet it has been reported elsewhere that 79.2% of employers provide unstructured training in the workplace (Cully, 2005). The development of high-level skills across the workforce is expensive and requires major investment. Nevertheless the costing of workplace training is very difficult to quantify and access to current information is problematic. The Australian National Training Authority combined vocational and structured training to estimate the 1996 cost to employers was $6.186 billion. However, this only reflects 57% of the total Australian training cost of $10.845 billion (Richardson, 2004). Even so, in 2001-02 the cost of structured training was estimated at $4.018 billion, an increase of almost 60% on the 1996 value of $2.518 billion (ABS, 2003). .

The purpose of this journal paper is to describe a three year research project (2009 – 2012) that has been funded by the *Australian Research Council* (ARC) involving two collaborative industry partners (see Acknowledgement) and academic researchers from RMIT University, Melbourne, Australia. The primary aim of the project is to evaluate the effectiveness of emerging *information and communications technology* (ICT) tools as intelligent AGENT-based adaptive training aids; by direct contrast with existing methods currently being used by several Australian state government agencies. Upon completion of the project the researchers will disseminate their understanding and insight into how Australian government agencies function with respect to their adoption of *online training* for their workforce reskilling programmes and the hurdles that will need to be overcome to shift the current negative perceptions towards eLearning solutions. The terms *online-learning/online training* and *eLearning* are interchanged throughout this paper to reflect the common understanding by most training practitioners that they mean the same thing.

The following background section of the paper highlights adult learning to set the context for the discussion on web-based government training practice; while the next section provides the rationale for

the ARC project, where we note the importance of taking account of the *human-dimensions of human-computer interaction* (HCI) when designing *online* reskilling/training programmes. The research design and methodology section then describes the research framework and evaluation techniques that were used to investigate the online training practice in Australian government agencies. The final parts of the paper involve the discussion of the preliminary results where the practice of *social networking* emerges as a powerful online training resource.

2. BACKGROUND

Evidence of the *social context of learning* is all around us. History shows us that since the early days BC, people listened to the great Greek philosophers espousing their knowledge in public forums of the day. At times there would be robust argument; disagreement would be common place. It is only natural that arguments arose as people gained new knowledge by listening and comparing their thoughts with others. Following the advent of computers, Gordon Pask's conversation theory explains how people learn by adding new concepts to what they already know (Scott, 2000). In the conversation theory, *social networking* systems are regarded as symbolic, language-oriented systems that model how human-beings communication with one another (Glanville and Muller, 2007). This phenomenon occurs when two or more people reach a state of (implied) agreement based upon their individual understandings; even when elements of their interactions with other people change. As they recreate meaning from their individual understandings, new agreements often replace the older ones. Unfortunately stability of these (learning) transactions may occur without being dependent on the correctness of the original details.

Our response to another's speaking will depend upon how one person interprets the other's behaviour. This is how we derive (or internalise) our own meaning of what was said, through these agreement checking conversations (Scott, 2000). In typical business law schools of today, the *social context of learning* reverts to the classic Greek philosophers' Socratic learning environment. For example: in a typical business meeting setting to promote a learning opportunity, a business manager may ask a question, then either calls on an employee who may or may not volunteer an answer. The manager may then ask the employee more questions or move on to another person in the meeting room. This interaction resembles a type of instructional strategy that does not necessarily promote better learning outcomes. Instead, research reveals this practice is mostly for the worse; this type of Socratic instructional method is also common in many eLearning programmes (McKay, Lenarcic and Richardson, 2008).

2.1 Adult Learning

Knowing how to learn new skills is something that improves as we grow older. For the most part, as we travel along our lifelong learning path, it becomes easier to differentiate which instructional strategies are likely to suit us best. The difficulties we are likely to face, especially when learning in Web-mediated instructional environments, will depend on whether there are any fast-tracking options for the learning tasks. This means taking account of prior domain knowledge. We propose this is where social networks may provide the missing link. It is well known that novice-learners lacking the prior domain knowledge of the task require the full range of rules and information to be given to them, so they can understand something new, whereas an experienced-learner might only require a quick revision (McKay, 2008). Novice-learners will therefore respond best to measured amounts of guidance through progressively more complex instructional content when there are strategic opportunities for interactive practice examples along the way (Tennyson and Bagley, 1991). Alternatively, a person possessing the required prior domain knowledge - and hence a more complete grasp of the task - will likely want to experiment first, preferring to refer to the rules and basic information only when they need to.

Unfortunately there are many online instructional strategies that do not cater for both modes of learning. When instructional systems cannot adapt to this important requirement, they run the risk of demotivating both groups of learners (Tennyson et al., 1991).
The result may be confusion for the novices when the primary rules and examples are not sufficiently explicit, and boredom and frustration for the experienced learner who is forced into following the complete

instructional strategy. The design of online instructional materials must therefore include consideration of the level of a learner's expertise, ie: their prior domain knowledge. Our research shows that adults have relevant experiences that either drive them or demotivate them to learn, and that when the content and design of instructional materials do not challenge or interest them, they can become demotivated.

3 PROJECT RATIONALE

3.1 The Human-Dimensions of HCI

While many organisations have *eLearning* Websites that include courseware and other *online-learning* artefacts, they often lack a coherent and effective broad-based *eLearning* strategy (Rosenberg, 2001). We are suggesting that the human-dimensions of HCI (defined here as *social networking*) offer the strategic Web 2.0 glue for successful *adaptive online training* which Rosenberg notes is lacking. The human-dimensions of HCI are but one piece of the complicated computer-usability or techno-puzzle that involves two distinct contexts. One relates to the human-dimension or social context of computing, while the other relates to the machine-side, with people's perspectives being shaped by the performance of the technical computing components. The literature deals more often with the latter. It is only in recent times that a voice has been given to computer-usability issues that involve the human-dimensions (McKay, 2008).

Considering the *social networking* opportunities afforded by the human-dimensions of HCI provides a useful framework for understanding how adult learners prefer to participate in their online training. As we have seen in the government focus groups that were conducted in phase-1 of this project (see Appendix), attention to their shared prior knowledge increases learners' willingness to participate. Yet there is little evidence here that instructional design in the government sector includes recognition of the factors that encourage a positive attitude towards such participation in an online community.

3.2 Timely Innovation

Traditionally, employers view training as an expensive solution that is implemented to fix problems. In the current climate of changing work practices, every time a new ICT-tool enters the work-environment, employers seem to pour endless amounts of money into upgrading their employees' skill-base. The dilemma of this continual investment in work-place training begs the question of what we know about the impact of these emerging ICT-tools on institutional effectiveness. Furthermore, we believe that many of the *eLearning* solutions that have been implemented to date have been poorly designed and inadequately tested. Often, paper-based training materials are simply loaded into a *learning management system* (LMS) or courseware shell; without including adequate knowledge navigation or consideration for the principles of instructional design (McKay and Merrill, 2003). Moreover, much of these *eLearning* strategies fail to check whether learning actually occurs (as demonstrated by increased proficiency of the participants). In cases where checks are made, most attempts fail to use valid measures of the changes in proficiency (Anderson, 2008; Izard, 1999). It is no wonder that many *eLearning* solutions are poorly regarded by management and left unused by employees; making them ineffective and an expensive waste of resources.

This project upgrades the *advanced repurposing pilot system* (ARPS) (McKay et al., 2007) to innovate two new features for application in the government sector (an electronic trainer/personal assistant, and customising online-learning preferences). In the first instance, we have designed and implemented an intelligent software-AGENT as a virtual reality avatar or personal eTraining assistant. This is cutting edge ICT-tool development. Technological AGENTs as they apply to Computer Science are a piece of software that runs without human control or constant supervision to accomplish an individual's training-goals. These AGENTs will typically collect, filter, and process information during each employee's training session, thus playing an important role in balancing exploitation with exploration in knowledge discovery in corporate *online training systems* (Murthy, 2005a, 2005b).
Consequently, the data that are captured *online* can be reused as a personalized training knowledge navigation tool that is SCORM compliant. SCORM (*sharable content object reference model*) is a

collection of specifications that enable interoperability, accessibility and reusability of Web-based learning content (McKay et al., 2007).

Our second innovation relates to the adaptive/flexible eLearning/training tools, which are not currently prevalent in the government sector. This means when using ARPS each trainee can experience their own knowledge/skill development path. For instance, novice-trainees are given the full step-by-step skill development path; while a more experienced-trainee can choose to refresh certain aspects of their training. Making this distinctive effort to understand the preferences, background, and interests of *online* learners is clearly going to enhance the usability and design practice for effective *Web-based instruction* (Lawrence and Tavakol, 2007). Our hypothesis is that combinations of instructional strategy, prior domain knowledge and preferred cognitive learning context (in terms of visual-imagery/verbal-textual strategies) will work much better than assuming the common axiom that one size fits all approach to training solutions that involve ICT. As a result, improving corporate training outcomes will have a significant impact on business results (McKay, 2000).

As said before, the government sector relies on employee re-skilling; therefore, our ARC project is intended to address four main issues that relate directly to employee re-skilling to:

1. identify current in-house training practices, workforce needs, and intended learning content;
2. design and development of adaptable, flexible eLearning tools;
3. implement a research design that collects data from government trainees before and after implementing three training strategies (face-to-face only, eLearning only, and blended face-to-face and eLearning); and
4. analyse and interpret the results and disseminate the findings.

4. RESEARCH DESIGN AND METHODOLOGY

The project has four-main phases: 1) collection of government department training needs, and review of current training methods; 2) design and development of adaptable ICT training tools; 3) research design to investigate three training strategies (briefly described below); and 4) analysis/interpretation of results, and dissemination of findings. While the design and development of the adaptable ICT-tools (personalized intelligent software-AGENT, talking-head translators, 3D-Machinma game-based ICTs to produce virtual reality-training movies) commenced in June 2009; at the point of writing this paper these components remain untested. Consequently at the time of writing this journal paper we are currently conducting phase-3 of the research.

4.1 Research Framework

This research design is a quasi-experimental 3x3 model that involves independent variables (instructional format, learning preference and prior domain knowledge).

There are three-levels for each instructional/training strategy:
- face-to-face training (*Treatment-1*);
- *eLearning* alone (*Treatment-2*); and
- a blended approach (*Treatment-3*) involves both traditional face-to-face and electronic training-tools.

Learning preference is categorized as:
- verbal;
- intermediate; and
- imagery.

Prior domain knowledge is operationalized when each participant undergoes a screening questionnaire before their training session. and is divided into:
- novice;
- intermediate; and

- experienced.

Bagley and Heltne (2003) define novice-learners as having little in the way of relevant prior knowledge in their memory. As a result, their cognitive processes are different from an employee with greater background experience. Consequently, novice-trainees benefit more from different instructional methods than experienced-trainees (Bagley and Heltne, 2003).

4.2 Key Research Questions

- Does the evaluation of eTraining outcomes lead to more effective training strategies?
- What are the effects of each specific instructional strategy on training outcomes in the corporate educational/training environment,
- What impact does the mix of ICT-tools have on performance outcomes in corporate/government sector's Web-mediated skills development programmes? and
- Can ARPS empower more corporate/government sector champions?

4.3 Data Analysis

We employed *item response modelling* (IRT) using the QUEST Interactive Analysis System (Adams and Khoo, 1996). The *eLearning* outcomes are evaluated in terms of the magnitude of change in participant proficiency (magnitude of effect size as defined by Cohen's (1977) statistical power analysis). We expect that this analysis will generate a set of hypotheses regarding the interactive dynamics of skill development with and without ICT-tools as training mediation techniques.

Upon completion of the project, we expect that three directly parallel sets of data will result: one set for the training environments using the eLearning strategies as a central instructional tool for a whole training period; one set for the training sessions not using computer mediation at all or to any significant degree for the whole training period; and the third set that will comprise a blended training approach that implements both traditional face-to-face and electronic instructional tools. These data sets will be comparable because they will involve the same training facilitator(s) (whose knowledge of the business process and technical competence in *eLearning* has been identified as of equally high standard to their general work-place training competence), working with various government employees in the same locations for each training session. It will also be possible to identify paradigmatic differences between the levels of government practice, and demographic variations (time of service, gender and previous education) that may affect the training dynamics and training outcomes across and within the three training environments.

4.4 Training Practices, Workforce Needs, and Intended Learning Content

Government Skills Australia (GSA) run focus groups were used in phase-1 of the project to collect information relating to government employees' *eLearning* experiences. The expectation of the resulting data was to enable the University research team to understand the levels of computer literacy of government employees in general. It should be noted that due to the usual government ethics requirements for their participants' anonymity, a research code alone provided the researchers with the social and demographic characteristics and economic profile within the various government disciplines. Analysis of the evidence from these focus groups was reported in McKay et al. (2011). To develop and implement *adaptable* (flexible) *eLearning*-tools, GSA (see Acknowledgement), produced a focus group report to inform the research team of: current in-house training practices; workforce needs and learning content. This report was received by the research team on 4th August, 2010. Feedback from the focus group participants informed the GSA choice of *an introduction to ethics* as the first instructional/training content deemed as an appropriate government training course for use in the Pilot Study.

4.5 Development of Adaptable, Flexible eLearning Tools

The research team analysed the ethics learning resources that were provided by GSA to develop a courseware storyboard or detailed specifications to articulate the GSA-provided paper-based learning

content into the digital/online format. In all, the ethics material provided to the research team was divided into three learning modules: Module:1 What is ethics; Module:2 Ethics and ethical reasoning; and Module:3 Code of ethics and the *PLAN* model. An eight step knowledge navigation framework was applied to the storyboard to enable the foundation skill development on ethics to proceed. On the 4th May 2010, GSA had provided the research team with a copy of the Public Sector Ethics Act 1994 (Qld.) and a confidential outline of one government training group's approach to an ethics training course.

The research team in conjunction with our other industry partner *NetEffective Media Group* (NMG), (see Acknowledgement), translated the paper-based learning content into the digital online format to be used as the *eLearning* training strategy for the Pilot Study. The research design implied release of sufficient numbers of participants from other work duties to achieve stable and dependable results (with implicit direct and indirect costs to their particular State government agency and GSA). Accordingly, the research team were required to provide valid pre- and post-test assessment instruments. Since, this research design depends on both the face-to-face and the *eLearning* strategies to be effective, the research team followed the usual sound practice of conducting a Pilot Study that followed each procedural (methodology) technique as specified by the research design. In this way, the team sought to increase the likelihood of gathering useful information in the main experiments that are to follow. We also chose to gather the preferences of Pilot Study participants to see whether that group differed from the GSA focus group (since such differences may offer plausible explanations for some of the findings in each learning area).

4.6 Pilot Study

As described earlier, 'an introduction to ethics' was chosen by GSA as the initial instructional material (from their focus group feedback). It was believed by GSA that this topic was of wide applicability across all government departments and of importance in maintaining trust and respect among the public (and in particular, taxpayers and voters). The research team requested a total number of 75 government agency participants (20+ per instructional strategy) and GSA sought to obtain the number required.

This first Pilot Study was conducted on 5th October, 2010 at the Police Academy, Rokeby, Tasmania, Australia. Its purpose was to check the details of the research design before implementing the main experiment(s). These details included: checking the internal consistency of the pre- and post-tests; calibrating test performance on each test so that learning outcomes could be measured on a common scale (Izard,1999); and checking features of each instructional strategy to ensure effectiveness.

4.7 Participants

GSA advised on 29th September 2010 that only 30 participants were expected on the chosen day for the Pilot Study, with the possibility of more coming on the actual day. The total number of participants recruited by GSA was 23. As a consequence of these low numbers of participants, the research team decided to conduct the Pilot Study using only two experimental groups *(Treatment 1 and Treatment 2)* with random allocation of participants to these treatment groups.

4.8 Procedure

4.8.1 *Development of assessment instruments*

The purpose of the pre-test was to determine prior domain knowledge. The content of the pre-test was drawn from a reading of *the Queensland Public Sector Ethics Act reprint No: 5E effective 1 January 2010*, supplied by GSA on the 4th May 2010. The research team cross checked the supplied Ethics Act with the ethics presentation material provided by GSA following the first sighting of the GSA Focus Group Report in August, 2010. There were five main items, although some test-items had separate parts. All test-items were open-ended in format and the test was paper-based.

The first test-item asked the participant how he or she would recognize an ethical person and asked for a list of qualities of an ethical person. The second test-item asked what motivates ethical behaviour. The third test-item sought the key ideas of accountability. The fourth test-item presented a brief case study and separate parts that asked participants to identify behaviours from the case study that were adopted for *legal, personal-responsibility*, or *ethical* reasons. The fifth test-item presented a different case study

about a protocol on bullying. Separate parts of the questions asked participants to identify decisions that complied, decisions that involved situations not precisely covered by the protocol but *sufficiently* similar to be made through judgment, and decisions that involved situations not precisely covered by the protocol nor sufficiently similar to be made through judgment but were situations that can be dealt with by an experienced officer using *discretion*. A final part of these types of questions, asked participants to indicate which decisions illustrated *improper use of status*. The scoring rubric provided for 10 separate sub-scores, one for each test-item (1, 2 and 3) or part of a test-item (4 and 5).

The post-test was dual-purposed and also paper-based. Some test-items in Part-A were repeated from the pre-test to exercise control on the difficulty of the new test-items. In the analyses, test-items common to both tests would be given identical difficulties, and other test-items of Part-A and Part-B were related in difficulty to these test-items-in-common. Learning achievement would be shown by participants achieving a high-scaled score (for example, by doing better on the test-items in common, or by demonstrating higher-achievement on the other test-items).

4.8.2 *Choice of an instrument to assess cognitive preferences*

The instrument chosen to assess cognitive preferences was the *Object-Spatial Imager and Verbal Questionnaire* (OSIVQ) by Blazhenkova and Kozhevnikov (2008). To ensure that this instrument would be suitable, the RMIT research team gathered responses from a trial group of colleagues and did a preliminary trial of the analyses before using the instrument in the Pilot Study. This preliminary trial provided information about the internal consistency of the three separate scales produced by the OSIVQ.

4.9 Data Collection Before and After Implementing Training Strategies

4.9.1 Evaluate prior domain knowledge of each participant

All participants were given the paper-based open-ended pre-test (comprising five sections) as described in the procedure section above. To further align the focus group data with the Pilot Study data, three categories of information in the focus group feedback were also sought from the Pilot Study participants. GSA were responsible for engaging the focus groups; the focus group report given to the researchers only gave a vague outline of the members' eLearning experience characteristics. Therefore, we devised a model that would enable a comparison to be made across the two distinct research environments. This model draws on the questionnaire used by GSA in their focus group sessions. The resulting categorical data was to be conveyed from the Pilot Study participants back to the RMIT research team by each participant entering a response to the focus groups' categorization data in a set of small tick-boxes placed at the top of the pre-test. These main informational categories included: preferred training mode – a rectangle; experience with eLearning – a diamond; and should in-service learning for work purposes by any mode be considered part of one's workload – a circle.

Responses were to be used in the subsequent analysis. Participants were given the following legend to enter appropriate code:

- ***Preferred Training Mode***
  - F = face-to-face (classroom)
  - ED=eLearning at the work desk
  - EE=eLearning elsewhere at work or other venue
  - EH=eLearning at home
  - C=combined face-to-face and e-learning at work or other venue
  - P=paper-based correspondence
- ***Experience with eLearning***
  - 3=less than 4 hours
  - 6=4 to 6 hours
  - 9=more than 6 hours
- ***Should in-service learning for work purposes by any mode be considered part of one's workload?***
  - Y=yes, always
  - M=maybe, depending on circumstances
  - N=no, never.

4.9.2 Collect information about cognitive preference for each participant

Each participant was given the OSIVQ; the participant's OSIVQ three scale scores were to be used to split the population into two treatments groups according to cognitive preference.

4.9.3 Deliver the learning content area's training approaches

Group-1 (12 participants) received *Treatment-1* (face-to-face) in the initial classroom while Group-2 (11 participants) were allocated to *Treatment-2* (*eLearning*) and moved to the adjacent dedicated computer laboratory.

4.9.4 Evaluate post-training knowledge on the same knowledge continuum

All participants undertook the open-ended post-test Part-A (five sections with a total of 13 separate parts – some of which were the same as the questions on the pre-test), together in the main treatment room. All participants undertook the post-test Part-B also presented in the main treatment room). The scoring rubric provided for 29 separate sub-scores, one for each part of a test-item for each of the four instructional strategy case studies.

4.9.5 Prepare the data for analysis

Each test-item part on the pre- and post-test papers was first scored by the research team during October-November, 2010, and cross-checked to ensure that all correct answers received credit, regardless of their wording. Results for all participants were coded in an Excel spreadsheet by Professor Izard.

4.10 Subsequent Analysis and Interpretation

Pre-test results and post-test results were analysed with a test-item matrix that had each individual's responses for every test-item part. Common items (identically worded) were 'anchored' so that scale scores on the pre-test were comparable with scale scores on the post-test. The difference between pre-test and post-test scaled scores indicated whether learning occurred, whether no learning occurred, or whether the instructional strategy resulted in reduced achievement.

5. DISCUSSION OF PRELIMINARY RESULTS

The range of scaled test-item difficulties covered the full range of participant knowledge for the pre- and post-tests. This is an important factor in research design: if there are ceiling or floor effects in the instruments, identification of progress is compromised. Individual scores on pre and post tests have little meaning unless they can be interpreted with respect to the attainments they summarise. By way of example: the participant with the lowest-scaled-score (-2.92) on the pre-test (*Treatment-1*) was unable to name any qualities of an ethical person; could not distinguish between behaviours adopted for legal reasons, personal-responsibility reasons, or ethical reasons; or identify decisions in a case study that complied with a given protocol. In the post-test (scaled score -0.27) this participant could: name qualities of an ethical person; was able to distinguish a behaviour adopted for personal-responsibility reasons; identify a problem to be addressed; provide alternative solutions; and explain why the chosen alternative was the best ethical solution.

Similarly, the participant with the lowest-score on the post-test (*Treatment-1*) was unable in the pre-test (scaled-score -1.19) to: name any qualities of an ethical person; could not distinguish between behaviours adopted for legal reasons; but could distinguish between behaviours for personal-responsibility reasons, and ethical reasons; but could not identify decisions in a case study that complied with a given protocol.

In the post-test (scaled-score -1.36 and lower than the pre-test result) this participant still could not: name qualities of an ethical person; was able to distinguish a behaviour adopted for personal-responsibility reasons and behaviours adopted for ethical reasons; identify a problem to be addressed, but not able to provide alternative solutions. The participant with the highest pre-test score (scaled-score 1.07) (*Treatment-2*), also had the highest post-test score (scaled-score 1.88). In the pre-test this participant was

able to: name qualities of an ethical person; provide motivations for ethical behaviour; give key ideas of accountability; distinguish between behaviours adopted for legal reasons, personal-responsibility reasons, and ethical reasons; and identify decisions that illustrate improper use of status. In the post-test this participant was able to: demonstrate all of the skills demonstrated in the pre-test; and also identify a problem to be addressed; provide alternative solutions; and explain why the chosen alternative was the best ethical solution. These examples show that there was a wide range of knowledge about ethics when the pre-test was administered (establishing a need for effective training), and that even the highest-scorer on the pre-test was able to demonstrate greater achievement after the training had been provided.

The 12 individuals in *Treatment-1* (ran out of time) had a pre-test mean achievement scale-score of -0.80 with a standard deviation of 0.93. The corresponding post-test mean achievement scale-score for the same 12 individuals in *Treatment-1* had a mean achievement scale-score of -0.27 with a standard deviation of 0.34. In terms of mean learning achievement, the *Treatment-1* group moved up from –0.80 to -0.27, a gain of 0.52 scale-units (when rounded).

The corresponding 11 individuals in *Treatment-2* (finished earlier than *Treatment-1*) had a pre-test mean achievement scale-score of -0.17 with a standard deviation of 0.75. The corresponding post-test mean achievement scale-score for the same 11 individuals in *Treatment-2* had a mean achievement scale-score of -0.10 with a standard deviation of 0.57. In terms of mean learning achievement, the *Treatment-2* group moved up from –0.17 to -0.10, a gain of 0.07 scale-units (when rounded).

Considering these results, perhaps we are capturing the *social context of learning* that occurs during face-to-face instruction where an assumption is made in the literature that communities of *eLearning* (Johnson and Landvall, 2000) occur as an innate phenomenon. It is entirely fitting to raise the possibility for developing online *evolutionary learning communities* (ELC) (L'Amoreaux 2000). Originally the Laszlo ELCs were devised for school-based learning.

It is easy to use their three interrelated concepts of an ELC to model an industry-based *eCommunity* that draw on the Web 2.0 tools:

- a community-based corporate eTraining system – rather than an emphasis on going into a formal face-to-face training room;
- a learning-oriented skills development model – rather than an emphasis on preset training; and
- a wider learning *eCommunity* – promoting self-directed, flexible, ongoing collaborative learning online.

5.1 Social Networking

In a corporate working environment, when people gather around a computer to share ideas - is this not *a community*? After all, as the literature reveals - you can have a community that consists of *"a group of two or more individuals with a shared identity and a common purpose committed to the joint creation of meaning"* (Laszlo and Laszlo, 2000).

We summarise this view to say that a community is:

> *"a way of being together with both individual authenticity and interpersonal harmony so that people become able to function with a collective energy even greater than the sum of their individual energies"*.

We add to the following table to represent the different types of learning communities according to L'Amoreaux (2000). These groupings clarify how important it is to know what you are getting into when preparing to develop an eCommunity or online project-based team (Table 1 on next page).

Table 1. Promoting effective eCommunities of practice (adapted from Laszlo and Laszlo, 2000)

Grouping	Context	Attributes
Traditional	A closed and stable system. The collective identity is rooted in transmitted myths, values, norms, rituals and beliefs.	Narrow reference group, slow to respond to change, unless domination occurs from external group.
Surrogate	A closed and unstable system. Created artificially to attract and satisfy disenfranchised people who yearn for community through imposed norms and values.	Individuals must accept pre-established values, beliefs and rules identified by others in the community. For instance: considerable energy is needed to keep up the empathic relationships experienced in workshop when it is over.
(simple) Learning	An open and dynamic system. Individuals collectively learn to adapt to their environment.	Ideal for exploring new ways of working, learning, and enjoying life in an integrated manner. When functioning well, may lead to an ELC.
Evolution *Through effective Web 2.0 tools*	An emergent – self-designing eLearning system. Demonstrates stability by adapting WITH its environment according to the wishes and practice of the Web-based participants.	ELC is a human activity system that strives to be self-sustaining, promoting co-creativity towards mutually sustainable pathways for evolutionary development.

Due to the multi-disciplinary nature of project-based team work, good *social networking* skills are essential (Anklam, 2005). When these project-based teams are managed well, information and the Web 2.0 offer effective communication tools. We suggest it is a logical progression that these new hypermedia-ICT-tools enable virtual or managed learning environments. Forming successful *eCommunities* involves a type of knowledge transformation that requires both explicit and tacit knowledge creation. Explicit knowledge has quantifiable elements such as words and numbers; while tacit knowledge is more difficult to formalise – it is often more personalised and therefore *"often problematic to communicate in a controlled way across computer networks"* (Schwalbe, 2006, p.346). By utilising ICT-tools to their advantage, project-based teams have a unique opportunity to process a special type of knowledge creation. As they get to know each other, the team members will usually undergo a mutual cognitive skills development process, which includes: exploratory; collaborative; interactive; and individualistic learning.

Exploratory learning online often involves tacit-to-tacit social interaction, where people like to share their experiences in highly abstract ways. When all goes well with their exploratory phase of knowledge creation, their collaborative learning will evolve almost naturally. As such, their shared tacit knowledge evolves to become agreed explicit elements of knowledge that can be formally expressed in words and numbers.

Interactive learning online is similar to the collaborative environment described above. While the latter has a stronger exploratory focus in group-based activities, interactive learning is, therefore, all about specific performance-based knowledge creation (Schwalbe, 2006). This is where the shared abstract ideas of tacit knowledge will be forthcoming from the more explicit knowledge – or physical artefacts - that team members bring into their online team-work. Last, but not the least important in team-work-online, is the individualistic learning phenomenon. It is felt this individualistic approach is a product of the commercial acceptance of the Internet (Schwalbe, 2006). Corporate training programmes will commonly utilise this type of individualistic knowledge creation strategy in their design and development of their online skills-based training programmes. Communities, on the other hand, develop a closer bond between their members.

Typically, communities of practice evolve into longer lasting relationships than experienced in work or project-based teams. Members pass through a relationship-growing process where they learn to cope with the ups and downs of 'community life' in much the same manner as experienced in their everyday lives.

> *"… the members are part of an ongoing story, the community is always developing, members are interested in the needs of others and have a vested interest in each other – communities continue on after a specific project finishes or particular person's part of a specific project ends. Communities have an entity that is more than the individuals involved"* (Seaton and Sobek. 2007, p.1272).

It is interesting to note that *eLearning* changes control of learning (Seaton and Sobek, 2007). This is primarily due to the *social networking* that takes place within *eLearning* environments, quite separate from the planned educational/training schedule. The ongoing nature of these *eCommunities* promotes the type of continuing communication that gives people the 'cognitive room' to familiarise themselves with another person's perspective (Table 1). The result of this heightened understanding will be the development of more realistic and effective timelines, which in turn, are adhered to by the group. Moreover, we are suggesting that true collaborative relationships begin to emerge, fuelled by the *social networking* that is channelled through the Web 2.0 *eLearning* conduits. We believe further, that the emergent shared repertoire of these *eCommunities'* activities will lead to true collaborative relationships.

5.2 Collaborative Work Space

One of the aims of this paper is to portray the use of *online-training* through a *social networking* lens; rather than taking a more usual approach to convey a traditional view of education and training. Having said that, it is not unusual for an assumption to be made that *collaborative work space* and *online-training* should go hand-in-hand. Much has already been said in the literature about *collaborative learning*. These valuable contributions largely come from the educational technology research paradigm where the literature concentrates on leveraging the best out of the Internet to enhance instructional outcomes. There are just too many good contributions to mention here. Should the reader wish to know more about the historical context of educational technology research, they should start with an investigation of what is meant by the term *collaborative learning*. Much of this work comes from a multi-disciplinary research community, which combines the usually disparate fields of psychology, computer science and education. Known as *computer-supported, collaborative learning* (CSCL), their contributions concentrate on facilitating learning for people who are in different locations to collaborate online. Since the advent of modern ICT-tools, some would argue that we have moved a fair way down the *collaborative learning* pathway. Yet the reverse is true - as many people are still novice-users when it comes to effective use of the more advanced and interactive multi-media, or Web-2.0 tools, which are available on the Internet today.

Creating *collaborative work space* is certainly not a mere theoretical dream anymore; it is now a reality brought about with the advent of *eCommunities*. More and more we are seeing how the corporate workplace is engaging directly with information; giving rise to the term *information* or *knowledge worker*. In a sense, collaboration is a *bread and butter skill* for most people in the workforce – where the triple bottom line matters the most. For those readers who may not be aware – *triple bottom line* is derived from the accounting profession; it means expanding the traditional reporting framework to reflect the ecological and social performance in addition to financial performance. Some of us believe that *collaborative work space* is therefore a commercial necessity, if we are to survive in a global business environment. However, there are major hidden costs in such global networking. According to Felman et al. (2005), the hidden costs to a corporation for their information work with 1,000 information workers - with an average salary of US$60,000 each per year, plus benefits - is US$30 million for wasted time. There can be no doubt this is telling us there is enormous potential for software developers to come up with more efficient and effective collaborative ICT-tools that are easy to understand and use.

Content and quality of *eLearning* instructional strategies need to be designed with the utmost consideration for effective training. To achieve this, it is useful to think that the ***e*** in *eLearning* refers to *how* an online course is digitised, while the *learning* refers to *what* the course content involves and the instructional strategies needed to achieve the expected training outcomes. Furthermore, the *why* is about helping individuals achieve their educational goals or assisting organisations to improve employee skills and workforce performance (Clark and Mayer, 2008). For employees/corporate trainees to engage more intuitively with *eLearning*, it is important for designers to consider the learning needs of adult learners, to measure their learning outcomes effectively. Jasinski (2007) asserts that *eLearning* may facilitate highly valuable training and skills development, yet if the learning achievement is not measured, employers and employees will be less inclined to participate or believe in the potential of *eLearning*.
It is difficult to measure the effectiveness of *eLearning*; however, this goal is a design challenge shared by other types of training and workplace strategies (Jasinski, 2007). If effectiveness is not measured appropriately, there will be no legitimate evidence that *eLearning* occurred.

6. OBSERVATIONS FOR FUTURE INVESTIGATIONS

The expectation of substantial gains with a short training period around 2 hours) is unrealistic for both *Treatments 1* and *2* (and by extension, presumably, *Treatment-3*). Future investigations should include 1-day, 2-day and 2+day training to infer the duration of training that will allow substantive magnitudes of learning to be detected. Similarly, the size of each training group needs to be larger: it is difficult to justify such small groups being involved in training given the costs associated with providing trainers, the provision of suitable facilities, and the transport costs for both presenters and participants.

Face-to-face learning can provide more opportunities for feedback to participants. It would be better to add further feedback opportunities to the *online-training* strategy so that there is greater control of the magnitude of feedback which may be an alternative explanation of differential learning. Secondly, limiting the instructional material to a single content area (such as *ethics*) would provide no evidence of the extent to which the information obtained generalizes to other learning content areas. Additional content areas need to be added, with sufficient time allowed for the RMIT research team and the linkage partners to generate *eLearning* content, and pre- and post-tests.

The ethics pre-test has an internal consistency of 0.61 without deleting or adding items. This value needs to be improved by using the analysis to modify some items, and perhaps to move some items from the post-test to the pre-test so both tests are of comparable internal consistency and accuracy. The ethics post-test has an internal consistency of 0.77 without deleting any test-items. Refinement of this test by deleting Part-B test-items that failed to detect any differences between participants with knowledge and participants lacking knowledge on the dimension of interest (applied knowledge of ethics), would serve to improve the evaluation of post-training knowledge. These procedures will be followed in the next analyses while waiting for advice from GSA on the groups to participate in the forthcoming main experiment(s). The complexity of the case studies used in the face-to-face group *(Treatment 1)* may well be affecting the post-test evidence of achievement. This shows when participants identify stakeholders (for example), but do not choose the best solution or explain why that is so. The OSIVQ instrument does not have similar internal consistency indices for each of the three-scales. This suggests that, either permission has to be obtained to extend the weak-scale, or an alternative cognitive preference instrument should be chosen to replace the OSIVQ. Scoring of the OSIVQ needs simplification to provide this information more efficiently.

7. CONCLUSION

In closing this journal paper, we believe it is fair to say that creating a user-centred, flexible and *adaptive web-based training programme* by employing the integrated power of Web 2.0 tools will improve the delivery of corporate training. It might also address the needs of organisations seeking to become more competitive by building a well-trained, skills-enhanced workforce. A user-centred, flexible and adaptive *online-training* programme relies heavily on good instructional design and a learner-friendly interface. A poorly designed interface means learners must spend more time on learning the instructional materials than on mastering the knowledge provided (Ardito et al., 2006). The difficulty encountered in adjusting to such an interface will render the learning ineffective, which in turn, delays the inevitable groundswell of *online-training* implemented in government and corporate training.

We suggest that *social networking* has emerged in the business sector as a new way to harness corporate knowledge. As such Web 2.0 connectivity affords people to transgress across organisation boundaries that would otherwise be impossible. These connections have the potential to remain in place through the resulting friendships and business acquaintances, lasting as long as people have a reason to connect and may remain for long periods of time.

There can be little doubt about the added value of interactive *online-training* support systems that have shown there is an immense attraction towards implementing ICT-tools to enhance our learning potential. Some believe this rather new approach to increasing our experiential knowledge is now achievable through an enriched combination of Internet technologies. By combining the best of both worlds; that is, the client-side (customised operation) with the server-side (providing wider connectivity), we can see an

emerging field that some describe as the *rich-Internet-applications* (referred to as RIA). Thereby the Web 2.0 as it emerges post-dotcom, provides a range of powerful ICT-tools that include: easier access; updating capability; scheduling of tasks; and flexible eBusiness. But without evidence of learning, such enterprise will be seen being as ineffective.

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AUTHOR PROFILES:

Dr. Elspeth McKay, PhD, Fellow ACS, is an Associate Professor at the School of Business IT and Logistics, RMIT University, Melbourne, Australia. Her current research focuses of the human-dimensions of human-computer interaction (HCI) as it relates to government training and workforce skill development.

Dr. John Izard, PhD, is an Adjunct Professor at the School of Education, RMIT University, Melbourne, Australia, and a research design and assessment consultant. His current research includes the evaluation of learning as it relates to government training and workforce skill development, and evaluation of learning and teaching in university courses.