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The Use of Knowledge Management Techniques to Aid Learning Retention in On-LIne Learning Environments

Frank O'Reilly
Technological University Dublin

The Use of Knowledge Management Techniques to Aid Learning Retention in On-line Learning Environments

Frank O'Reilly

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M.Sc. in Computing (Knowledge Management)

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I certify that this dissertation which I now submit for examination for the award of MSc in Computing (Knowledge Management), is entirely my own work and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the test of my work.

This dissertation was prepared according to the regulations for postgraduate study of the Dublin Institute of Technology and has not been submitted in whole or part for an award in any other Institute or University.

The work reported on in this dissertation conforms to the principles and requirements of the Institute's guidelines for ethics in research.

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Date: ***01 September 2011***

ABSTRACT

The focus of this research is e-Learning and Knowledge Management and the synergies between them. While they are both very distinct and different domains, they share the twin goals of delivering personal advancement and improving performance through the acquisition of new skills. They both set about to achieve these goals by means of knowledge sharing and knowledge transfer.

However, both disciplines suffer from poor reputations due to low success rates – sometimes perceived, but often real. In particular, e-Learning has failed to live up to the promise it was said to show when it emerged as the successor to Computer-Based Training in the late 1990s. Organisations that embarked on extensive e-Learning programs have often failed to see a return on their investment in the form of performance improvements of those they trained. From the learners' perspective, e-Learning has often failed to engage, or to deliver the outcomes and personal advancement they expected.

This research aims to address the poor success rate of on-line learning by specifically examining the transfer of knowledge in the context of e-Learning solutions. It will do so by means of an experiment that will examine whether techniques from the world of Knowledge Management can be employed in the area of e-Learning to improve the learning outcomes, leading to a higher rate of personal advancement and performance improvement on the part of the learner.

Key words: *knowledge management, knowledge elicitation, knowledge acquisition, e-Learning, online learning, learning retention*

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Finally, I must thank the project partner, the Irish Society for Quality and Safety in Healthcare. Without their co-operation this project would not have been possible.
They also provided the volunteers for the project experiment, who I would like to thank for taking the time to participate in this project.

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GLOSSARY OF ACRONYMS

Terms

KM	Knowledge Management
KE	Knowledge Elicitation
CBT	Computer-Based Training
WBT	Web-Based Training
CPD	Continuous Professional Development
CME	Continuous Medical Education
LMS	Learning Management System
VLE	Virtual Learning Environment

Organisations

DIT	Dublin Institute of Technology
ISQSH	Irish Society for Quality and Safety in Healthcare

1 INTRODUCTION

1.1 Project Introduction

Knowledge Management (KM) and e-Learning are two very different fields that share a key characteristic – both involve the creation of useful knowledge from information or data found in existing resources (Marshall et al. 2003). They are both about knowledge generation (acquisition, creation, capture and adoption), knowledge storage, knowledge distribution, and knowledge application (Wild et al. 2002). However, despite this common link, the synergies between the two are only beginning to be explored.

At the same time, the e-Learning market is expanding rapidly every year with, for example, predicted annual growth rates in the UK of between 6.7% and 8% (Patterson et al. 2009). But the success of e-Learning in delivering on requirements is very mixed (Arbaugh & Duray 2011). Examining if KM can improve the success rate of e-Learning solutions is the central focus of this research.

This project, therefore, proposes to investigate the use of KM techniques as a tool for learning re-enforcement in the realm of e-Learning. However, it must be stressed that finding a perfect model for this marriage is beyond the scope of this project.

1.2 Background

This research has been undertaken to analyse how people learn and examine the role of knowledge sharing in the learning process. For a long time, learning for work was described as vocational education or even simply as training. The very terminology seemed to diminish the role of the learner and offered no sense of ownership. Many people have formed an impression of learning for work as something dull and uninteresting – perhaps because the delivery was dull and uninteresting.

In the course of the last twenty years, e-Learning has grown significantly to occupy an increasingly important role in education – not least professional education or Continuous Professional Development (CPD) as it is commonly known. For example, in the healthcare sector, where professional training is referred to as Continuous Medical Education (CME), it is estimated that currently around 10% of CME is delivered by way of e-Learning with the figure set to rise to 50% by 2017 (Harris et al. 2010). In addition, the results of e-Learning in medical education have demonstrated increased retention rates and better utilisation of content, in turn, resulting in higher achievement (Ruiz et al. 2006).

However, up until now much of what has been considered e-Learning content has been nothing more than a digitised version of hard copy training materiel. Far too often, little attention has been paid to the task of developing content based on the specific pedagogical characteristics of e-Learning. At the same time, what the most successful approaches have in common is that they avoid acting as a simple 'electronic filing cabinet' for learning resources delivered by other teaching methods but use the technology to transform the learning experience (Bilham 2009).

But, without seriously considering aspects of instructional design specific to e-Learning, the simple embracing of easy-to-use learning technologies such as Virtual Learning Environments (VLEs) can be mistaken for educational innovation (Westera 2004). All too often, VLEs are simply an attempt at a transference by electronic means of pre-existing pedagogy (Salmon 2005).

This research project seeks to explore the relationship between e-Learning and KM and to examine the potential benefits of using KM techniques to reinforce learning in such environments. In performing this research it is hoped to uncover new ways in which KM techniques could be exploited in the e-Learning domain.

1.3 Project Partner

To facilitate the research for this dissertation, the project was conducted with the help of a community partner. This partner was the Irish Society for Quality and Safety in Healthcare (ISQSH). The Society is a not-for-profit, charitable, non-governmental

organisation. They are dedicated to improving the quality and safety of healthcare, to supporting the development of professionals in healthcare quality through professional education, training and research and to providing a network for those working in or interested in healthcare quality to learn from and share with each other. The Society is governed by a multidisciplinary elected council. The Society has strong collaborative links with a number of national and international partners including the European and International Societies for Quality in Healthcare. Their commitment to professional education is evidenced by their decision to develop an e-Learning program for their members.

Their participation in this project is the first step in this process. The experiment conducted as part of this dissertation would not have been possible without their co-operation.

1.4 Research Problem

The primary problem addressed by this research is to determine if KM techniques can reinforce learning when incorporated into an e-Learning tool. The relevance of testing this hypothesis is based on the evidence that knowledge acquisition and validation appear to be a key outcome of the learning process in certain contexts (Carroll et al. 2009).

The effective role of KM techniques in the elicitation of knowledge from domain experts has been widely proven. (McGraw 1992). This research examines the potential of KM techniques, not in the extracting of knowledge, but in the embedding of knowledge (in the form of learning) in online learning environments.

1.5 Intellectual Challenge

A number of intellectual challenges run through this research:

- Understanding the relationship between KM and e-Learning
- Analysing the critical success factors in developing e-Learning solutions

- Examining how people learn and investigating the role KM techniques can play in this process
- Critically analysing the experiment results in order to draw scientifically valid conclusions

1.6 Research Objectives

The following objectives have been achieved throughout the dissertation and contributed to the overall outcome:

1. Establish the work done to date on the relationship between KM and e-Learning
2. Analyse success and failure factors in the delivery of e-Learning solutions
3. Investigate the appropriateness of using Knowledge Elicitation (KE) techniques as tools for learning re-enforcement
4. Demonstrate, through experiment, the application and effectiveness of a KE technique as a re-enforcement tool in e-Learning
5. Reflect on the process, identify future work and conclusions

1.7 Research Methodology

For the purposes of this research, the following methodology was employed:
Various sources were accessed to: realise a broad view of current KM theories and practices; identify existing synergies between KM and e-Learning; and discover models which facilitate the effective use of KM techniques in the e-Learning domain.
Sources include:

- Books
- Journals
- Websites

Further research was performed in the form of interviews to examine best practice in the area of e-Learning. These included a number of face-to-face interviews with representatives of the community partner aimed at listening to their views on e-Learning and understanding where it was placed in their organisation's strategic plan. Discussions were also held with people working within in the area of e-Learning

delivery to collect important material on best practice within the field. In addition, during the course of this research, regular meetings were held with the project supervisor to ensure the validity of the work being carried out. Finally, the hypothesis at the core of this research, namely whether KM techniques can aid learning re-enforcement in online environments, would be tested as part of an experiment involving two sample groups who would undertake a short e-Learning module. One of the groups would complete an exercise using a pre-defined KM technique and the learning outcomes would be evaluated to analyse its impact.

1.8 Resources

A number of resources were used in the course of this project:

- This research used as its starting point a collaboration with the Irish Society for Quality and Safety in Healthcare (ISQSH) who agreed to participate in the project as part of their development of an e-Learning strategy.
- From a technical point of view, a number of software tools were used to put together the prototype for the project experiment: Mindflash, Survey Monkey and Optimal Workshop.
- Google Scholar was used for unearthing the most up-to-date literature available.
- The on-line resources available through the Dublin Institute of Technology (DIT) library were extensively used for access to subscription journals and conference proceedings.
- The printed media available in the DIT library (books and journals) were also used for background research.
- Regular contact with the project supervisor provided invaluable feedback and ensured the project remained in scope and on time.

1.9 Scope and Limitations

This project attempts to test the hypothesis that KM techniques can be used as a tool for learning re-enforcement. In order to achieve this, a small group of volunteers will test and evaluate a simple prototype that incorporates a KE technique into an e-Learning module.

The main limitation of this research project is that KE techniques are primarily used to gather knowledge from domain experts. As such, no other instance of their use as re-enforcement tools has been found. Therefore, comparing the results of this project with other, similar research has not been possible.

What this research aims to do is examine the use of a single KE technique when applied to a learning module and, therefore, evaluate that particular technique. What it does not aim to do is examine the whole range of KE techniques (for there are many) and evaluate the effectiveness of each one in an online learning environment.

1.10 Organisation of the Dissertation

The dissertation is organised as follows:

- Chapter 2 : An overview of e-Learning and a discussion of its benefits and the challenges it faces
- Chapter 3 : A discussion of KM as well as an examination of the relationship between KM and e-Learning
- Chapter 4 : A description of the design of the experiment to be carried out as part of this project
- Chapter 5 : An explanation of the deployment of the experiment
- Chapter 6 : A presentation of the results of the experiment
- Chapter 7 : An analysis of the experiment is presented and conclusions are drawn

2 E-LEARNING

2.1 Introduction

This chapter will examine the field of e-Learning.
It will begin by defining what is learning. It will then examine what we mean by e-Learning before discussing its characteristics and principle forms. The chapter will also analyse the benefits of e-Learning and also the challenges it faces. Future trends in e-Learning will then be briefly discussed. It will place particularly focus on the role e-Learning can play in Continuous Professional Development (CPD).

2.2 Definition of Learning

Before examining e-Learning we need to be clear what we mean by the very term learning. For the purposes of this dissertation, learning is defined as a process, the core of which is the acquisition of competence and skills that allow the learning individual to be more successful in reaching individual goals or those of the organisation they are part of. It will also involve a change in context of meaning and purpose for the individual and affect their knowledge (OECD 2000).

In the professional context, one of the key elements of the above definition is that the learning facilitates the achievement of individual goals for the learner as well as operational objectives for the organisation. This definition also emphasises the notion of change in the understanding and knowledge of the learner, and the experiment conducted as part of this research is designed to evaluate this change. This is achieved by carefully assessing understanding of the subject matter both before and after delivery of the learning. This assessment of changed understanding is essential to evaluating the impact of the use of a KM technique on learning retention.

2.3 Definition of e-Learning

The term e-Learning has emerged in the last ten years as the successor to such previous incarnations as Computer-Based Training (CBT) or even Web-Based Training (WBT). There are a lot of definitions of e-Learning many of which are complex. But Horton offers a fairly simple and concise one:

"E-Learning is the use of information and computer technologies to create learning experiences" (Horton 2006)

The emphasis on the learning experience places the focus clearly on the learner. It reflects the wider shift in education away from the notion of training delivered by a teacher and towards a focus on the needs of the learner. E-Learning is also called web-based learning, online learning, distributed learning, computer-assisted instruction, or Internet-based learning (Ruiz et al. 2006). In reality, all of these terms refer to the same thing and may be used interchangeably in this dissertation.

While e-Learning is a form of distance learning, distance learning can be much more than e-Learning since it may include correspondence courses or one-way television lessons.

2.4 Characteristics of e-Learning

Clarke and Hermens (2001) outline what they see as the three vital components of e-Learning:

- Scalability: E-Learning can be scaled almost infinitely at little additional cost.
- Access: E-Learning is available anywhere there is an Internet connection.
- Timeliness: E-Learning can be continually updated with new information and knowledge relatively cost effectively.

Achieving a high degree in all three components is a complicated and difficult process that can prove beyond the resources of many organisations deploying e-Learning solutions. Scalability can only be delivered through detailed and flexible design and accessibility can involve significant investment in infrastructure. While achieving

timeliness requires resources be made available to regularly update content. However, the above vital components give e-Learning a major advantage over traditional modes of delivery which lack all three characteristics (Clarke & Hermens 2001).

2.5 Types of e-Learning

The arrival of the personal computer in the 1980s was a turning point in the history of what was then called CBT. Suddenly, new possibilities for computerised delivery of training opened up due to a more graphical, user-friendly interface lacking in the previous generation of mainframe and mini computers.

The emergence of the internet in the late 1990s took this evolution to a new stage by taking the content online and making it available wherever there was an internet connection. This move to networked delivery saw the arrival of software solutions aimed at providing the full range of functions required for managing the learning environment. This type of integrated solution is commonly known as a Learning Management Systems (LMS) or a Virtual Learning Environments (VLE) with the two terms used inter-changeably. A LMS or VLE can be defined as a system which uses the technology of the internet to manage the interactions between users and learning resources (Rosenberg 2001). Such a system usually incorporates at least the following functions: online course catalogue, online registration, launch and tracking of learning, assessments (including of prior learning), and management of learning materials.

2.6 E-Learning and CPD

In the modern, rapidly changing world, the need for organisations to constantly update their workers' skills is no longer a luxury but has become essential. It is estimated that 50% of all employees' skills become out-dated within 3-5 years (D. Zhang & Nunamaker 2003). As a consequence of this, the notion of lifelong learning, in which people continually learn and acquire new skills throughout their lives, has taken centre stage as a policy issue (Field 2000).

One of the most important characteristics of e-Learning is that it bridges the gap between work and learning (Rosenberg 2001). And if the best classroom experiences bring the workplace into the classroom, the best e-Learning experiences bring learning

into the workplace. Professional education and e-Learning allow workers the opportunity to keep their skills continually updated and abreast of any new job-related training. However, evidence suggests that e-Learning is more efficient because learners gain knowledge, skills, and attitudes faster than through traditional instructor-led methods (Ruiz et al. 2006).

In the professional world, learning is a means to an end and, in general, that end is enhanced performance in the workplace. Or to put it another way, in the world of work, learning is the process by which people acquire new skills or knowledge for the purpose of enhancing their performance (Rosenberg 2001).

E-Learning can also play a central role in organisational change as it provides a bridge between the cutting edge of education and training and out-dated procedure embedded in institutions and professional organisations (Harden 2005).

2.7 E-Learning Benefits

E-Learning has a number of benefits that make it appealing to many organisations. The most commonly cited benefits of e-Learning include lower course fees, reduced travel costs, and minimising lost productivity and work time on the job. Indeed, e-Learning is often the most cost effective way to deliver instruction (Rosenberg 2001). The financial benefits are clearer when viewed over the total lifetime of the learning program. While cost savings made on instructors, travel and accommodation are the most commonly cited financial benefits of e-Learning, the improvements in learner performance and, therefore, productivity may be even higher in financial terms (Rosenberg 2001). Another benefit is the flexibility e-Learning offers employees in relation to time and delivery constraints. E-Learning can offer learners control over the content, pace, time and place of learning, allowing them to tailor their experiences to meet their personal objectives (Ruiz et al. 2006). By using e-Learning, people are able to select a course or learning objective on an as-needed basis to meet a specific learning need when required.

E-Learning can also reduce the time it takes to train people. This can be achieved in a number of ways:

- It takes less time to start and end a learning session
- Learners can go at their own pace and not the pace of other group members
- Learning can be done at any time and in any place that suits the learner
- Learners can focus on what they need to learn and skip any content they don't require
- Encouraging staff to take responsibility for their own learning increases their motivation

Moreover, e-Learning can be designed to include outcomes assessment to determine whether learning has occurred. The experiment conducted as part of this dissertation incorporated this very notion of outcomes assessment into its design. This is described in detail in Chapter 4.

2.8 E-Learning Challenges

In its short history, e-Learning has had very mixed results. One report showed that 75 per cent of all workplace implementations of e-Learning programs have proved disappointing (Van Burren & Sloman 2003). According to Forrester research 70 per cent of learners starting with an online course will never finish it (Forrester 2000). It has also been noted that dropout rates are often 10 to 20 percentage points higher in distance education courses than in traditional courses (Carr 2000).

This raises important issues about the design and delivery of e-Learning solutions. Frankola (2001), in an article concerning dropout rates in corporate eLearning courses, states that learners most frequently reported lack of time, lack of motivation, poorly designed courses and incompetent instructors as the reasons for their attrition. Driscoll (2008) sees the failure of e-Learning in the workplace to live-up to its early expectations as having its roots in three factors:

- A poor initial pedagogical model of e-Learning
- Ambiguous distinctions between e-Learning technology and productive technology
- Increasingly blurred lines between learning and working

Far too often, the content delivered by e-Learning packages has simply been a digitised version of pre-existing material. And in the same way that e-Learning is different from traditional forms of learning; the design and delivery of e-Learning need to be different. Otherwise, the learner will lose motivation and interest and the e-Learning solution will fall short of its objectives.

A barrier to the production of high quality e-Learning courses is the high initial cost. Adopting e-Learning and its technology will often require large investments in people, time, money, and space that need to be justified to senior management (Ruiz et al. 2006). However, when designed correctly, this sometimes high initial outlay can be offset by the relatively low cost of on-going modification to content in the e-Learning solution.

E-Learning is often a solitary, individual activity and since there is limited social interaction in e-Learning, there is a high risk of learners losing motivation and dropping out if the material is not presented in an engaging manner.

2.9 Reasons Why e-Learning Fails to Deliver on Expectations

There has been much research into the reasons why e-Learning programs fail to deliver the desired outcomes for the learners. Rosenberg outlines the most commonly cited reasons (Rosenberg 2001):

Poor Quality of Content

In this case, the learner finds the content incomplete, inaccurate or out-of-date. This issue raises the question of quality control and continuous reviewing of content in e-Learning programmes.

Learning Lacks Authenticity

If the material is presented in a way that fails to relate to the real world of the learner in a way that they can see the application of the material, then they are unlikely to see its value.

Form Over Substance

Where too much emphasis is placed on the "look" of the learning, the instructional quality may suffer. Incorporating good multi-media into e-Learning doesn't eliminate the need for solid content behind it.

One Size Fits All

A "One Size Fits All" approach to content often results in a "One Size Fits No-one" result. Careful attention needs to be paid to the task of tailoring the content to the needs of the learning audience. This is a central principle of learner-focused education.

Technological Barriers

A difficulty with the technology involved in using an e-Learning solution is a very common problem. This can include a low level of computer proficiency on the part of the learner but also includes the many issues that can arise due to IT systems failure or incompatibility.

Lack of Learning Reinforcement

Reinforcement is one of the most powerful tools for learning and without it, learners will struggle to achieve the desired outcomes. Employing a technique from KM as a learning reinforcement tool is the central tenet of this dissertation.

Lack of Support

This refers primarily to a lack of available support for the learner in the event of a problem using the e-Learning solution – be that a technical problem or one of comprehension. But it can also refer to a lack of support, or more accurately, sponsorship from the learner's superiors thus undermining the learner's motivation.

Unhelpful Organisational Culture

If the learner is in an organisation that puts a low value on learning or fails to set aside time for the learning, then this can have a negative effect on learner motivation.

Un-engaging Design

If the learner fails to engage with the content due to a pure quality of design then the achievement of the learning outcomes will be adversely affected. This can be a design flaw as simple as too much text on the screen. Careful attention needs to be paid to all aspects of design if the above pitfalls are to be avoided.

2.10 Learning Re-enforcement and Assessment in e-Learning

The notion of Learning Re-enforcement is intended to describe tasks integrated into the design of an e-Learning solution that aims to assist the learner in retaining and internalising the course content. Ideally, the tasks should encourage self-reflection on the part of the learner as this can provide the foundation for learner-centred assessment and, therefore, should be incorporated into the design and expectations of any e-Learning solution (Palloff & Pratt 2009). The core of this project aims to test the effectiveness of just such a self-reflective re-enforcement task.

When applied to the area of e-Learning, assessment refers to methods used to test the learning of participants against the learner outcomes of the particular course. In the same way the e-Learning is different from traditional learning, the assessment techniques used in e-Learning need to be different (Palloff & Pratt 2009).

For the purposes of this project, Multiple Choice Questionnaires (MCQs) were used to assess the learners and they were incorporated into the prototype design on the principle that they should be both formative, meaning that they occur throughout the course and inform practice, and summative, meaning that they occur at the end of the course and assess cumulative learning from the course.

An issue that should not be ignored when talking about online assessment in e-Learning solutions is the potential for cheating. While this problem exists in traditional forms of educational delivery, it is complicated by the online nature of e-Learning which makes it difficult to know that the person taking the assessment is the same person doing the course.

As with traditional assessment, there is no perfect answer to the problem of cheating but in the online environment a mix of different assessment techniques and frequent assessments are often used to minimise this problem

2.11 E-Learning and the Future

The design and delivery of e-Learning has changed rapidly over the last twenty years. This has been driven both by technological innovation and also by a shift in the focus of education from the teacher or trainer to the student or learner. We have reached a point in the evolution of e-Learning where the technology is now just about robust enough for attention to turn to business development and pedagogical innovation and away from technical 'solutions' and 'fixes' (Salmon 2005). Also playing an increasing role in the future of e-Learning are ubiquitous learning, mobile technologies, social networks (communities) and personalized KM.

2.12 Summary

The chapter began by defining the very notion of learning itself. E-Learning was then defined and discussed and then its different forms and evolution were examined. The growing importance of e-Learning in CPD was highlighted. Time was also spent discussing in detail why e-Learning solutions so often fail to deliver on expectations. The role of learning re-enforcement and assessment in e-Learning was examined before the future of e-Learning was briefly discussed. The key theme running through the chapter was the need to focus on learning outcomes and how these can be assessed.

3 KNOWLEDGE MANAGEMENT

3.1 Introduction

This chapter examines the area of Knowledge Management (KM).
It begins by defining "knowledge" before examining the different types of knowledge namely tacit and explicit. A definition of KM is then given followed by a discussion of the benefits of KM to an organisation. The concepts of knowledge transfer are then explained and discussed.

3.2 What is Knowledge?

Before discussing how to manage knowledge, we must find a suitable definition for knowledge. Becerra-Fernandez & Sabherwal (2001) offer the following definition:

"Knowledge refers to information that enables action and decisions"

The above definition is particularly appropriate when looking at KM and CPD. One of the key objectives of learning in the context of CPD is to ensure the transfer of knowledge and skills from domain experts to practitioners. In the professional world, this transfer of knowledge has the specific purpose of equipping the learner with new skills to allow them to perform more productively and make more informed decisions. Collison and Parcell (2004) hold that knowledge is richer than data or information. Nonaka (2000), one of the leading figures in KM explains the relationship between information and knowledge as follows:

"Information becomes knowledge when it is interpreted by individuals and given a context and anchored in the beliefs and commitments of individuals."

The emergence of a new stress on knowledge is a reflection of the dramatic technological changes that have spread across the world since the 1960s (Field 2000). Indeed, it was in the 1960s, that Drucker coined the term "knowledge worker" when discussing the role of knowledge within organisations (Drucker 1969) and today the

term “knowledge economy” is widely used to describe an economy in which more and more people work with their heads rather than their hands.

Knowledge as a resource causes great confusion for economists, as it is the only resource which increases with use rather than diminishing. Knowledge may be expensive to generate but there is little cost to diffusion. Unlike physical goods that are consumed as they are used, providing decreasing returns over time, knowledge provides increasing returns as it is used. The more it is used, the more valuable it becomes, creating a self-reinforcing cycle.

3.3 Types of Knowledge

Nonaka distinguishes between two distinct types of knowledge – explicit and tacit (Nonaka 2008). Explicit knowledge is formal and concrete and can easily be recorded or written down. The product specifications of a bread-making machine are an example of explicit knowledge. Explicit knowledge is the easiest form of information to capture and once it has been recorded it can easily be stored and quickly accessed.

On the other hand, tacit knowledge is much more informal and encompasses the less concrete and hard to pin down skills often described as “know-how”. The mastery acquired over time by a baker is an example of tacit knowledge. Tacit knowledge differs from explicit knowledge in that it is highly personal and difficult to formalise, making it hard to communicate to others. It is knowledge that is deeply rooted in an individual’s actions and experiences. The notions of explicit and tacit knowledge constitute the building blocks of KM.

3.4 The Knowledge Pyramid

Davenport and Prusak created the knowledge pyramid as an attempt to represent and manage knowledge in organisations (Davenport & Prusak 1998). In it they draw distinctions between data, information and knowledge which they represent hierarchically as follows:

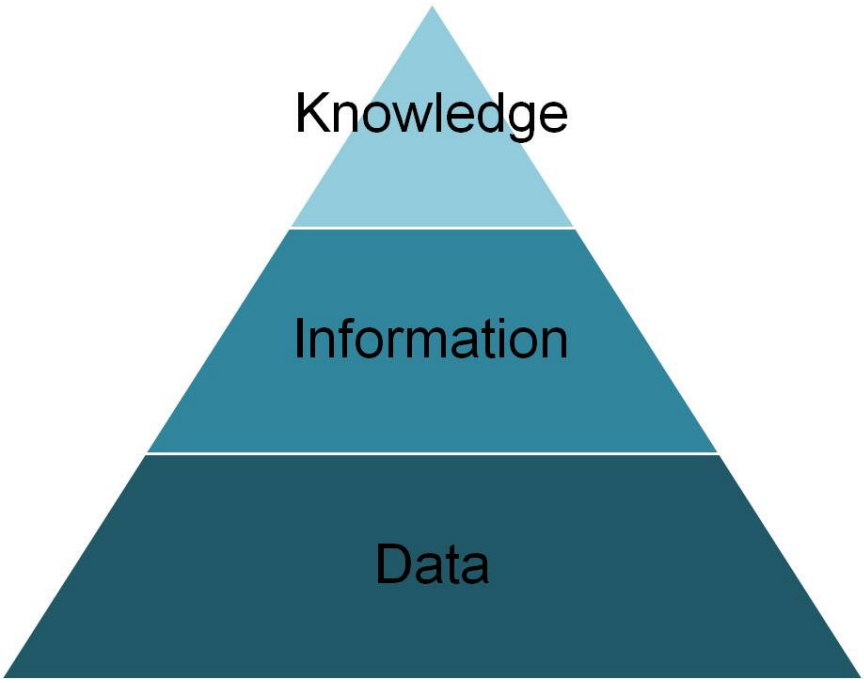


Figure 1 The Knowledge Pyramid

3.5 The Spiral of Knowledge

Nonaka and Takeuchi describe the process of knowledge creation and sharing by means of a spiral.

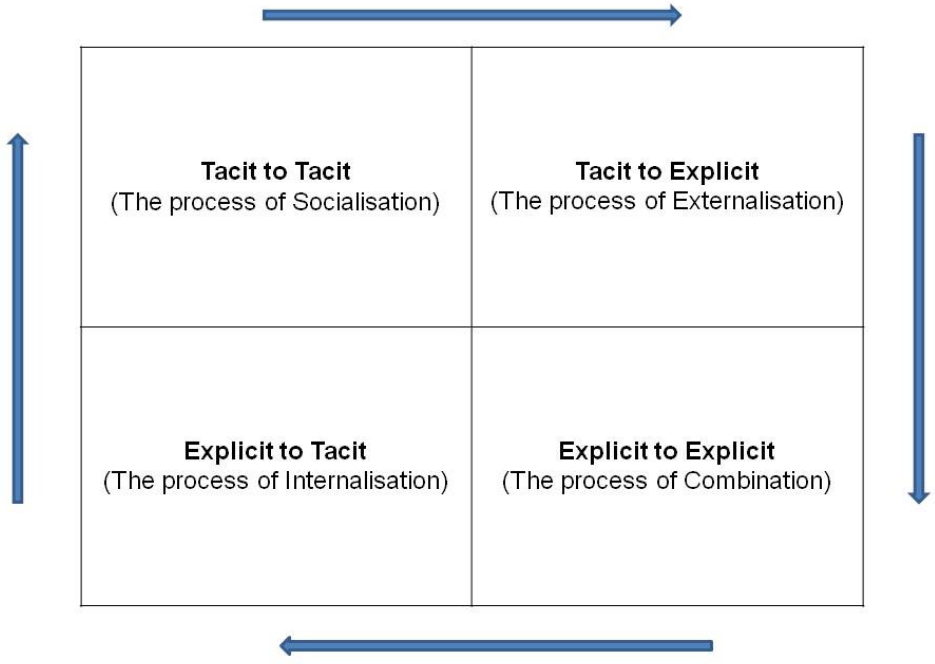


Figure 2 Spiral of Knowledge

The Spiral of Knowledge can be explained as follows:

Tacit to Tacit - the Socialisation Process

In the socialisation process knowledge is acquired and shared without being made explicit. In other words, the knowledge is not “captured” but shared through a combination of talking and observation. This can be in the form of, for example, lectures, meetings or simply conversations.

Tacit to Explicit - Externalisation Process

In the externalization process tacit knowledge is transformed into explicit knowledge. For this to happen, there must be recording and documenting of the knowledge

Explicit to Explicit - Combination Process

The combination process is more mechanical whereby multiple sources of documented information and knowledge are combined or re-configured which leads to the creation of new explicit knowledge.

Explicit to Tacit - Internalisation Process

This is the process of learning by repetitively doing a task during which we "internalise" existing information so that the applied principles and procedures become absorbed. The newly acquired knowledge therefore becomes incorporated into our existing prior knowledge.

3.6 Definition of KM

Although it has now existed as a clearly defined discipline for over 20 years, there is still considerable divergence on the definition of KM. Gabriele Piccoli offers a concise definition in his Information Systems for Managers:

"The term Knowledge Management refers to the set of activities and processes used to create, codify, gather, and disseminate knowledge in the organization" (Piccoli 2008)

KM is the process of capturing and using an organisations expertise – be it explicit knowledge (on paper or in databases) or tacit knowledge (in people's heads) (Awad & Ghaziri 2004). It involves people, technology and process in overlapping parts and can therefore be represented as follows:

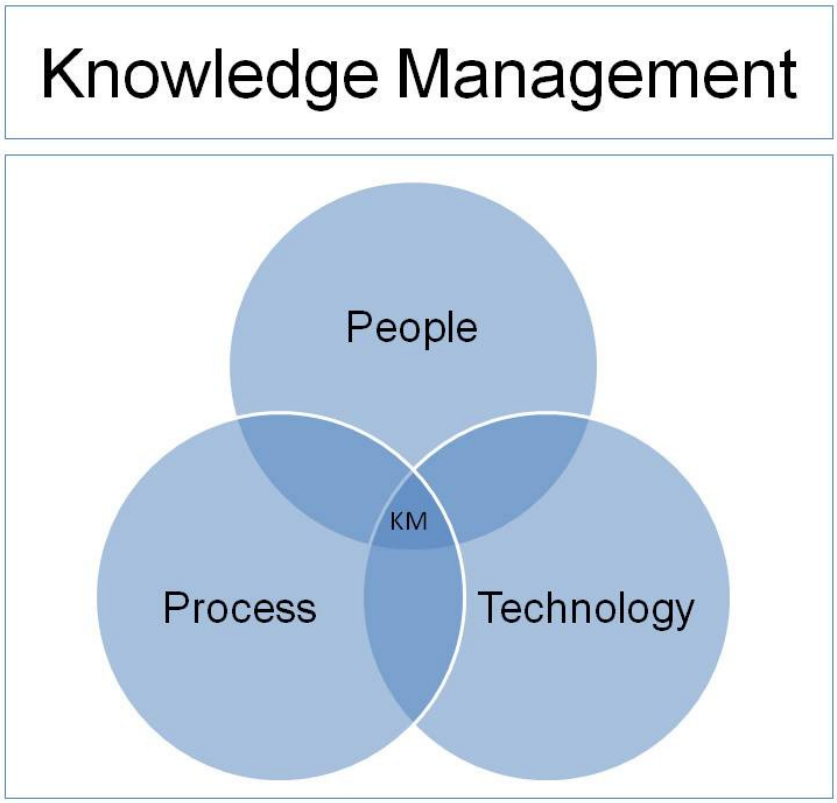


Figure 3 Knowledge Management

Wiig (1993) takes the analysis of KM further by defining what it is and it is not. According to Wiig, KM is:

- A management philosophy that takes explicit advantage of knowledge to make the organisation act more intelligently
- A management initiative that views and understands knowledge as it is used in operational situations and for long-term strategic improvements
- Ways to find, analyse, and focus on critical knowledge areas and associated management opportunities, and ascertain that proper knowledge is available wherever needed
- Methods to allow managers identify and characterize knowledge contents, needs, and opportunities associated with specific operations

Practitioners now clearly distance themselves from the knowledge engineering and information practices advocated by so many consulting firms in the 1980s – which often resulted in costly, lossmaking investments. These are now commonly characterised as "what KM is not" in line with the thinking of Wiig (1993), namely:

- A set of isolated techniques without a common framework
- A different label for Human Resources management and training
- A standardized methodology for "how to" KM
- A different name for "expert systems"
- A set of computer application programs
- A system to control distribution and security of knowledge

3.7 Knowledge Transfer

The notion of transferring knowledge is central to effective KM. KM is a conscious strategy of getting the right knowledge to the right people at the right time and in a way that helps people share and use that knowledge to improve organisational performance (O'Dell et al. 1998). Knowledge transfer or sharing is effectively knowledge creation as an organisation creates exponential benefits from the knowledge as people learn from it (Awad & Ghaziri 2004). In an economy where the

only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge (Nonaka 2008).

3.8 Knowledge Elicitation

Knowledge Elicitation (KE) is the area of KM aimed at collecting broad and deep knowledge of a particular domain. Typically, KE is carried out by an elicitor who is collecting expertise from an expert in the domain being studied. Traditionally, it was used to for the transfer and transformation of problem-solving expertise and domain knowledge from a source for recording on a computer system (McGraw 1992). It involves identifying the major aspects of a domain including the key concepts and relationships. It is a crucial step in the effective design of successful systems in domains dominated by deep and complex knowledge (McGraw 1992). There are many techniques used for KE. For the purposes of this research, we will examine the most commonly used techniques.

Interview

The interview is the most commonly used KE technique (McGraw 1992). It is a very effective way of collecting general information concerning a domain. Interviews may be structured, in which there is a clear structure and goal, unstructured, where there is no clear organisation of the interview, or semi-structured, which is a mixture of the two.

Observation

Observation is a very simple technique for understanding the skill and knowledge involved in a task. In this technique, the elicitor observes and records the domain expert for the purposes of KE.

Teach Back

The technique of Teach Back involves the elicitor "teaching back" their understanding of the domain to the expert. The expert may then comment on and correct the teaching thereby refining the elicitors understanding of the domain.

Card Sorting

Card Sorting (or Concept Sorting as it is sometimes called) is a technique used primarily to generate information about the associations and groupings of specific data items. In a typical Card Sorting exercise, the elicitor presents the domain expert with a list of items (or concepts) related to a particular subject domain and asks the expert to arrange them into one or more groups based on any relationship the expert sees between items.

3.9 KM and e-Learning

KM is really just a metaphor because knowledge cannot be "managed" (Horton 2008). Unlike, for example, Project Management where concrete tasks and resources are managed, KM deals with something much less concrete and difficult to identify – the know-how within an organisation. However, it is possible to improve the processes used to collect, create, reuse and share knowledge within organisations, and e-Learning is the perfect tool to achieve this goal. It is said that the ideal knowledge organisation is one where people exchange knowledge across the functional areas of the organisation by using technology and established processes (Awad & Ghaziri 2004). Initiatives to exploit the synergies between KM and e-Learning are not new. In the late 1990s, Siemens in Belgium and Luxembourg launched a project called Siemens Learning Valley that combined KM and e-Learning and which has been cited as a best practice both inside and outside the company for its pioneering approach to organisational learning (Staes 2002).

If e-Learning can be used to share tacit knowledge across an organisation, then it will serve as a valuable tool for KM (Wild et al. 2002). Indeed, making personal knowledge available to others is the central activity of the knowledge creating organisation (Nonaka 2008). The integration of KM and e-Learning is an elaboration of KM systems and e-Learning systems. KM could be a cornerstone of e-Learning. Effective e-Learning leverages traditional e-Learning technology such as computing, communication, and multimedia technologies, and KM to create learning environments that can be richer and more flexible, scalable, and cost effective than the standard classroom or lecture hall (Piccoli et al. 2001; Becerra-Fernandez & Sabherwal 2001).

Therefore, e-Learning systems integrating with KM are designed to support the rapid capture, delivery, and measurement of knowledge in a Web-based fashion. They are designed to consider online learners' attributes and instructional strategies to provide adaptive, learner control and collaborative e-Learning environments, and to thereby maximize e-Learning effectiveness. If e-Learning is to effectively complement KM then it must aim to deliver what Tiwana described as knowledge that is actionable (relevant) information available in the right format, at the right time, and in the right place for decision-making (Tiwana 2000).

In a survey of six companies Efimova & Swaak (2003) found that perceived connections between KM and e-Learning are not operationalised. Despite the many synergies between KM and e-Learning, the research found that the only KM techniques that was commonly used to assist in the delivery of e-Learning solutions was what are called Communities of Practice (Efimova & Swaak 2003).

3.10 Summary

This chapter began by defining the very notion of knowledge and explaining the difference between tacit and explicit knowledge. Davenport and Prusaks Pyramid of Knowledge and Nonaka's Spiral of Knowledge were used to illustrate the concepts. The chapter then defined KM before discussing in details its characteristics. The importance of knowledge transfer (particularly in the professional world) was analysed. KE was then defined and accompanied by an overview of the some of the key KE techniques. Most of us live in a world where today's knowledge will not solve tomorrow's problems (Awad & Ghaziri 2004). A key theme of the chapter was that KM is an inherently human-centric endeavour (Smith and McLaughlin, 2004). And while it is enabled and underpinned by technology, KM is, above all, about people (Wiig 2004). This is demonstrated by the fact that its raw ingredient is knowledge, which only exists in people's heads.

4 EXPERIMENT DESIGN

4.1 Introduction

This chapter will outline in detail the experiment performed to test the hypothesis put forward in this research.

Firstly, the choice of KM technique will be described and justified as will its application in the e-Learning prototype. It was considered essential to choose the technique first before embarking on the design of the prototype to ensure that the technique was incorporated into the design and not the other way around. The overall design of the prototype that was used for the experiment will then be explained. The different components of the experiment will be explained and the software tools that were used will be briefly described and justified. Finally, a summary of the experiment will be presented.

4.2 Choice of KM Technique

Once it was decided to examine the benefits of using KM techniques in e-Learning, an appropriate technique had to be found.

It was decided to used Card (or Concept) Sorting as the KM technique for a number of reasons:

1. The technique was easy to explain and understand
2. Its use as a learning re-enforcement technique could be justified
3. It required minimal effort to put together
4. It could be easily implemented online using freely available software
5. The results could be easily analysed

The following sections discuss Card Sorting in more detail.

4.3 Card or Concept Sorting

Card Sorting (also known as Concept Sorting) is a KM technique used primarily to generate information about the associations and groupings of specific data items. In a typical Card Sorting exercise, the participant is presented with a list of items (or concepts) related to a particular subject domain and asked to arrange them into one or more groups based on any relationship the participant sees between items. Depending on the type of exercise, the participant may or may not be asked to label the groups. The intention of asking the participant to name the groups is to elicit the nature of the relationship the participant sees between the items they have grouped together. The exercise may involve one round of sorting or the participant may be asked to repeat the sorting exercise until they run out of connections between the items. This is often used in complex domains to expose multiple relationships between the items presented.

4.4 Card Sorting as a Tool for Learning Retention

Card Sorting as a KE technique is often used to collect the deep, tacit knowledge pertaining to a domain. However, the core of the technique involves the participant reflecting on key concepts in the subject domain. Therefore, there is a compelling argument for using Card Sorting as a learning re-enforcement tool on the grounds that the process of reflecting on key subject concepts could help comprehension and internalisation of the learning material.

4.5 Card Sorting as a Tool for Content Validation

In addition to generating relationships between items, the use of a Card Sorting technique in an e-Learning module can also provide valuable feedback for the content manager by exposing hidden associations in the learning and, perhaps more interestingly, exposing gaps in the content. For example, if participants regularly class items in a way that runs counter to the learning objectives, then the material provided may need to be reviewed. However, it must be stressed that the Card Sorting Technique is intended to be used as a tool for learning re-enforcement and to complement assessment and not replace it.

4.6 Limitations

There are a number of limitations in using a Card Sorting Technique as a learning re-enforcement tool in e-Learning. Firstly, the quality of any results from the card sort depends on the quality of the items chosen and their relevance to the e-Learning material. Therefore, they must be carefully selected either after consulting experts in the domain in question or, ideally, directly chosen by the experts themselves.

Secondly, the quality of the results also depends on the participant's understanding the technique and having the motivation to perform it correctly. If the participant doesn't understand what they are being asked to do or simply does it in a random, non-reflective way it would be hard to see any merit in using the technique.

4.7 Summary

This chapter began by explaining the KM technique that would be used as part of the experiment, namely the Card Sort Technique. The importance of choosing the technique as the first step in the process was explained so that the prototype could be designed around the technique and not the other way around. The chapter then described in detail how the Card Sort Technique would be used as part of the dissertation experiment before discussing its limitations.

5 EXPERIMENT DEPLOYMENT

5.1 Introduction

This chapter will explain how the prototype design discussed in the previous chapter was developed and deployed. It will begin by detailing the components of the prototype before explain the choice of software to be used for delivering the prototype. Then it will discuss the approach taken to set up each of the four components of the prototype, namely, the Pre-Module Survey, the Process Mapping Learning Module, the Post-Module Assessment and the Final Survey. It will also explain how the Card Sorting Technique was developed and integrated into the prototype.

5.2 Prototype Design

To test the effectiveness of KM techniques when used in an e-Learning solution, it was decided to develop a small prototype e-Learning module. The module's core content, on the subject of Process Mapping, would be supplied by the community partner, the ISQSH, in the form of a PowerPoint slideshow.

The module would be developed in two versions – only one of which would incorporate the KM technique. Otherwise, the two versions would be identical. This was essential to ensure that any difference in results from the experiment was not due to any factor other than exposure to the KM technique. In the experiment, the version without the KM technique is referred to as Process Mapping A, while the version which incorporates the KM technique is referred to as Process Mapping B.

The community partner had kindly agreed to supply a sample group from its membership to participate in the experiment. The group would be split in two with one half completing the version incorporating the KM technique while the other half would complete the version without the KM technique.

5.3 Prototype Components

It was decided that the prototype would be made up of the following components:

1. A Pre-Module Survey
2. The Process Mapping Learning Module (with our without the Card Sorting Exercise)
3. A Post-Module Assessment
4. A Final Survey

Each of the above components will be examined in detail later in this chapter.

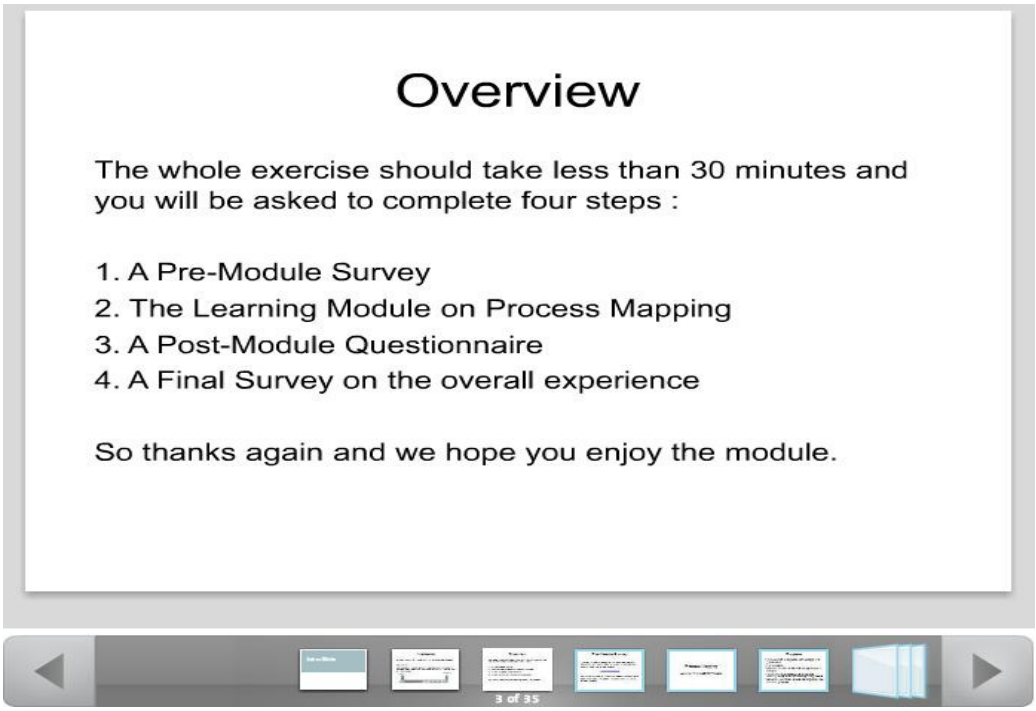
5.4 Prototype Software

In order for all of the components of the e-Learning module to be integrated as seamlessly as possible, a tool had to be found to assemble the different elements of the prototype and fulfil the following criteria:

- Be quick to learn and easy to understand
- Have a user-friendly interface from the point of view of the participants
- Allow for the integration of third party content such as PowerPoint
- Have the capacity to handle the number of participants expected to take part in the experiment
- Run as a stand-alone solution that didn't require integration into a LMS
- Exist in a free version

After examining a number of online e-Learning development tools, it was decided to go with a solution called Mindflash (www.mindflash.com). Mindflash is an online tool that allows users to create e-Learning modules from existing material (such as Word or PowerPoint).

Below are some sample screens from the prototype developed using Mindflash.



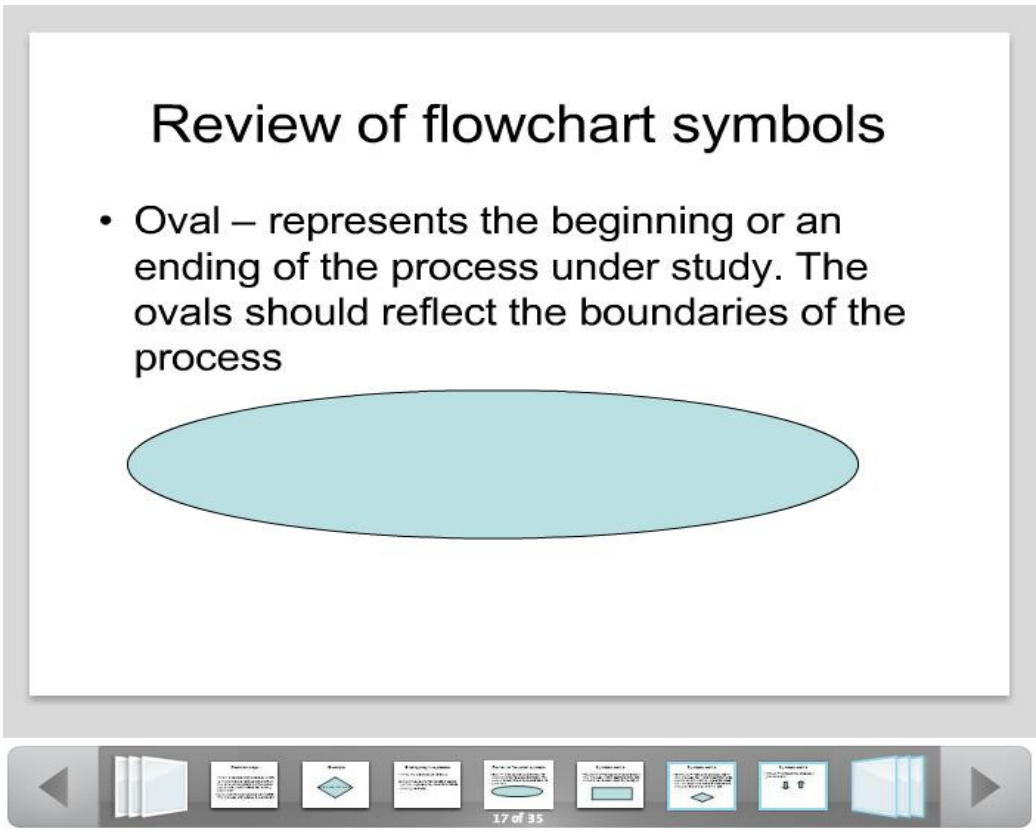


Figure 4 Screenshots from Mindflash prototype

It has a function that allows users to develop tests and quizzes within their modules and also has a course management function that lets users add participants and send out automated invitations. Below is a screenshot of from the Post-Module Assessment in Mindflash.

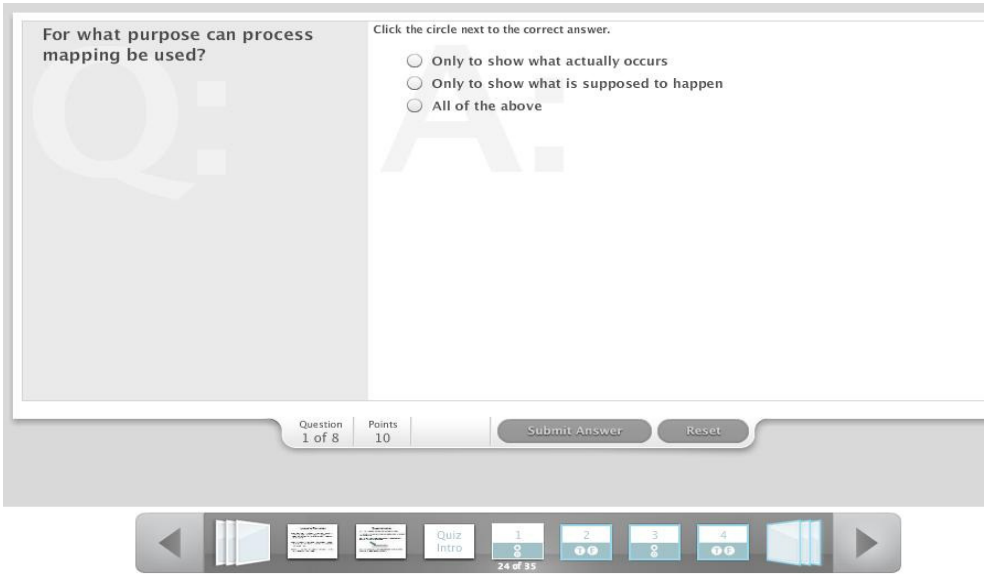


Figure 5 Screenshot from Mindflash assessment

In addition, it has a tool for tracking participation and analysing the results of any tests or quizzes added to the module. Below is a screenshot of the module tracking screen from Mindflash.

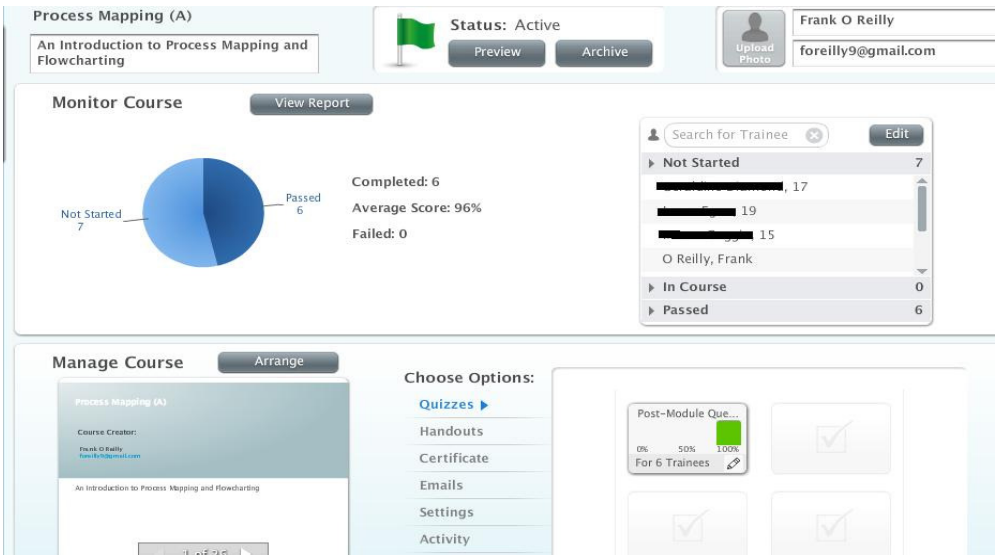


Figure 6 Screenshot of module tracking from Mindflash

The only disadvantage of Mindflash was that it didn't allow for email addresses to be passed between the different components of the e-Learning module to facilitate the collating of results. But this problem was dealt with by asking the user to enter his or her email address during the course of the module where required for data collection purposes.

5.5 A Pre-Module Survey

This consisted of a questionnaire composed of a first question asking the participant to enter his or her email address which would be used to collate the results. There then followed a series of questions aimed at evaluating the prior learning of each participant and their previous experience with e-Learning tools (if any).

A crucially important characteristic of the participants in this experiment is their substantial and different experiences, gained from both education and prior and current experiences within their professional healthcare roles. In the health sector, people who undertake a programme of CME display a crucially important characteristic through their substantial and different experiences, gained from both education and prior and current experiences within their professional healthcare roles (Bilham 2009). Acknowledging this fact, a Pre-Module Questionnaire was designed in an attempt to evaluate the prior knowledge of each participant. A list of the questions can be found in Appendix A.

The first question simply asked for the participant's email address to subsequently collate the results. Of the other six questions, five used a Likert Scale of proposed responses while the other question was of a simple Yes/No type. A Likert Scale offers a list of responses in a form of a multiple choice where the participant is asked to select one of a number of possible replies. In responding to a Likert questionnaire item, participants are expressing their level of agreement or disagreement using a graded scale determined by the questionnaire designer. For this questionnaire, the typical range of five potential choices used in a Likert Scale was used, namely strongly agree, agree, neutral, disagree, strongly disagree. This was deemed to be a simple but appropriate choice that would be familiar and easy-to-use for many of the participants.

The participants would complete the Pre-Module Survey just after a brief presentation of the module and immediately before being shown the learning content

5.6 Pre-Module Survey Software

After examining a number of freely available online survey tools, it was decided to use Survey Monkey to develop the Pre-Module Survey. Survey Monkey is an online survey design tool that in its basic free version allows for a maximum of 10 questions and 100 participants per survey which corresponded to the experiment design.

In addition it fulfilled the following functional criteria:

- It is simple and easy to use
- It allows for Likert Scale questions
- It has strong post-survey analytical tools

Comparing Survey Monkey with other available options showed that it was the right solution to use.

5.7 Learning Module Content

The subject chosen for the learning module was Process Mapping. Process Mapping is a technique where a process or workflow or series of events is converted into a visual, step-by-step diagram. Process Mapping is used both to better understand an existing process and to help develop a more effective process. This choice of subject matter was a decision taken by the community partner who felt it was an important topic that would appeal to a number of their members.

The content was provided in the form of a PowerPoint slideshow a copy of which can be found in Appendix B. The content was incorporated unaltered into the e-Learning module.

5.8 Card Sorting Exercise

Only one sub-set of the participants, namely Sample Group B, would complete the Card Sorting Exercise, therefore, in one of the two versions of the e-Learning module, namely Process Mapping B, the Card Sorting technique previously described was

incorporated immediately after presentation of the learning module content on Process Mapping. On one of the slides presented in the learning module, there would be a hyperlink on which the participant would click to launch the Card Sorting software which would open in a new navigation window. Once the Card Sorting Exercise was complete, the participant would simply close the navigation window in which it was running to return to the learning module.

5.9 Choice of Items to Sort

A list was drawn up of terms and concepts that had been identified as relevant to the material presented in the learning module. This was done using a combination of notes from various discussions with members of the ISQSH and from reviewing the presentation on Process Mapping supplied as module content. A total of twenty items were chosen for inclusion and the list can be found in Appendix C.

5.10 Application of Card Sorting Technique in the Project

For the experiment that forms the central part of this project, it was decided that the participants would be presented with a list of items related to the subject of Process Mapping And asked to arrange them into groups. The participants would also be asked to label the groups of items they arranged together. This was done in an effort to encourage self-reflection by the participant on the learning module they had just completed. By asking the participants to both sort and label the items it was hoped to stimulate a deeper reflection on the learning content than would have been the case if they had simply been asked to complete a sort.

By having to name each group, the participants were obliged to think about why exactly certain items were related. This was intended to improve learner engagement with the module and also to attempt to relate the material to their day-to-day work.
If the participants could be encouraged by a short and simple exercise to think about the learning content by having to sort some concepts related to it, then perhaps their retention of the material would be enhanced. If the exercise was not to be considered as something that was peripheral and viewed as pointless then it had to be seen a step in the learning process and a logical part of the e-Learning module. No time limit was

placed on the exercise, but it was anticipated that it would take less than ten minutes to complete.

5.11 Card Sorting Software

In order for the technique to be incorporated into the e-Learning module, a suitable tool for creating an online Card Sort exercise had to be found. After looking at a number of possible solutions, a decision was taken to use a free 30-day trial of Optimal Sort from Optimal Workshop (www.optimalworkshop.com). Optimal Sort was chosen because it offered a fully functioning version in a free 30-day trial. It also fulfilled the following functional criteria:

- The "look and feel" of the software was very user-friendly
- The instructions on the Card Sorting technique were clear and easy to understand
- Participants could be obliged to name their groups by means of a setting in the software
- It allowed participants to leave items unsorted

Allowing participants to leave items unsorted was considered important in the context of this experiment as obliging them to sort every item might distort the results and give the participants a bad experience of a task that was meant to assist with their engagement and learning. In practical terms, the exercise would present the participants with a list of items on the left-hand side of their computer screen. They would then simply "drag and drop" the items to the right-hand side of the screen where items could be left on their own or arranged into groups (again by means of "dragging and dropping"). Below is a screenshot taken at the start of the Card Sorting exercise.

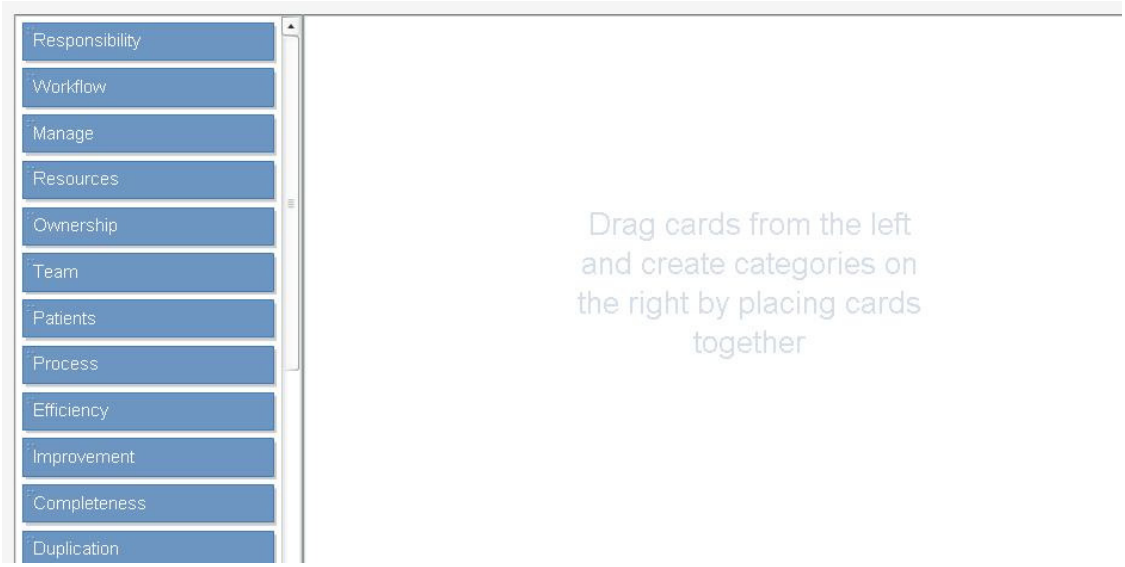


Figure 7 Screenshot of start of Card Sorting Exercise

The participants could continue the process of selecting and grouping items for as long as they wished. They would not be obliged to select all items and any ungrouped items would simply be left in the list on the left-hand side of the screen. Below is a screenshot of the Card Sorting exercise in progress.

Figure 8 Screenshot of Card Sorting exercise in progress

Once finished the exercise the participants would simply click on a validate button to record what they had done.

5.12 A Post-Module Assessment

As part of the e-Learning module a Post-Module Assessment was included as an assessment tool. It would consist of eight questions on the subject of Process Mapping. Four of the questions would be multiple choice while the other four would be true or false questions. The objective of the Post-Module Assessment was to evaluate the learning acquired by each participant during the module. In order to achieve this, the questions were specifically related to the Process Mapping learning materiel. A list of the questions in included in Appendix D. The questions were drawn up without any knowledge of the participants' profiles or their prior learning. This made the task of evaluating the learning particularly challenging.

5.13 Post-Module Assessment

The software chosen to manage the e-Learning module, namely Mindflash, offered a function to develop assessment tests and, after evaluation, it was decided to use it for the following reasons:

- The questionnaire would be seamlessly incorporated into the learning module
- There would be no need to ask participants to re-enter their emails to take the questionnaire
- It allowed the possibility of setting multiple choice and true/false type questions
- It offered a simple and easy to use reporting facility

The principle limitation was that, in its free version, Mindflash only reported the overall result for each participant and didn't give a breakdown of results by each question. However, as the analysis of the results for the experiment was to be carried out on the overall score of each participant, this was not considered a reason not to use the software for the questionnaire.

5.14 A Final Survey

In order to collect feedback on the overall experience of participants in the experiment, it was decided to conduct a Final Survey once all the other steps had been completed. As the sample group would be split in two, with one group (Sample Group A) doing

the module without the KM Card Sorting Exercise and the other group (Sample Group B) doing the module with the KM Card Sorting Exercise, two slightly different versions of the survey were designed. They were called Post-Module Process Mapping A and Post-Module Process Mapping B and both consisted of a questionnaire composed of a series of questions aimed at collecting feedback on the overall experience of the experiment. The only difference was that Post-Module Process Mapping B contained an additional question aimed at gathering feedback on the usefulness of the Card Sorting Exercise. A list of the questions can be found in Appendix E.

Each version of the survey begins with a question asking the participant to enter his or her email which will be used to collate results and ends with an open question asking for comments from the participants. The other questions used a Likert Scale of proposed responses and as with the Pre-Module Survey, the typical range of five potential choices was used namely strongly agree, agree, neutral, disagree, strongly disagree. It was felt that it was important to maintain a consistent design between the Pre-Module Survey and the Final Survey from the perspective of user-friendliness.

The participants would complete the Final Survey as the last step in the e-Learning module.

5.15 Final Survey Software

Survey Monkey was chosen as the tool to design the Final Survey on the same functional criteria as the Pre-Module Survey and also to maintain a consistent "look and feel" across the two surveys.

5.16 Running Order Of Experiment

The steps involved in conducting the experiment would be as follows:

Step 1

The names and email addresses of those who had volunteered to take part in the experiment would be supplied by the community partner.

Step 2

An email would be sent to all the participants briefly explaining the object of the experiment and detailing the steps they would have to perform.

Step 3

The names and email addresses would be loaded into the Mindflash database. The participants would be randomly split into two sample groups (A and B). Sample Group A would do the learning module without the Card Sorting Exercise while Sample Group B would do the learning module with the Card Sorting Exercise. This would be the only difference between the two groups.

Step 4

Once all the participants had been loaded into the Mindflash database the learning module would be activated. This would send out an automatic invitation to each participant. Those in Group A would receive an invitation to the learning module without the Card Sorting Exercise while those in Group B would receive an invitation to the version of the learning module with the Card Sorting Exercise

Step 5

The participants would be given five days during which they could complete the learning module. The module would take approximately thirty minutes to complete and it was felt the participants needed to be given the opportunity to find the time to take it.

Step 6

Once the completion date was passed, the results would be collected and analysed.

The workflow of the experiment can be represented as follows:

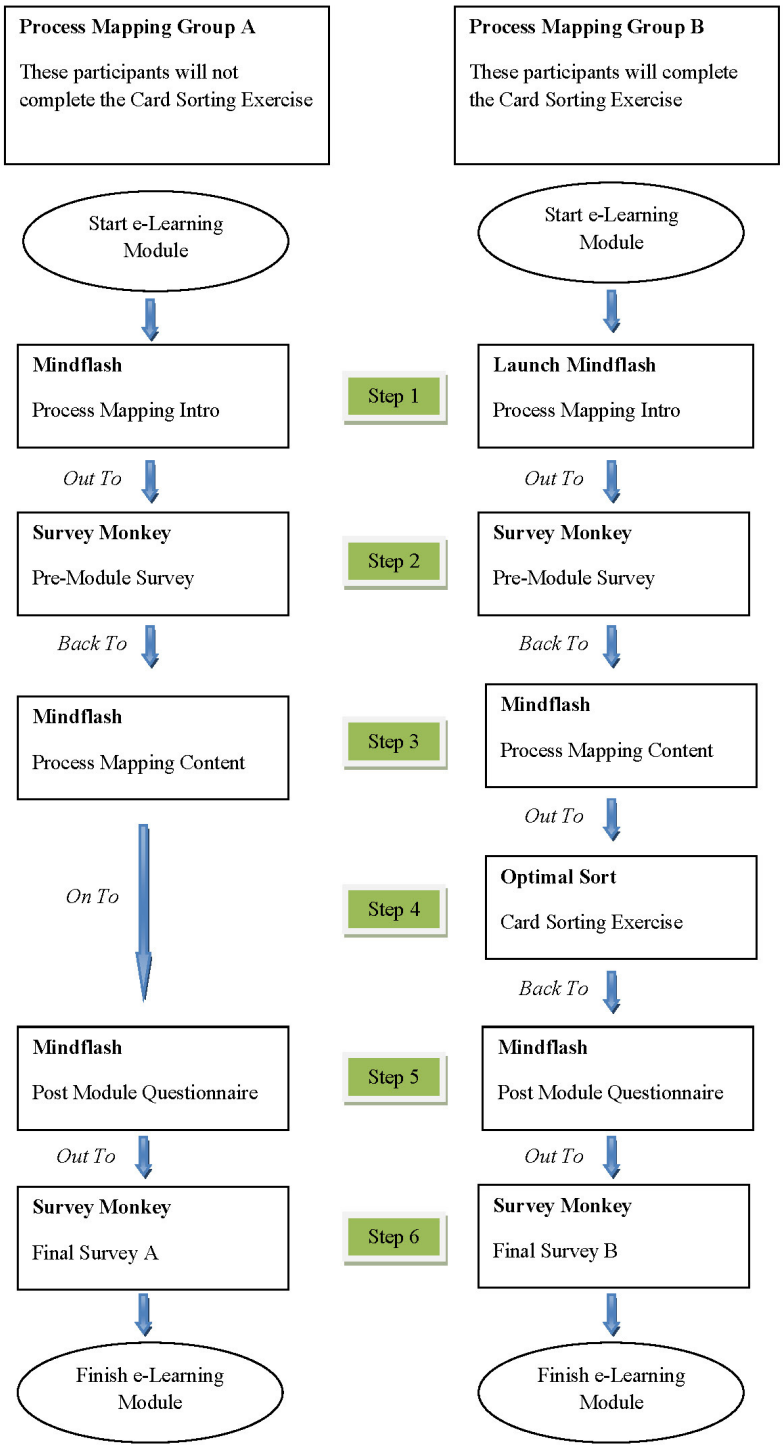


Figure 9 Visual Representation of Experiment

5.17 Summary

This chapter began by detailing the choice of software for the delivery of the learning module and outlining the criteria on which it was chosen. The development of the Pre-Module Survey was discussed and the choice of software used to develop it explained. The chapter then described how the Card Sorting Exercise would be used and the software that would be used to develop it. The development of the Post-Module Assessment was then explained before the Final Survey implementation was described. The running order of the experiment was then discussed in detail.

6 EXPERIMENTATION & EVALUATION

6.1 Introduction

The focus of this chapter will be on presenting and analysing the results of the dissertation experiment. The chapter begins by describing the process used to establish the two Sample Groups that would be required for the experiment. The running of the experiment is then explained, followed by a presentation of the different results from each component of the module. An analysis of the results is then presented with a particular focus on the impact of the Card Sorting Exercise on the outcome.

6.2 Participants

A list of twenty five volunteer participants was supplied by the community partner, the ISQSH. The volunteers were from a variety of backgrounds in the healthcare sector. They included administrative staff and medical practitioners. Some of the volunteers might have been familiar with the subject matter of the learning module, namely Process Mapping. However, existing prior knowledge of the subject matter (or lack thereof) was not used in any way as a selection criterion.

The volunteers were randomly divided into two sample groups for the purposes of the experiment and comparison of results. Sample Group A was composed of thirteen participants who would complete the learning module without taking the Card Sorting Exercise designed to aid their learning retention. Sample Group B was composed of twelve participants who would complete the learning module while also taking the Card Sorting Exercise. The participants were not told there were two different Sample Groups and undertook the experiment in the belief that all participants were completing the module in the identical fashion. This was considered essential if the outcome of the experiment was not to be biased because the participants had prior knowledge of the hypothesis it set out to test. An overview of the Sample Groups and their role in the experiment is provided in the following table:

Characteristic	Group A	Group B
Number of Participants	13	12
Participate in Pre-Module Survey	Yes	Yes
Participate in Card Sorting Exercise	No	Yes
Participate in Post-Module Assessment	Yes	Yes
Participate in Final Survey	Yes	Yes

6.3 Procedure

The names and email addresses were loaded into the database of the software used to manage the learning module, namely Mindflash. Two versions of the e-Learning module had been created only one of which, namely Process Mapping B contained a link to the Card Sorting Exercise.

Once the participants had been entered into the Mindflash database, the two versions of the module were activated and this triggered the sending of automatic emails to the two sets of participants. Those in Sample Group A received an email inviting them to the Process Mapping A learning module, while those in Sample Group B received an email inviting them to the Process Mapping B module.

6.4 Completion Rate

Although a total of twenty five people volunteered for the experiment only thirteen participants completed the module in full. Another seven participants began the lesson but were unable to complete due to issues with their IT systems. The main IT problems encountered by those forced to abandon were difficulties launching either the Mindflash software to run the learning module or the Optimal Card Sorting software to carry out the Card Sorting Exercise. A further five people were unable to take part in the experiment in the allotted timeframe.

A summary of this data is presented below.

Participants	Invited	Completed	Abandoned	Not Started
Group A	13	6	4	3
Group B	12	7	3	2
Totals	**25**	**13**	**7**	**5**

6.5 Results of The Pre-Module Survey

The purpose of the Pre-Module Survey was to evaluate the prior learning of each participant. The survey contained a number of questions and we will analyse the results of the most relevant below.

Question: **How often have you used an e-Learning tool before?**

This question was obligatory and the participants were asked to choose one of the following 5 options: Never, Once or Twice, Occasionally, Often or All the Time

The responses from the two Sample Groups were as follows:

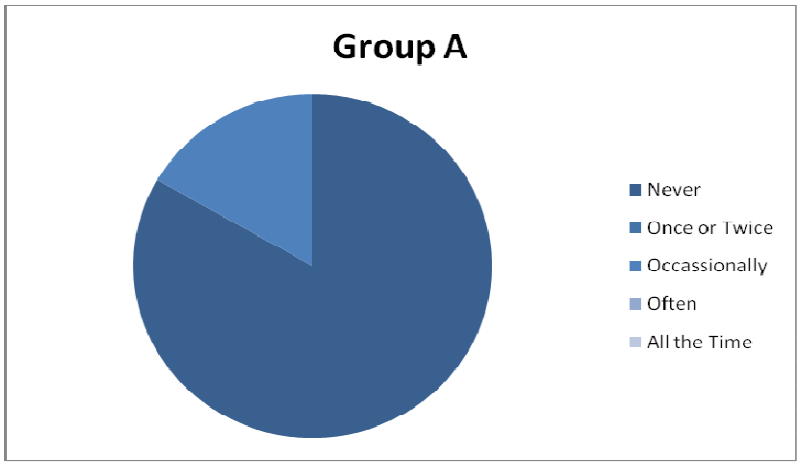


Figure 10 How often have you used an e-Learning tool before? Group A Responses

Of the responses given by participants from Sample Group A, 83% replied that they had never used an e-Learning tool and 17% replied they had used one occasionally.

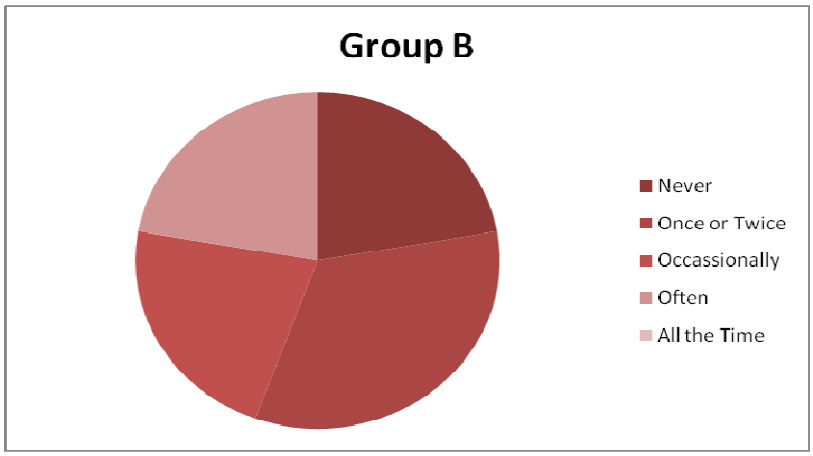


Figure 11 How often have you used an e-Learning tool before? Group B Responses

Of the responses given by participants from Sample Group B, 22% replied that they had never used an e-Learning tool, 34% replied that they had used one once or twice, 22% replied that they had used one occasionally and 22% that they had used one often.

The combined responses from the two sample groups were as follows:

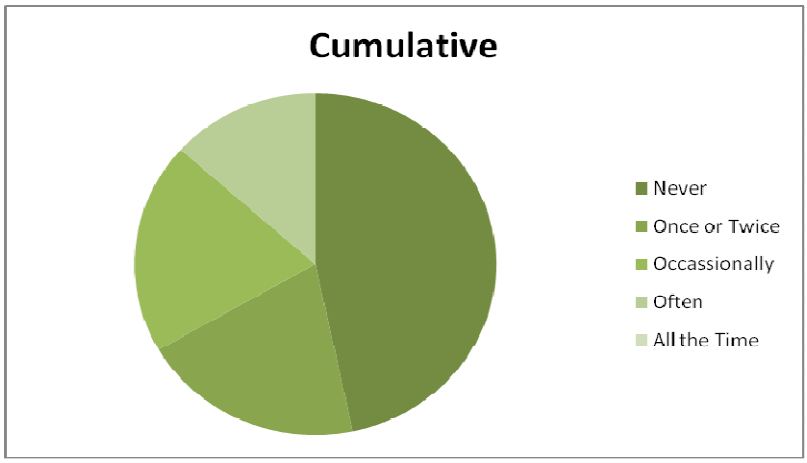


Figure 12 How often have you used an e-Learning tool before? Cumulative Responses

Of all respondents to the question, 47% had never used an e-Learning tool before. 20% had used such a tool once or twice, while 20% had used one occasionally with the final 13% having used an e-Learning tool often.

Question: **If you have previously used an e-Learning tool, what did you think of it? (If not, please skip to the next question)**

This question was not obligatory and the participants were asked to choose one of the following: Didn't Like It At All, Didn't Like It, Indifferent, Liked It or Liked It A Lot

The responses from the two Sample Groups were as follows:

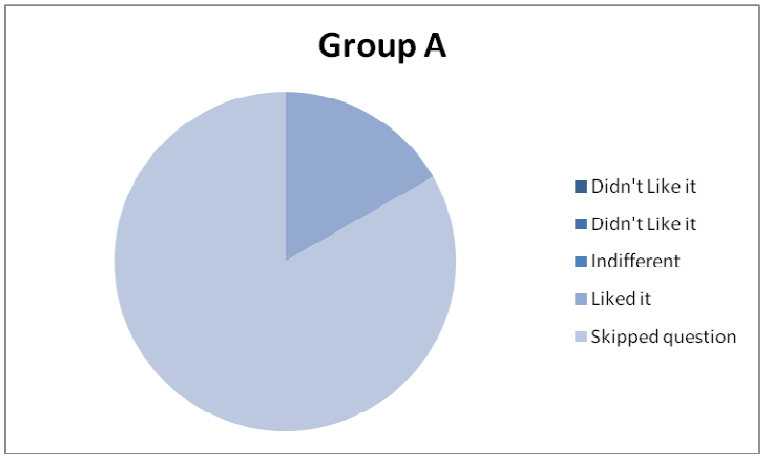


Figure 13 If you have previously used an e-Learning tool, what did you think of it? - Group A

Only one participant from Sample Group A had previously used an e-Learning tool and they replied that they didn't like it.

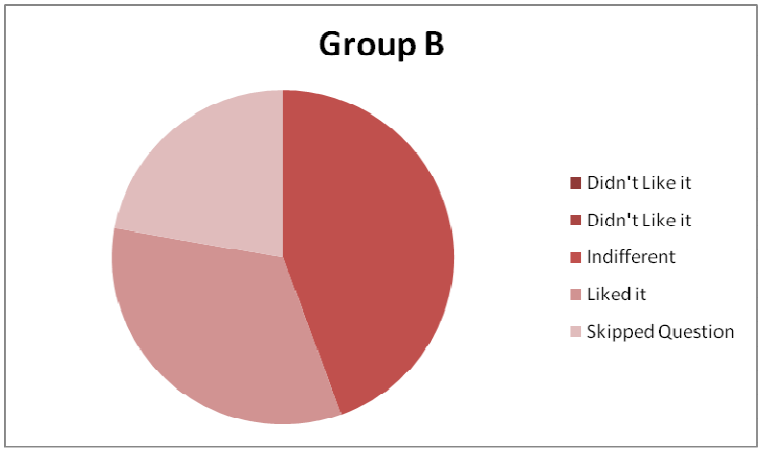


Figure 14 If you have previously used an e-Learning tool, what did you think of it? - Group B

Of the responses given by participants from Sample Group B, 45% replied that they were indifferent to the e-Learning tool they had used while 33% said the liked it.

The combined responses from the two sample groups were as follows:

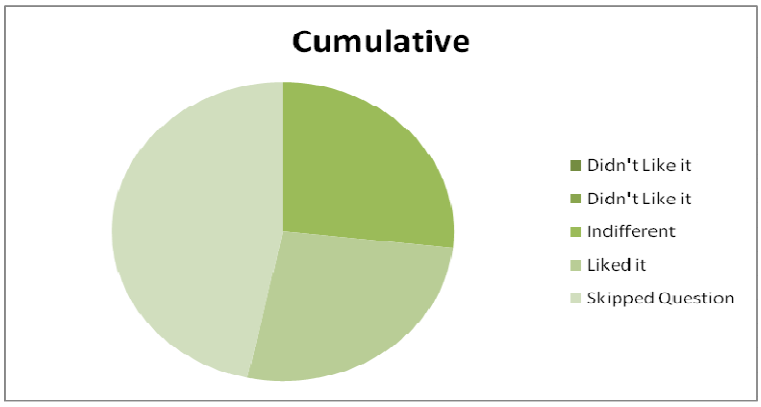


Figure 15 If you have previously used an e-Learning tool, what did you think of it? - Combined

Of all respondents to the question, 27% said they were indifferent, 27% said they liked it while 46% skipped the question.

Question: **E-Learning tools are a useful aid to teaching**

This question was obligatory and the participants were asked to choose one of the following: Strongly Disagree, Disagree, Neutral, Agree or Strongly Agree

The responses from the two Sample Groups were as follows:

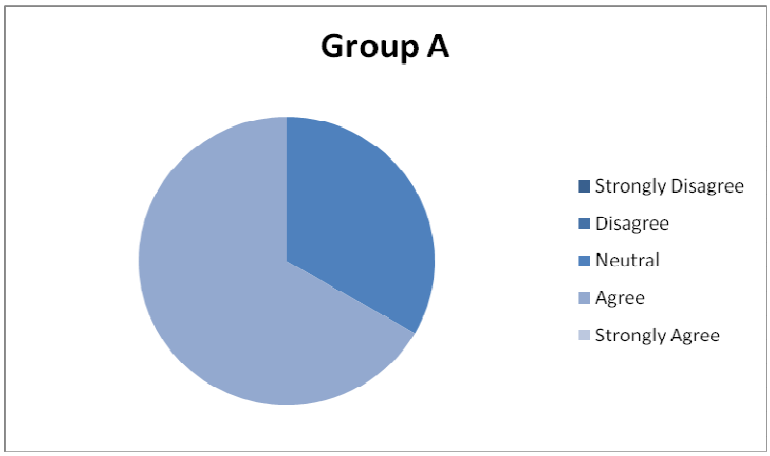


Figure 16 E-Learning tools are a useful aid to teaching - Group A Responses

Of the responses from the Sample Group A, 67% replied that they agreed wth the staement, while 33% were neutral.

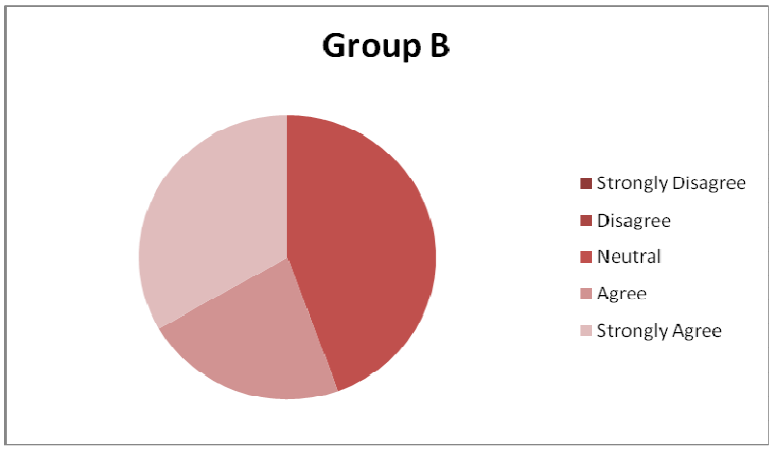


Figure 17 E-Learning tools are a useful aid to teaching - Group B Responses

Of the responses from the Sample Group B, 33% replied that they strongly agreed with the statement, 22% agreed with the statement while 45% were neutral.

The combined responses from the two sample groups were as follows:

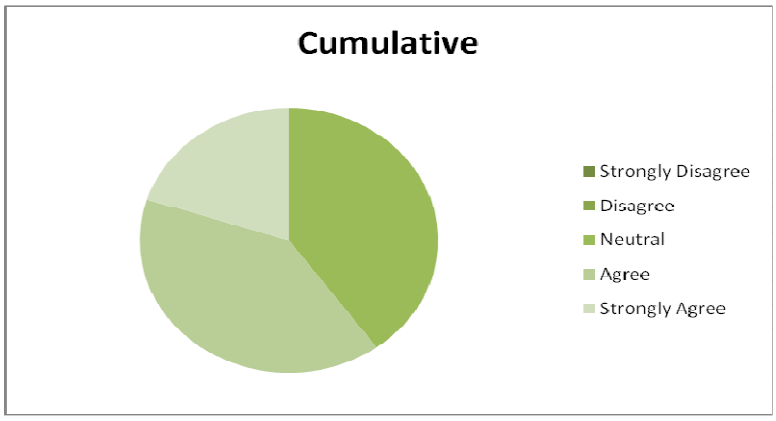


Figure 18 E-Learning tools are a useful aid to teaching - Cumulative Responses

Of all respondents to the question, 40% agreed with the statement, 40% said they were neutral , while 20% strongly agreed with the statement.

Question: **Have you previously done a course in Process Mapping or read any material on the subject?**

This question was obligatory and the participants were asked to choose one of the following: Yes or No

The responses from the two Sample Groups were as follows:

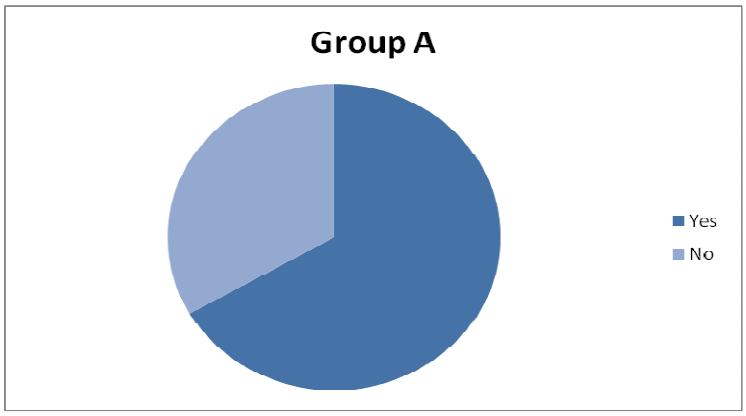


Figure 19 Have you previously done a course in Process Mapping or read any material on the subject? - Group A Responses

Of the participants from Sample Group A, 67% replied yes to the question while 33% replied no.

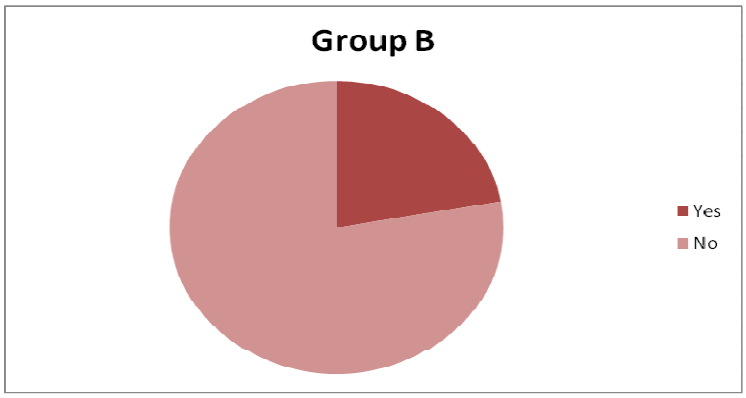


Figure 20 Have you previously done a course in Process Mapping or read any material on the subject? - Group B Responses

Of the participants from Sample Group B, 78% replied no to the question while 22% replied yes.

The combined responses from the two sample groups were as follows:

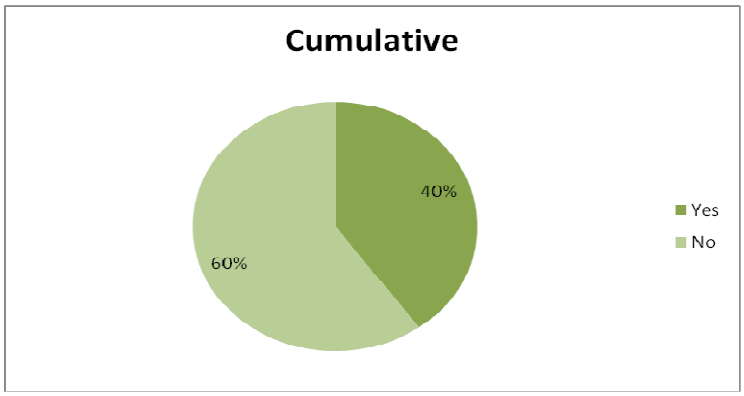


Figure 21 Have you previously done a course in Process Mapping or read any material on the subject? - Cumulative Responses

Of all respondents to the question, 60% replied yes while 40% replied no.

Question **How would you rate your understanding of Process Mapping?**

This question was obligatory and the participants were asked to choose one of the following: None, Basic, Average, Good or Very Good

The responses from the two Sample Groups were as follows:

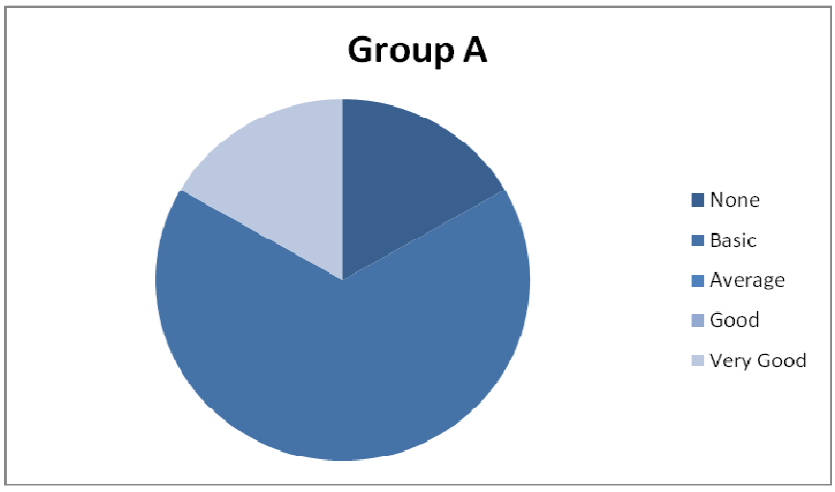


Figure 22 How would you rate your understanding of Process Mapping? - Group A Responses

Of the responses from the Sample Group A, 67% described their understanding of Process Mapping As basic, 16.5% described it as very good, while the other 16.5% rated their understanding at none.

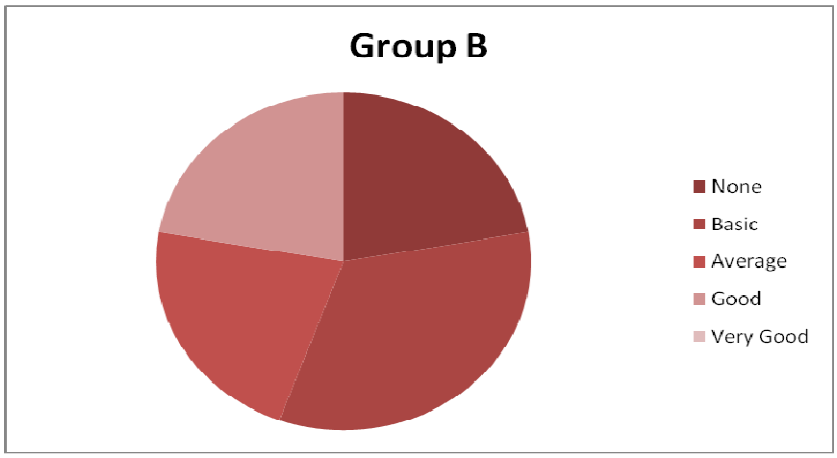


Figure 23 How would you rate your understanding of Process Mapping? - Group B Responses

Of the responses from the Sample Group B, 34% described their understanding of Process Mapping As basic, 22% described it as good, 22% described it as average, while the other 22% rated their understanding at none.

The combined responses from the two sample groups were as follows:

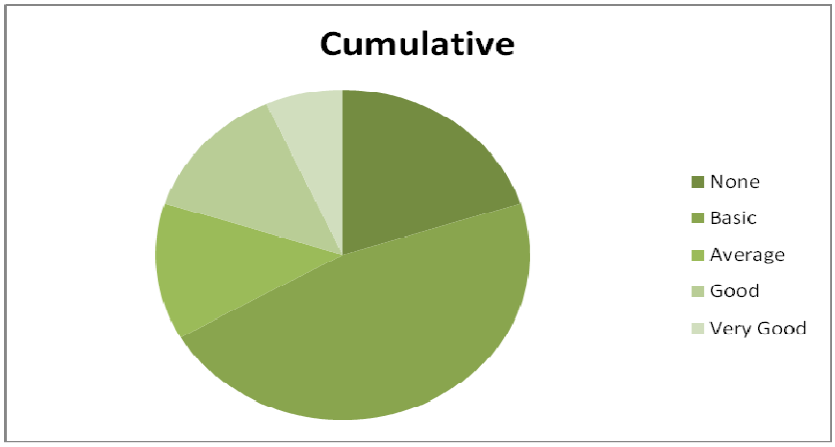


Figure 24 How would you rate your understanding of Process Mapping? - Cumulative Responses

Of the combined responses, 47% described their understanding of Process Mapping As basic, 20% stated it was none, 13% described it as average, 13% described it as good, while the other 7% rated their understanding at very good.

Question: **Do you use Process Mapping or Flowcharting in your workplace?**

This question was obligatory and the participants were asked to choose one of the following: Never, Rarely, Sometimes, Often or All The Time

The responses from the two Sample Groups were as follows:

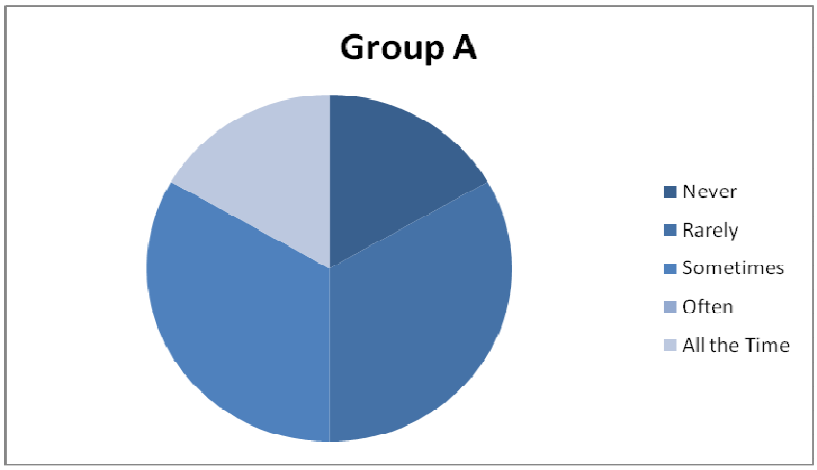


Figure 25 Do you use Process Mapping or Flowcharting in your workplace? - Group A Responses

Of the responses from the Sample Group A, 33% stated that they rarely used Process Mapping in their workplace, 33% said they sometimes did, 17% said they never did, while 17% said they used Process Mapping All the time.

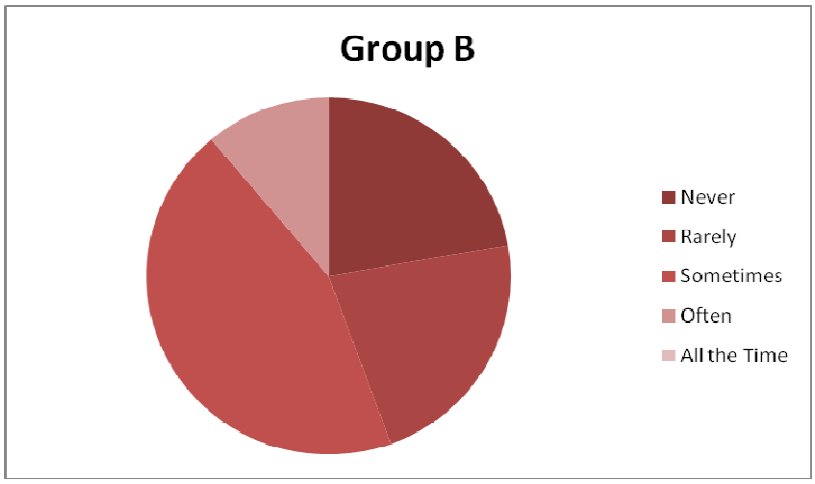


Figure 26 Do you use Process Mapping or Flowcharting in your workplace? - Group B Responses

Of the responses from the Sample Group B, 45% stated that they sometimes used Process Mapping in their workplace, 22% said they rarely did, 22% also said they never did, while 11% said they used Process Mapping often.

The combined responses from the two sample groups were as follows:

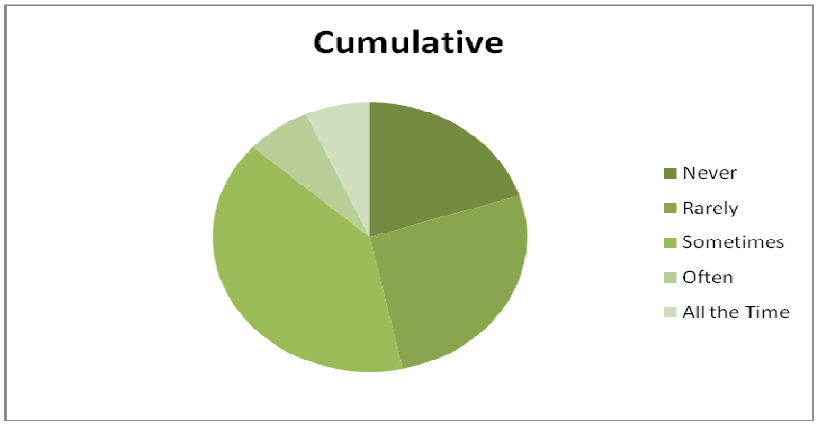


Figure 27 Do you use Process Mapping or Flowcharting in your workplace? - Cumulative Responses

Of the combined responses, 40% stated that they sometimes used Process Mapping in their workplace, 27% said they rarely did, 20% also said they never did, 6.5% said they used Process Mapping often and 6.5% said they used it all the time.

6.6 Card Sorting Exercise

The Card Sorting Exercise was only completed by participants in the Sample Group B. The exercise took place immediately after the presentation of the course material on Process Mapping And immediately before the Post Module Assessment. The participants were presented with a list of twenty two items and asked to sort them into what each participant considered logical groupings. The participants were then asked to label each group. The participants could arrange the items in one or any number of groups. They were also allowed to leave items unsorted.

A total of seven people completed the Card Sorting Exercise. Although twelve participants had been invited as part of Sample Group B to complete the learning module including the Card Sorting Exercise, three were forced to abandon the module due to technical IT problems, and another two were unable to take the module before

the deadline. The twenty items were sorted into a total of twenty-five unique categories and the results can be found in Appendix F. The average time taken to complete the Card Sorting Exercise was 6 minutes and 50 seconds.

Similarity Matrix of Card Sorting Exercise

A similarity matrix was calculated for the Card Sorting Exercise. A similarity matrix shows how many participants agree with each pair combination of cards and it then groups related clusters together in a table. It is a simple tool that quickly and effectively helps to identify clusters.

A similarity matrix creates a table with all the possible pairs, and then counts how many participants agree with each pair (a pair is strong if many participants agree with it). It clusters related pairs together by finding the strongest pair, grouping them with the next strongest pair that either of those cards have, and then repeats the process for that new pair. This way, clusters of cards that are strongly related to each other appear together on the matrix.

Ownership																					
7	Responsibility																				
5	5	Manage																			
4	4	6	Change																		
5	5	4	3	Resources																	
5	5	4	3	5	Team																
4	4	3	2	5	4	Focus															
2	2	3	2	3	2	5	Improvement														
1	1	3	2	2	1	2	4	Quality													
0	0	2	2	1	0	1	3	6	Safety												
0	0	1	2	0	1	1	2	4	4	Impact											
1	1	1	2	2	2	1	2	1	1	3	Workflow										
0	0	0	1	1	1	1	2	1	1	3	6	Bottleneck									
1	1	1	0	2	2	3	4	3	2	3	5	5	Duplication								
0	0	0	0	2	0	1	2	2	3	1	4	5	4	Efficiency							
2	2	2	3	4	2	2	1	1	1	1	5	4	3	4	Process						
1	1	1	2	2	1	2	3	2	2	3	5	4	3	3	4	Completeness					
3	3	2	2	3	4	3	1	1	2	1	1	0	0	1	2	3	Patients				
2	2	2	2	3	3	1	0	2	3	1	1	0	0	2	3	2	5	Service			
2	2	3	2	2	2	3	2	3	2	2	1	2	2	2	2	3	3	2	Clarity		

Figure 28 Card Sorting Similarity Matrix

6.7 The Post-Module Assessment

The purpose of the Post-Module Assessment was to evaluate what the participants had learnt from the learning module. All participants from both sample groups took the questionnaire and the total number of participants was thirteen. The results are firstly

presented and analysed by group before the performance of the two groups is discussed.

Sample Group A

A total of six participants from Sample Group A completed the Post-Module Assessment. The average result was 96% with a high of 100% and a low of 88%. The standard deviation was 6.20%.

Sample Group B

A total of seven participants from Sample Group B completed the Post-Module Assessment. The average result was 91% with a high of 100% and a low of 62%. The standard deviation was 15.82%.

Overall Analysis

Value	Group A	Group B
Number of Participants	6	7
Average	96%	91%
Highest Result	100%	100%
Lowest Result	88%	62%
Standard Deviation	6.20	15.82

Figure 29 Consolidated Post-Module Assessment Results

6.8 The Final Survey

The purpose of the Final Survey was to collect feedback on the learning experience from each participant. It was an important step in the process of evaluating the use of e-Learning in a specific professional environment – that of the healthcare sector.
It was hoped that the survey responses would provide an insight into the considerations that needed to be taken into account when designing, developing and deploying e-Learning solutions.

The survey contained a series of questions which will each be analysed in turn.

There were two versions of the Final Survey. The only difference between the two was the addition of a question on the subject of the Card Sorting that was asked only of Group B. Otherwise the survey was identical and the responses are presented below.

Question: **The instructions for using the e-Learning tool were clear.**
This question was obligatory and the participants were asked to choose one of the following: Strongly Disagree, Disagree, Neutral, Agree or Strongly Agree

The responses from the two Sample Groups were as follows:

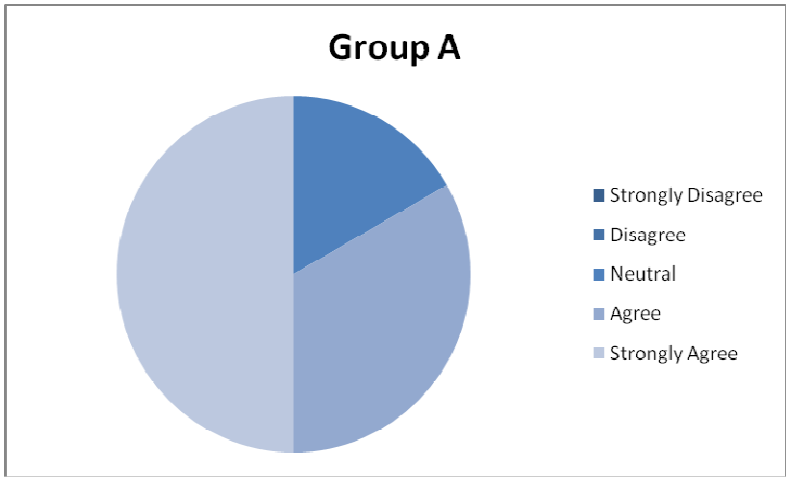


Figure 30 The instructions for using the e-Learning tool were clear - Group A

Of the responses from the Sample Group A, 50% strongly agreed that the instructions were clear, 33% agreed while 17% were neutral.

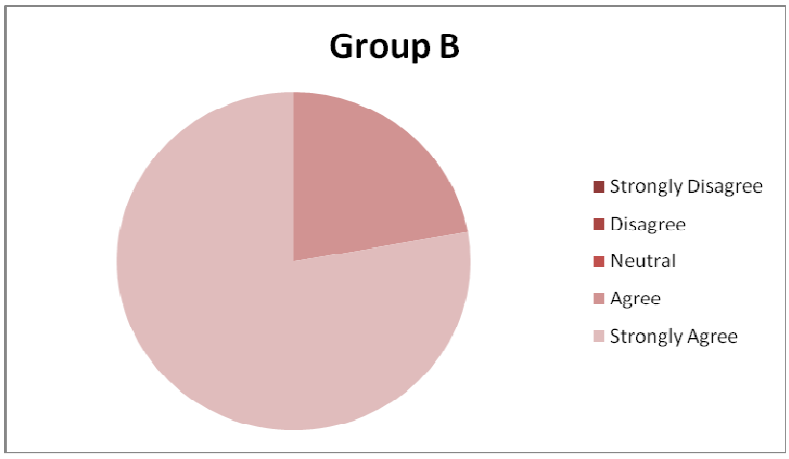


Figure 31 The instructions for using the e-Learning tool were clear - Group B

Of the responses from the Sample Group B, 78% strongly agreed that the instructions were clear, while 22% agreed.

The combined responses from the two sample groups were as follows:

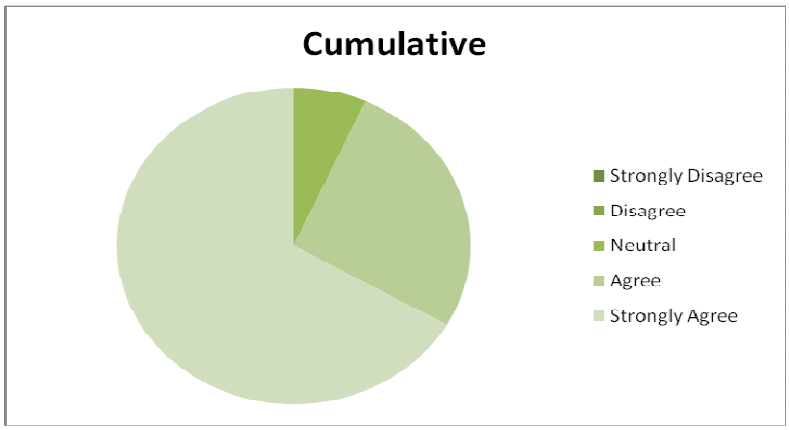


Figure 32 The instructions for using the e-Learning tool were clear - Combined Results

Of the combined responses from both Sample Groups, 67% strongly agreed that the instructions were clear, 27% agreed, while 6% were neutral.

Question: **The module improved my understanding of Process Mapping And Flowcharting**

This question was obligatory and the participants were asked to choose one of the following: Strongly Disagree, Disagree, Neutral, Agree or Strongly Agree

The responses from the two Sample Groups were as follows:

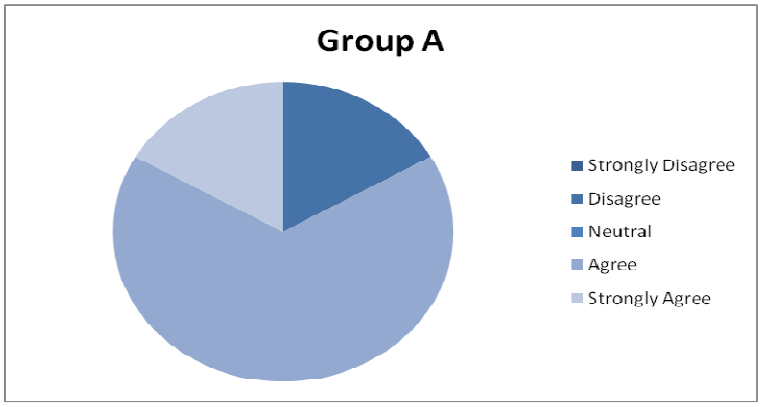


Figure 33 The module improved my understanding of Process Mapping And Flowcharting - Group A

Of the responses from the Sample Group A, 67% strongly agreed that the module improved their understanding of Process Mapping, 16.5% agreed while 16.5% disagreed.

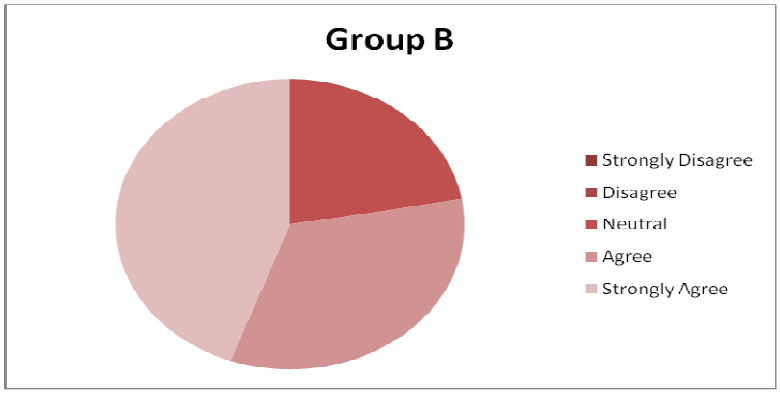


Figure 34 The module improved my understanding of Process Mapping And Flowcharting - Group B

Of the responses from the Sample Group B, 45% strongly agreed that the module improved their understanding of Process Mapping, 33% agreed while 22% were neutral.

The combined responses from the two sample groups were as follows:

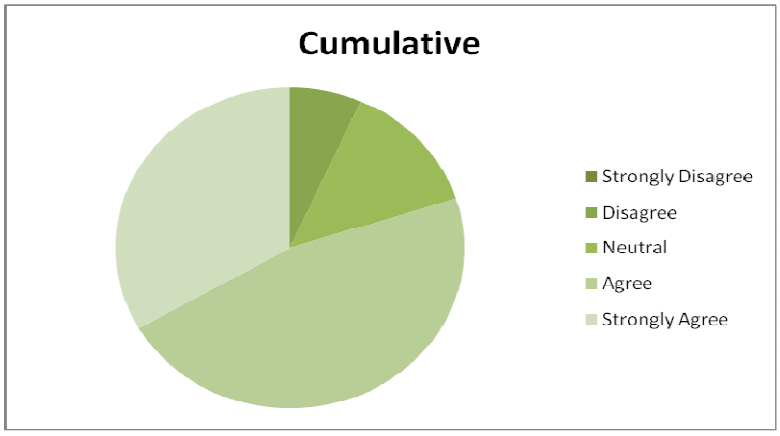


Figure 35 The module improved my understanding of Process Mapping And Flowcharting - Combined Results

Of the combined responses from both Sample Groups, 47% agreed that the module improved their understanding of Process Mapping, 33% strongly agreed, 13% were neutral, while 7% disagreed.

Question: **The module was relevant to my day-to-day work**

This question was obligatory and the participants were asked to choose one of the following: Strongly Disagree, Disagree, Neutral, Agree or Strongly Agree

The responses from the two Sample Groups were as follows:

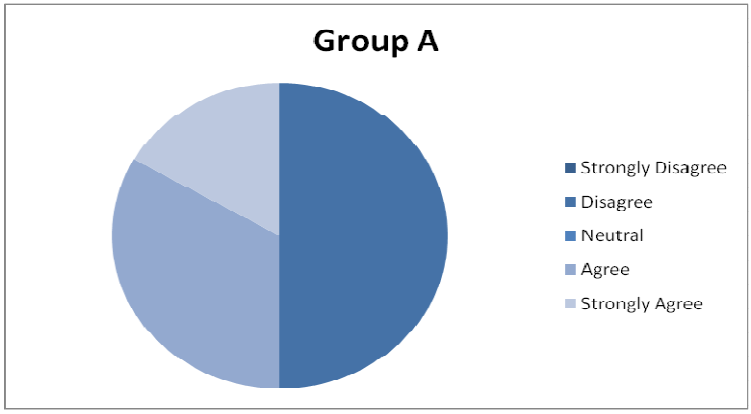


Figure 36 The module was relevant to my day-to-day work - Group A

Of the responses from the Sample Group A, 50% disagreed that the module was relevant to their day-to-day work, 33% agreed while 17% strongly agreed.

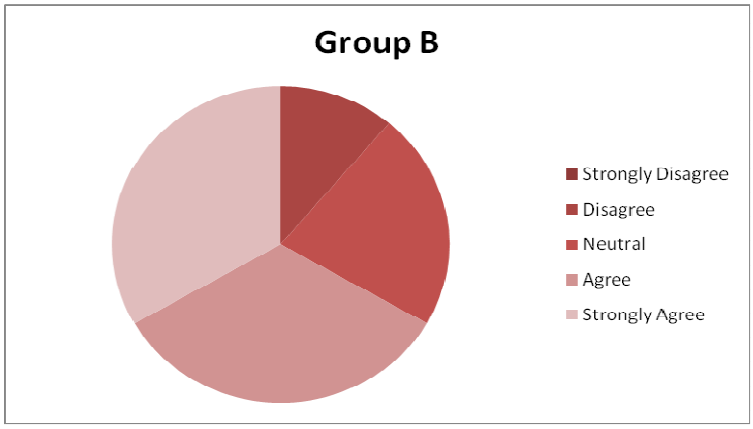


Figure 37 The module was relevant to my day-to-day work - Group B

Of the responses from the Sample Group B, 33.5% strongly agreed that the module was relevant to their day-to-day work, 33.5% agreed, 22% were neutral, while 11% disagreed.

The combined responses from the two sample groups were as follows:

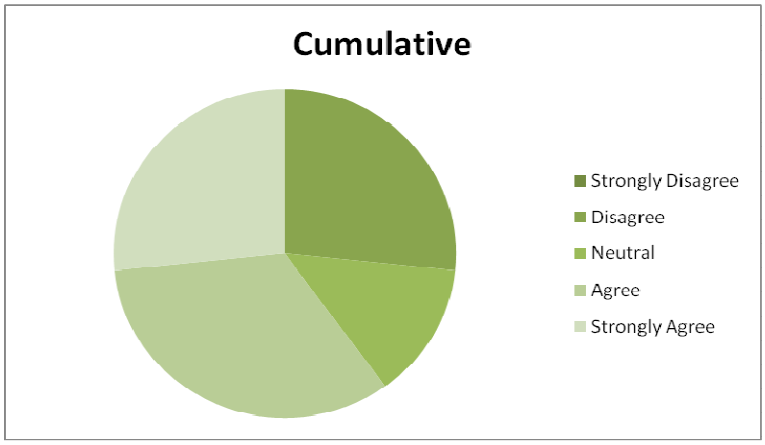


Figure 38 The module was relevant to my day-to-day work - Combined Results

Of the combined responses from both Sample Groups, 33% agreed that the module was relevant to their day-to-day work, 27% strongly agreed, 27% disagreed, while 13% were neutral.

Question: **After this experience, I would be more inclined to use an e-Learning tool**

This question was obligatory and the participants were asked to choose one of the following: Strongly Disagree, Disagree, Neutral, Agree or Strongly Agree

The responses from the two Sample Groups were as follows:

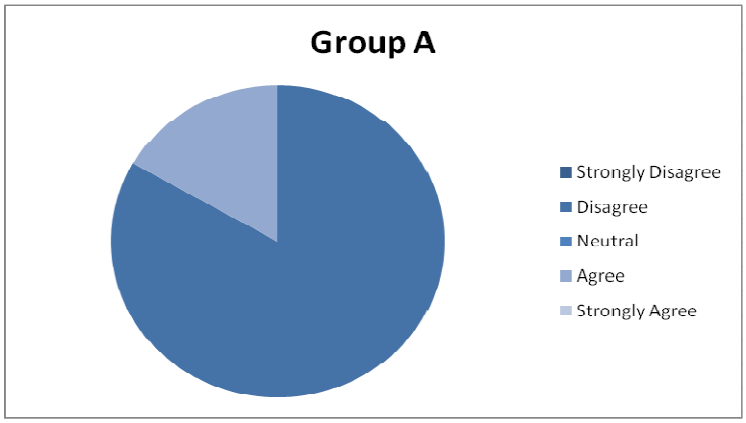


Figure 39 After this experience, I would be more inclined to use an e-Learning tool - Group A

Of the responses from the Sample Group A, 83% agreed that after this experience, they would be more inclined to use an e-Learning tool, while 17% disagreed.

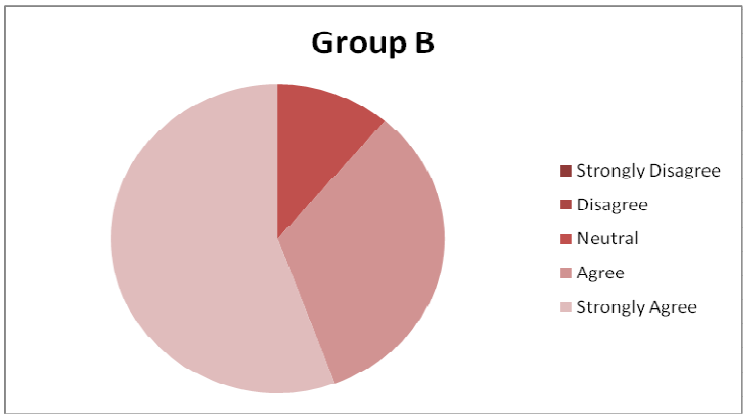


Figure 40 After this experience, I would be more inclined to use an e-Learning tool - Group B

Of the responses from the Sample Group B, 56% strongly agreed that after this experience, they would be more inclined to use an e-Learning tool, 33% agreed, while 11% were neutral.

The combined responses from the two sample groups were as follows:

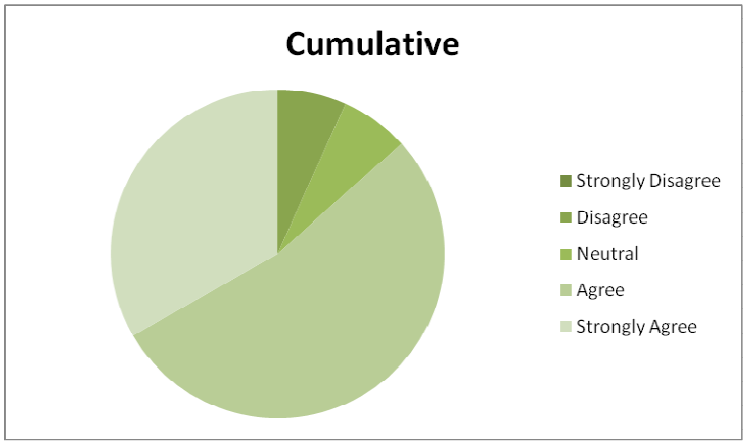


Figure 41 After this experience, I would be more inclined to use an e-Learning tool - Combined Results

Of the combined responses from both Sample Groups, 53% agreed that after this experience, they would be more inclined to use an e-Learning tool, 33% strongly agreed, 7% disagreed, while 7% were neutral.

Question: **E-Learning tools are a useful aid to teaching**

This question was obligatory and the participants were asked to choose one of the following: Strongly Disagree, Disagree, Neutral, Agree or Strongly Agree

The responses from the two Sample Groups were as follows:

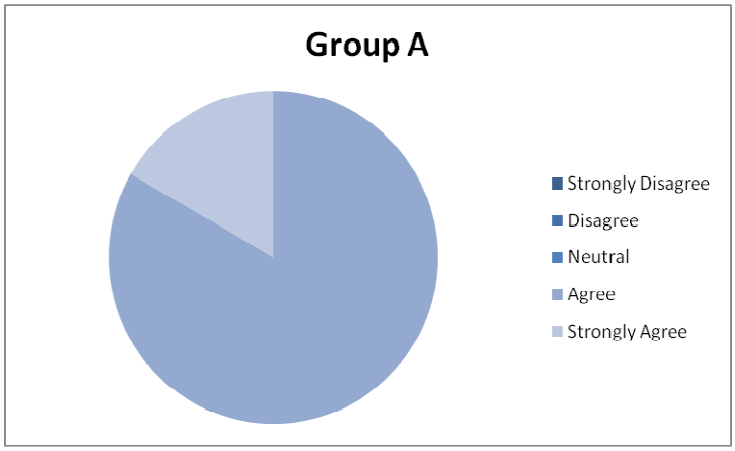


Figure 42 E-Learning tools are a useful aid to teaching - Group A

Of the responses from the Sample Group A, 83% agreed that E-Learning tools are a useful aid to teaching, while 17% strongly agreed.

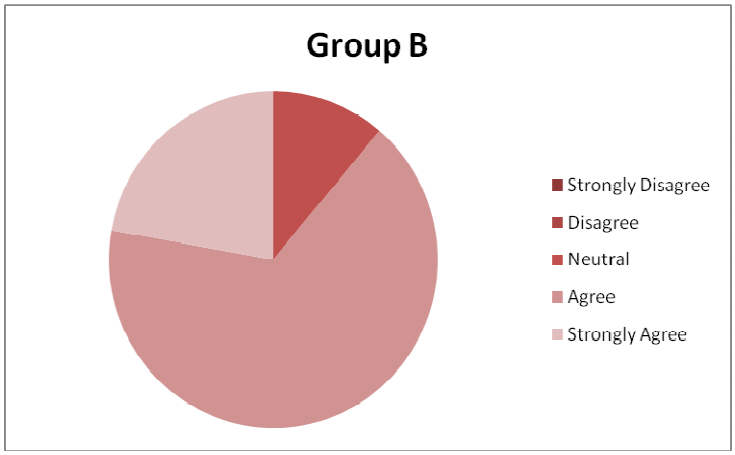


Figure 43 E-Learning tools are a useful aid to teaching - Group B

Of the responses from the Sample Group B, 67% agreed that E-Learning tools are a useful aid to teaching, 22% strongly agreed, while 11% were neutral.

The combined responses from the two sample groups were as follows:

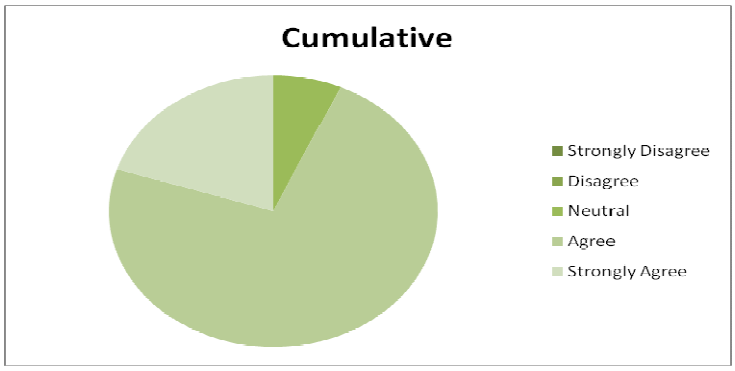


Figure 44 E-Learning tools are a useful aid to teaching - Combined Results

Of the combined responses from both Sample Groups, 73% agreed that E-Learning tools are a useful aid to teaching, 20% strongly agreed, while 7% were neutral.

Question: **The Card Sorting Exercise helped my understanding of the module content**

This question was only asked of these participants in Sample Group B and was obligatory. The participants were asked to choose one of the following: Strongly Disagree, Disagree, Neutral, Agree or Strongly Agree

The responses from Sample Group B were as follows:

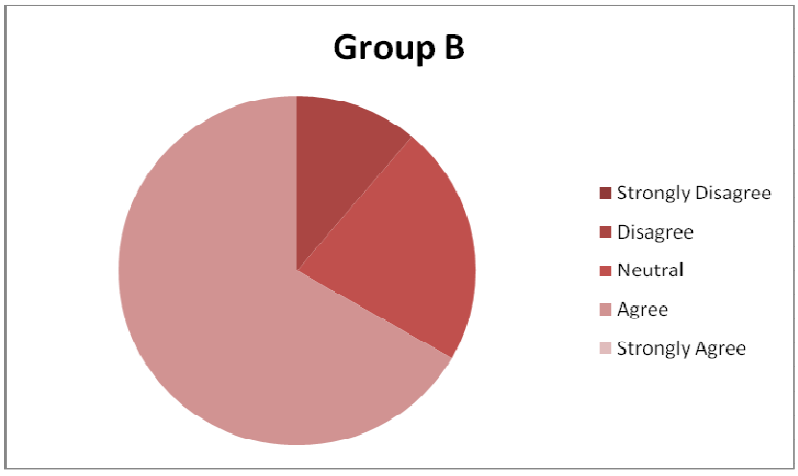


Figure 45 The Card Sorting Exercise helped my understanding of the module content - Group B

Of the responses from the Sample Group B, 67% agreed that the Card Sorting Exercise helped my understanding of the module content, 22% were neutral, while 11% disagreed.

Question: **How would you rate your understanding of Process Mapping?**

This question was obligatory and the participants were asked to choose one of the following: None, Basic, Average, Good or Very Good

The responses from the two Sample Groups were as follows:

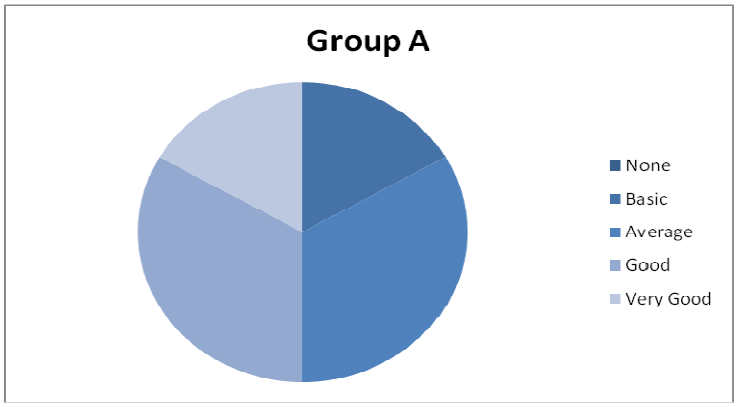


Figure 46 How would you rate your understanding of Process Mapping? - Group A

Of the responses from the Sample Group A, 33% rated their understanding of Process Mapping As good, 33% as average, 17% as very good and 17% as basic.

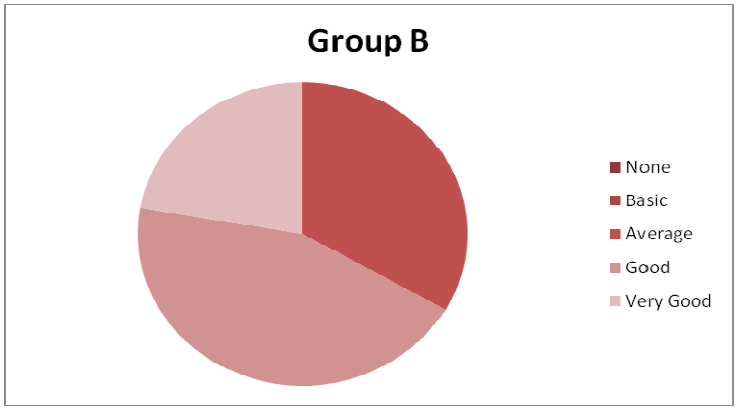


Figure 47 How would you rate your understanding of Process Mapping? - Group B

Of the responses from the Sample Group B, 45% rated their understanding of Process Mapping As good, 33% as average, and 22% as very good.

The combined responses from the two sample groups were as follows:

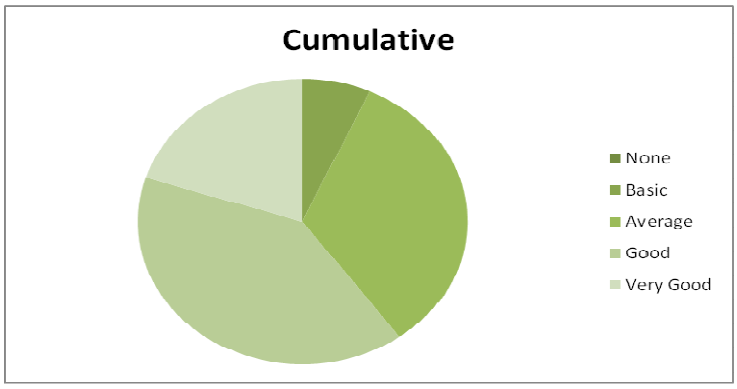


Figure 48 How would you rate your understanding of Process Mapping? - Combined Responses

Of the combined responses from both Sample Groups, 40% rated their understanding of Process Mapping As good, 33% as average, 20% as very good and 7% as basic.

Question: **How would you rate your overall experience?**

This question was obligatory and the participants were asked to choose one of the following: Very Poor, Poor, OK, Good or Very Good

The responses from the two Sample Groups were as follows:

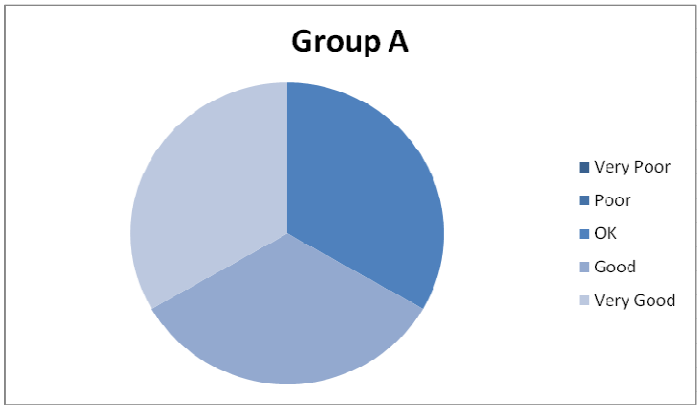


Figure 49 How would you rate your overall experience? - Group A

Of the responses from the Sample Group A, 33.3% rated their overall experience as very good, 33.3% as good and 33.3% as OK.

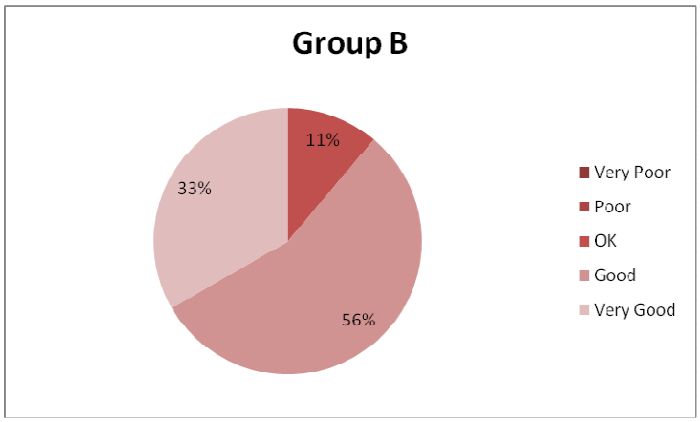


Figure 50 How would you rate your overall experience? - Group B

Of the responses from the Sample Group B, 56% rated their overall experience as good, 33% as very good and 11% as OK.

The combined responses from the two sample groups were as follows:

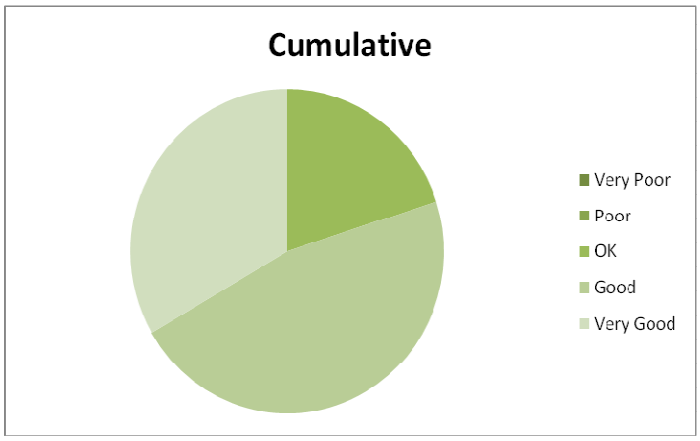


Figure 51 How would you rate your overall experience? - Combined Results

Of the combined responses from the both Sample Groups, 47% rated their overall experience as good, 33% as very good and 20% as OK.

Finally, participants were asked to leave a comment on the overall experience. This question was discretionary.

Question: **Please feel free to make any comments here. All feedback is very much appreciated**

Some of the comments were as follows:

"Definitely feel I learnt something in a few free minutes at my own desk, great!"

"Excellent resource - learned key points for mapping in less than a half hour, good achievement in an environment that is so busy."

"Some examples of flowcharts would be beneficial. Also it would be good to give people the opportunity to develop their own flowchart in a way such as the word mapping.."

"I found the screens a little boring - could have done with some colour and images. Also it would have assisted to have a voice over."

"Course content very simple and limited. Therefore not valid to make assumptions re complex e learning courses."

6.9 Analysis of the Results

Before presenting the results, it is recalled that Sample Group A completed the module without the Card Sorting Exercise while Sample Group B completed the module with the Card Sorting Exercise. For the analysis of results they will simply be referred to as A and B.

The main finding of the results is that, despite taking the Card Sorting Exercise, B scored less well than A in the Post-Module Assessment. The Average Score for A was 96% while the Average Score for B was 91%. At the same time, 67% of B felt the Card Sort helped their learning and, moreover, 100% of B rated their understanding of Process Mapping as good or very good in the Final Survey taken at the end of the module. In the Pre-Module Survey, only 54% of B rated their understanding of the subject matter as basic or better. So it would seem that those in B felt they had learnt a lot from the module even though this is not reflected in the assessment results. This may indicate that the questions in the Post-Module Assessment were not the most appropriate for measuring the learning acquired during the module.

Perceptions of the usefulness of e-Learning in the minds of the participants could definitely be said to have changed as a result of the experiment. When asked prior to the module whether they thought e-Learning tools were a useful aid to teaching, 67% of A agreed while 55% of B agreed or strongly agreed. In the Final Survey after the module, 100% of A and 89% of B agreed or strongly agreed that e-Learning tools were a useful aid to teaching.

The overall experience for all participants would appear to have been a good one. 67% of A and 89% of B rated their overall experience as good or very good. This seems to show that the overall design and implementation of the e-Learning prototype was well received by the participants.

The participants gave some interesting and valuable feedback .One participant stated that although "the sorting exercise was useful", they felt the design could be improved to make it easier to use. Another participant commented that "the word mapping was really interesting giving an example of another way the words could work would also be great so that people could see alternatives. The word mapping is a very good technique for getting you to think about the subject". However, a third participant stated: "I didn't really see the benefit to the Card Sorting Exercise." Although this comment was from a participant who also stated that they didn't use Process Mapping in their day-to-day work it still raises an important point. If the Card Sorting Exercise is to work as a learning re-enforcement tool it must not only be simple and easily understood, but the benefit of using it clear. Regardless of the relevance of the subject matter of the learning module, the presence of the Card Sorting Exercise must seem logical. It should aid the learning process and not be seen as confusing step in the learning process with no clear benefit.

The problems with the Card Sorting Technique highlighted in the experiment could arise for a number of reasons:

- The choice of items to sort was not chosen carefully enough.
- The Card Sorting Exercise simply doesn't work as an aid to learning retention.
- The Sample Group was too small to be scientifically accurate

There were also ease of use issues that commonly occur in e-Learning solutions. Another participant from Sample Group B stated that: "I could not complete the Card Sorting Exercise as it did not appear possible to drag the boxes where I wanted them to go". Another participant stated: "I found the exercise on grouping of words a little abstract". This comment indicates the broad range of reactions and opinions to the Card Sort Exercise even within a small sample group.

6.10 Summary

This chapter presented and analysed the results of the dissertation experiment.

The chapter began by detailing the methodology used to establish the two Sample Groups that would be required for the experiment. It then explained how the experiment would be run before presenting, in detail, the results from each component of the module. An analysis of the results was then presented with the main focus placed on the impact of the Card Sorting Exercise on the outcome.

7 CONCLUSION

7.1 Introduction

Predictions of the coming revolution in learning are not new. In 1922, Thomas Edison predicted that the motion picture would replace textbooks in the classroom. He was better at inventing than predicting. In reality, the changes are more often evolutionary but with the pace of change increasing all the time. One of the most significant evolutions in education in the recent period has seen a shift to more learner-centred education. As we have already seen, learning is a lot more than training (Rosenberg 2001).

When we start talking about learning and not just training we shift the emphasis from delivery to outcomes. For the individual learner this means they see the benefits of taking an e-Learning course. To achieve this, learning modules must be designed with learner-specific outcomes in mind. However, the development of participants capable of being fully engaged in the process of online learning takes time (Salmon 2004). From the perspective of any organisation providing e-Learning for its members or employees, they want to see the learning produce clear and measurable performance improvements that will help the organisation work more effectively.

One of the most promising technological advances on the horizon is the building of e-Learning solutions based on learning or knowledge objects. A learning/knowledge object is the smallest "chunk" of instruction or information that can stand alone and still have meaning to the learner (Rosenberg 2001). Changes in the way people work are not only driven by technology but also by new ways of organising and regulating the workplace (Field 2000). This has particular importance in the healthcare sector where the constant evolution of practices and regulations places CPD at the centre of any healthcare professional's career path. However, whether the medium used influences learning is an open question (Clark 1994). Therefore, it is essential to avoid the pitfall of believing that technology alone will produce effective e-Learning solutions.

7.2 Research Definition & Research Overview

The primary research addressed in this dissertation is to examine whether KM techniques can reinforce learning when incorporated into an e-Learning tool. The justification for this research is based on the evidence that knowledge acquisition and validation appear to be a key outcome of the learning process in certain contexts (Carroll et al. 2009).

This research is placed at the intersection of KM and e-Learning and attempts to examine how new knowledge is best acquired and internalised during the learning process.

7.3 Contributions to the Body of Knowledge

This research examined an area where relatively little previous research has been conducted, namely the use of KM techniques to aid learning retention in Online Learning Environments. The evidence produced has not shown that KM techniques can enhance learning but it should only be the one of a number of studies into the area.

7.4 Experimentation, Evaluation and Limitation

The experiment at the centre of this research set out to examine the hypothesis that KM techniques can aid learning retention in Online Learning Environments. The experiment was conducted by developing a prototype e-Learning module in two versions, one of which incorporated a KM technique, the other one which did not include the technique. The two versions were completed by two sample groups drawn from volunteers from the project partner, the ISQSH.

Once the experiment had been run, the results were collected from the different components in the learning module, namely, a Pre-Module Survey, a Card Sorting Exercise (completed by half the participants), a Post-Module Assessment and a Final Survey. The results were analysed to examine the impact of the KM technique and conclusions were drawn from the analysis.

The main limitation to the experiment was the small number of participants which had to be taken into account when drawing any conclusions.

7.5 Reflections

The experiment proved a very interesting and worthwhile undertaking. Although it was limited to a small number of participants, the results were, nonetheless, rich and informative. Learning clearly occurred during the module judging by the feedback from the participants. Also, the results showed a noticeable change in the perception of e-Learning among all participants. After the experiment, they all expressed a more positive attitude to e-Learning as training aid.

7.6 Future Work & Research

This research focused on the use of a single KM technique as an aid to learning retention in one e-Learning module. There is ample scope for future work and research in the area be carried out

Card Sorting is a KE technique that lends itself to use in an on-line, e-Learning environment. Although the experiment results showed no improvement in the learning assisted by the technique, it does not bring into question the value of this research or any future work in the area. A more extensive experiment in a field other than healthcare merits consideration. For future work in the area to be worthwhile it must take account of the following factors:

- More participants would be required if the Sample Groups are to be representative
- The prior learning and knowledge of the participants should be evaluated in detail
- The learning content should be sufficiently complex to allow for meaningful evaluation
- Any KM technique to be evaluated should be integrated into the learning in a way that makes it seem an integral part of the process
- Post-learning assessments should be carefully designed to evaluate the learning and the impact of any KM technique employed

E-Learning needs to improve its effectiveness and we need to research how this can be achieved.

7.7 Summary

At a time when the desire and need for learning and knowledge is outstripping the possibilities of conventional training methods, e-Learning offers the potential to respond quickly and effectively to this growing demand (Rosenberg 2001). In an era when change is faster than ever a key advantage of e-Learning is that it has faster delivery cycle times than traditional classroom-based instruction. There is a practical limitation on how fast learning can be rolled out with classroom-based instruction, as the capacity to deliver learning is limited by the number of available classrooms and trainers. The route to ensuring quality of online pedagogy may therefore be best pursued by ensuring that designers and, more importantly, implementers of online learning, are familiar with the research on learning, understand its implications, and take care to apply the principles that are derived from it (Jackson & Anagnostopoulos 2001).

The noted educational theorist Charles Reigeluth stressed the need for a view of training and education where the learner is at the top of the organisational chart and not at the bottom (Reigeluth 1999). Designing and supporting learning interactions that are genuinely engaging, meaningful and conceptually stimulating within online learning contexts remains a significant challenge in contemporary education (Ravenscroft & McAlister 2006). What we must remember is that this new information technology is only the pipeline and storage system for knowledge exchange. It does not create knowledge and cannot guarantee or even promote knowledge generation or sharing if the culture of the organisation does not encourage it (Davenport & Prusak 1998). A focus on the individual learner is essential if KM and e-Learning are to complement each other. Because new knowledge always begins with the individual (Nonaka 2008). The convergence of e-Learning and KM can help to create a constructive, open, dynamic, interconnected, distributed, adaptive, user friendly, socially concerned, and accessible wealth of knowledge (Lytras et al. 2005). It is hoped that this research has somehow contributed to that convergence.

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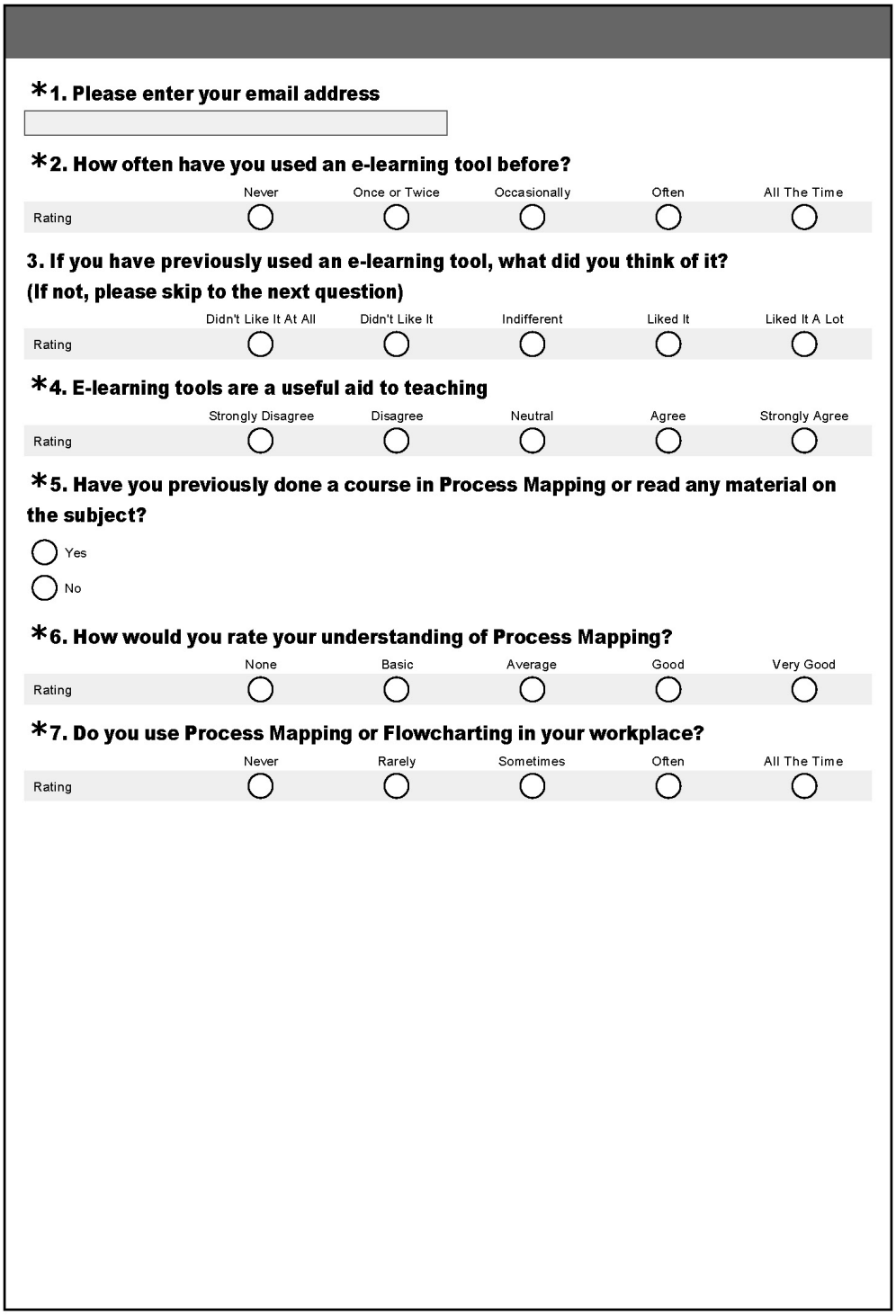
APPENDIX A

Pre-Module Survey – Questions



***1. Please enter your email address**

***2. How often have you used an e-learning tool before?**

	Never	Once or Twice	Occasionally	Often	All The Time
Rating	◯	◯	◯	◯	◯

3. If you have previously used an e-learning tool, what did you think of it? (If not, please skip to the next question)

	Didn't Like It At All	Didn't Like It	Indifferent	Liked It	Liked It A Lot
Rating	◯	◯	◯	◯	◯

***4. E-learning tools are a useful aid to teaching**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	◯	◯	◯	◯	◯

***5. Have you previously done a course in Process Mapping or read any material on the subject?**

◯ Yes

◯ No

***6. How would you rate your understanding of Process Mapping?**

	None	Basic	Average	Good	Very Good
Rating	◯	◯	◯	◯	◯

***7. Do you use Process Mapping or Flowcharting in your workplace?**

	Never	Rarely	Sometimes	Often	All The Time
Rating	◯	◯	◯	◯	◯

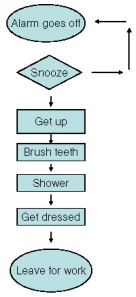
APPENDIX B

Process Mapping Learning Module – Course Content

30/08/2011

Process Mapping

How to "Flowchart a Process"



Purpose

A flowchart is a picture of the steps in a process.

It is used to:

- Examine the relation and sequence of steps
- Identify redundancy, unnecessary complexity, and inefficiency in a process
- Create common understanding of the flow of the process

Steps to develop a Flowchart

- Decide on the process that you wish to describe
- It is very important to clearly identify the parameters of the process – i.e. define the **beginning** and **ending** steps of the process.

The beginning and ending steps are also known as boundaries.

Process

- A process is a defined set of causes transforming inputs into outputs.
- Process improvement begins by understanding your service user's needs and expectations and how processes work
- Organisations are networks of interrelated processes.

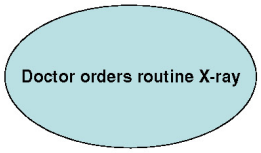
Beginning

When developing the flowchart, steps can be written on a Post-It note and then the actions and decisions can be recorded easily and placed in sequence.

The beginning of the process is described in an OVAL shaped symbol.

1

Example



Decision steps

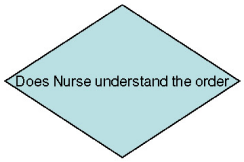
When a decision step is reached, i.e. there is more than one pathway depending on the answer to a question, write a yes/no questions in a DIAMOND and develop each path

Make sure that each decision loop re-enters the process or is pursued to a conclusion

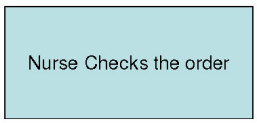
Next steps

Asking "what happens next?", write each subsequent step in a RECTANGLE.

Example



Example



Ending step in a process

- Write the ending step in an OVAL.

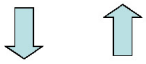
Sometimes, due to the branching at decision points, a process may have more than one ending boundary.

Review of flowchart symbols

- Oval – represents the beginning or an ending of the process under study. The ovals should reflect the boundaries of the process

Symbols cont'd

- Arrows – represent the direction of process flow



Symbols cont'd

- Rectangle – represents an actions step in the process. A brief description of the step should be included inside the rectangle.

Use of a Flowchart

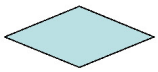
When identifying a process to improve, flowcharts are often used to clarify HOW a process is being performed or to agree on how it SHOULD be performed.

When a process is improved the changes should be noted on the flowchart in order to standardise the revised flow.

Flowcharts can also be used as a graphical format for procedures and training.

Symbols cont'd

- Diamond – represents decision steps in the process flow. A brief description of the decision in the form of a questions should be included in the diamond. Each decision should have a "yes" or a "no" path.



APPENDIX C

Card Sorting Exercise – List of Items to Sort

Process
Quality
Responsibility
Manage
Efficiency
Patients
Safety
Service
Improvement
Ownership
Resources
Clarity
Completeness
Change
Focus
Bottleneck
Team
Workflow
Impact
Duplication

Total Number of Items = 20

APPENDIX D

Post-Module Assessment – Questions

1. For what purpose can Process Mapping Be used?
    - Only to show what is supposed to happen
    - Only to show what actually occurs
    - Both of the above

2. You can use any symbols you want in a flowchart
    - Yes
    - No

3. In a flowchart, which symbol is used to indicate a step in a process?
    - Rectangle
    - Triangle
    - Square

4. In a flowchart, the beginning and end step are also known as boundaries
    - True
    - False

5. For the purpose of flowcharting, organisations are considered to be networks of inter-related
    - Tasks
    - Processes

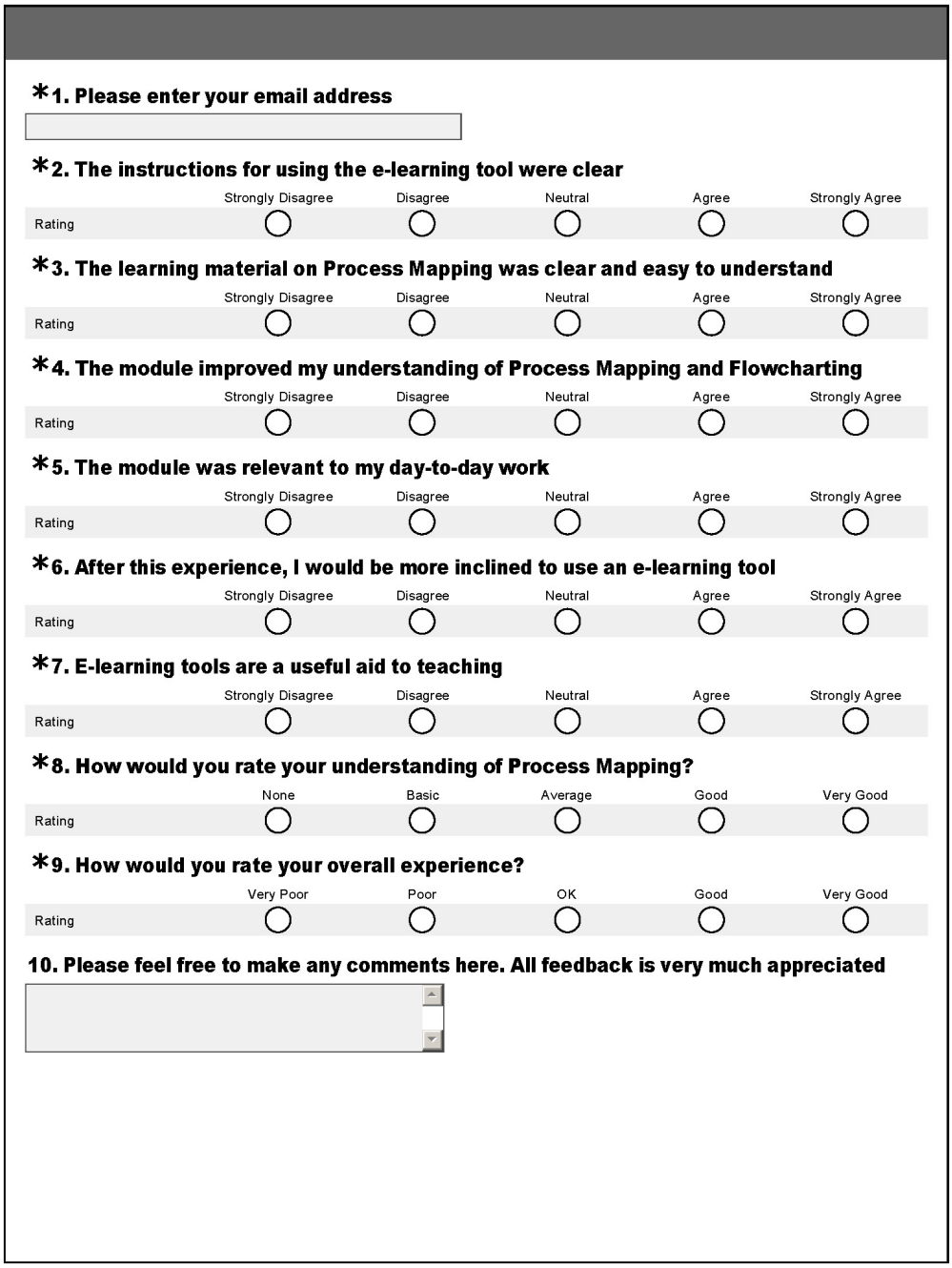
6. A process map can help identify inefficiencies
    - True
    - False

7. An oval shape in flow-charting is used to represent
    - Only the end of a process
    - Only the beginning of a process
    - Both of the above

8. A diamond symbol is used to represent a decision step in flowcharting
    - True
    - False

APPENDIX E

Final Survey – Questions Sample Group A



*1. Please enter your email address

*2. The instructions for using the e-learning tool were clear

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	○	○	○	○	○

*3. The learning material on Process Mapping was clear and easy to understand

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	○	○	○	○	○

*4. The module improved my understanding of Process Mapping and Flowcharting

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	○	○	○	○	○

*5. The module was relevant to my day-to-day work

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	○	○	○	○	○

*6. After this experience, I would be more inclined to use an e-learning tool

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	○	○	○	○	○

*7. E-learning tools are a useful aid to teaching

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	○	○	○	○	○

*8. How would you rate your understanding of Process Mapping?

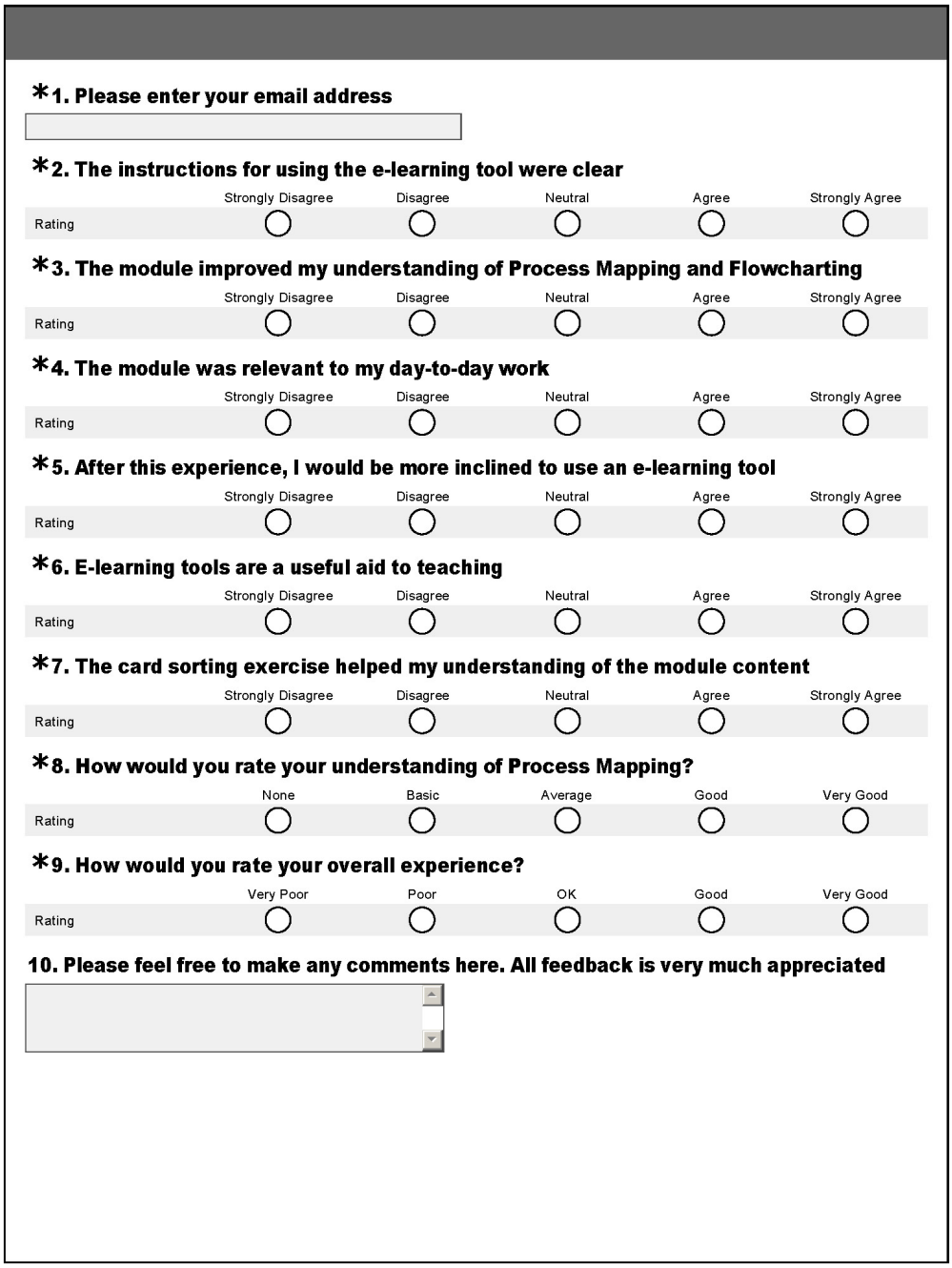
	None	Basic	Average	Good	Very Good
Rating	○	○	○	○	○

*9. How would you rate your overall experience?

	Very Poor	Poor	OK	Good	Very Good
Rating	○	○	○	○	○

10. Please feel free to make any comments here. All feedback is very much appreciated

Final Survey – Questions Sample Group B



*1. Please enter your email address

*2. The instructions for using the e-learning tool were clear

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	○	○	○	○	○

*3. The module improved my understanding of Process Mapping and Flowcharting

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	○	○	○	○	○

*4. The module was relevant to my day-to-day work

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	○	○	○	○	○

*5. After this experience, I would be more inclined to use an e-learning tool

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	○	○	○	○	○

*6. E-learning tools are a useful aid to teaching

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	○	○	○	○	○

*7. The card sorting exercise helped my understanding of the module content

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Rating	○	○	○	○	○

*8. How would you rate your understanding of Process Mapping?

	None	Basic	Average	Good	Very Good
Rating	○	○	○	○	○

*9. How would you rate your overall experience?

	Very Poor	Poor	OK	Good	Very Good
Rating	○	○	○	○	○

10. Please feel free to make any comments here. All feedback is very much appreciated

APPENDIX F

Card Sorting Exercise – Categories defined by participants

Accountability
Aims
Areas to improve
Benefits of Process Mapping
Change jargon, cutbacks?
Competencies
Good Service Provision
Healthcare
Healthcare Management
How to improve
Key Players
Keys to successful process mapping
Problems identified
Process Mapping helps
Reasons to use Process Mapping
Satisfaction
Service Challenges for Patients
Steps
Team and Service Systems
Team Development & Functioning
Team Development Process
What Process Mapping can help you explore
Words relating to Health care management
Words relating to patients
Words relating to the team- Health care team

Total Number of Unique Categories = 25