School of Education

Self-regulated Learning in an E-learning Environment in a Malaysian University

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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made.

Signature: _____
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Abstract

This study aimed to conceptualise, design and validate an instrument for measuring self-regulated learning in the e-learning environment. It examined how students at Univerisiti Sains Malaysia (USM) self-regulate their learning in an e-learning environment. It investigated how learners monitor their reflections, learning strategies, metacognitive awareness, intrinsic motivation, extrinsic motivation and amotivation in their learning activities.

A conceptual model of self-regulated learning in an e-learning environment was developed from a review of pertinent literature. This model was then used to develop a student self-report rating scale instrument, the data from which were scrutinised by the Statistical Package for the Social Sciences (IBM -SPSS), and Rasch Unidimensional Measurement Models (RUMM2030).

Quantitative research methodology was adopted based on deductive approach. Thus, convenience sampling was employed for university students who volunteered to participate anonymously.

Factor analysis identified 28 factors and after data reduction, eight 'natural' groupings were found. The factors were *Ability and Effort Beliefs*, *Reflection*, *Introjected Regulation*, *Task Character*, *Strategic Use*, *Value of Task*, *Stimulus Response* and *Recognition*. Data from the respective items comprising the eight factors were then analysed using RUMM20303 to ascertain whether the factors could be measured. This showed that measures had been constructed. Data were also examined for the effects of categorical variables such as student gender, age, year of study, ethnicity and school.

The findings of this study provide useful information for university instructional technologists, software developers, students, facilitators, administrators and researchers who are interested in self-regulated learning and ways in which information and communication e-learning technology can enhance and facilitate

learning. The study is also significant because it used a highly contemporary method for instrument development and data analysis – the Rasch model.

Acknowledgements

I could not have accomplished what I have up to now without the help of both my supervisors (Associate Professor Lina Pelliccione and Professor Rob Cavanagh). Most of my university-level education has been in information technology; I have my Bachelor of Science in Computer Information Systems and Master of Science in Information Technology in Business. I have found that education technology is quite different from information technology.

The undertaking of a PhD is a lonely path. I could describe my encounters as swimming across a river in the dark with my head above the water with the determination to reach the shore. Supervisors were like "light towers" standing tall on the banks of the river. This swim lasted four years and finally I have landed (到披岸). During my journey I also received extensive support and help from people who surround me. I wish to express my sincere appreciation to those who have supported and assisted me throughout my doctoral research (Associate Professor Lina Pelliccione and Ms June Houston). Special thanks to Professor Robert Cavanagh who guided me in my method of analysis when I did not know how to commence it.

Most important of all, I acknowledge my wife Amy Kah Hooi Boo who has been supportive and patient during the course of my studies, encouraging and pushing me as I confronted the various challenges of conducting doctoral research. Thanks also go to my daughter Yi Quan Phung who showed her consideration and support while Dad was busy. Although I have not been playing with her or been totally aware of what she has been doing at Rossmoyne Primary, I will spend a lot more time with her after this submission. I also would like to share this joy and honor with my beloved parents, the Malaysian Ministry of Higher Education, and the Universiti Sains Malaysia that have provided me with the opportunity to undertake this journey.

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CHAPTER ONE

INTRODUCTION

1.1 Overview

This chapter introduces e-learning environments in Malaysia and self-regulated learning in general and then moves on to self-regulated e-learning. Next, the research problems and questions are presented. This is followed by the significance of the study. Finally, the structure of the thesis is outlined, providing a brief overview of each chapter.

1.2 E-learning Environment in Malaysia

The Ministry of Education (MOE) in Malaysia has embarked on many different projects over the past twenty years. Computer literacy, computers in education and smart schools are among some of the latest projects in Malaysia (Ngah & Masood, 2006). According to her report on the United Nations Educational Scientific and Cultural Organization (UNESCO) in 2003, Belawati (2004) states that 30% (approximately MYR 4.2 billion) of the MOE annual budget was being used to improve the ICT infrastructure in the entire nation to enhance e-learning. It is also expected that there will be an increased use of ICT in teaching and learning as well as education management with the infrastructure in place. ICT in Malaysia is fuelled by the government's initiatives such as the Malaysian Super Corridor (MSC) and Vision 2020 which emphasize the use of ICT as the main impetus for bringing Malaysia into the digital and 21st century (Ngah & Masood, 2006). The emphasis on the use of ICT in education in Malaysia continues to be one of the major challenges under the 9th Malaysia Plan (RMK-9) (Malaysia Ministry of Education, 2006).

With regards to higher learning, the direction of Ministry of Higher Education (MOHE) in Malaysia was to develop university graduates which will benefit the nation and society. Taking into consideration of the nation's visions in MSC, MOE,

MOHE and RMK, E-pembelajaran Institut Pengajian Tinggi Awam (EIPTA) emerged. According to EIPTA, e-learning and global engagement were among the most important elements in achieving quality graduates for our nation (Malaysia) and society (Embi and Adun 2011). Also, Majis E-pembelajaran Institut Pengajian Tinggi Awam (MEIPTA) in Malaysia has set target to enable all staff members and students available for e-learning at all levels nationwide and internationally by 2015 (Syafawati 2011). In addition, Portal Malaysia Education Online (MedO) (Embi and Adun 2010) which involved 20 poublic universities will be utilised to enable every Malaysian to gain access to tertiary education . The objectives of MEIPTA were:

1. A platform for sharing and collaborating between public universities with regards to e-leanring and
2. To be united for solving issues and sharing resources to improve e-learning among all public universities (Embi and Adun 2010).

Apart from setting up a e-learning platform for sharing and collaborating and further solving issues and sharing resources, more importantly, there is a need to know how e-learners self-regulate their own learning (Vighnarajah, Wong et al. 2009). Therefore, it is very import to enable each student to self-regulate their learning.

There is evidence that at the tertiary level, Malaysia is moving away from didactic approaches to teaching and learning (Cyberjaya University College of Medical Sciences, 2007; University College Sedaya International, 2007). Of significant concern was the traditional teacher-centred approach that has complicated and threatened the implementation of other teaching practices (Betoret & Artiga, 2004). Also, there has been concern regarding the overuse of lecture-based and teacher-based instructional strategies in Malaysia with little thought given to introducing strategies that promote a higher level of thinking (Zakaria & Iksan, 2007). There is a need to examine how e-learning will benefit the Malaysian education system as well as the development of self-regulated learners. As with any innovation, there are a number of challenges in the adoption process. Ismail and Alexander (2005) identified that the lack of experience with co-operative learning would cause some concern when moving from didactic teaching to more student-centred approaches in Malaysia. Cooperation is one of the elements that is

lacking in e-learning environments in Malaysia. This is due to the fact that most e-learners learn from a distance: they are external students. To overcome this problem, there is a need to look at both the level of Metacognition and of self-determination. The key levels of Metacognition are: Awareness use, Strategic use and Reflective use. Further, the key components of Self-determination are: Extrinsic motivation, Intrinsic motivation and Amotivation.

Implementing ICT teaching and learning may fail if the role of self-regulated learning in e-learning in Malaysian Higher Education is not taken into consideration. This study investigated Metacognition and Self-determination in self-regulated learning within an e-learning environment in Malaysia.

Any self-regulated learning in an e-learning environment requires students to be engaged in Metacognition and Self-determination (motivation). Self-regulation can assist students to monitor their own cognitive and self-determined motivation levels (Flavell, 1979, 2004; Schraw & Dennison, 1994; Schraw & Moshman, 1995). Therefore, the literature review (detailed in the following chapter) investigates each of these themes: Metacognition and Self-determination.

1.3 Self-regulated Learning

Self-regulated learning (SRL) has gained much attention in the past twenty years in the field of education. SRL originated from social cognitive theories (Bandura, 1991) and a big part of SRL concerns Metacognition (Flavell, 1979). The term SRL has not been clearly defined. For example, Steffens (2006) indicates that there are many SRL terms that are used interchangeably, such as: independent study, individual study, self-directed learning, self-education, self-guided learning, self-instruction, self-planned learning, and self-teaching. However, a more recent definition of SRL has emerged: "the degree that individuals are metacognitively, motivationally, and behaviourally active participants in their own learning process" (Zimmerman, 2001, p. 15). In addition, it "can help describe the ways that people approach problems, apply strategies, monitor their performance, and interpret the outcomes of their efforts" (Paris & Winograd, 2001, p.3 as cited in Steffens, 2006). Furthermore, SRL is defined by Bandura (1991) as the ability to self-reflect and

self-react upon one's "thought, feelings, motivation, and actions"(p. 249).

1.4 Research Problem

Typically, students in Malaysia rely on direction in their learning through didactic practice which in turn creates a culture of dependence. This is further complicated by a memory or rote learning approach to assessment which results in the use of surface learning approaches. Thus, when opportunities are provided through e-learning environments, students are unable to self-regulate.

1.5 Research Questions

1. Can self-regulated learning in an e-learning environment in a Malaysian university be measured?

2. What are student perceptions of their e-learning and their e-learning environment?

3. What aspects of e-learning were easy for the students to affirm and which were difficult to affirm?

4. Does membership of particular groups (e.g. gender) account for variance in student e-learning perceptions?

1.6 Significance of Study

This research defined and expanded current knowledge of self-regulated learning in an e-learning environment. It also identified the main aspects and sub-aspects of self-regulated learning in this context. This study conceptualised, designed and validated an instrument for evaluating self-regulated learning in an e-learning environment. It provided a theory of e-learning in educational settings and evaluated how students' self-regulated learning processes relate to the e-learning environment. Further, it extended and elaborated on current theory within the field of self-regulation of learning behaviour, by exploring components of this construct in a university e-learning environment.

Furthermore, this research will contribute to the teaching and learning with respect to education technology, measurement, and educational psychology. The results of this research will provide the instructional technologist with useful insights into the development of e-learning software. The results will streamline the ways to improve self-regulated learning in an e-learning environment and also impact significantly on e-learning software development and learning environments.

1.7 Structure of the Thesis

Following this introductory chapter, Chapter Two presents a detailed review of the literature on the existing theories of self-regulated learning, the characteristics that define self-regulatory learning skills, a discussion of the instruments that have been chosen and a discussion of self-regulated e-learning in Malaysia. Chapter Three describes the methodology that was applied to elicit data and conduct analyses to answer the research questions. Chapter Four, presents the results of the empirical investigation. Finally, in Chapter Five a detailed discussion of the findings is presented, together with recommendations for the development of self-regulated e-learning in Malaysia. The limitations of the study and suggestions for further research are also presented here.

CHAPTER TWO

THEORETICAL FOUNDATION OF THE STUDY

2.1 Overview

This chapter covers a detailed review of the literature which formed the basis of the theoretical foundation of the study. It begins with an examination of self-regulated learning concepts. In this section, readers are introduced to the existing theories of self-regulated learning and the characteristics that define self-regulatory learning skills which focus on how learners direct their learning process. This is followed by a discussion of the instruments used to assess self-regulated learning. This chapter ends with an important discussion of Self-regulated e-learning in Malaysia.

The pertinent literature was synthesised into a preliminary theoretical framework of key constructs. This is presented in the Proposed Model of Self-regulated Learning in an E-learning Environment (see Figure 2.0.1.1.). The organisation of this chapter was based on the structure of the Model.

2.1.1 Proposed Model

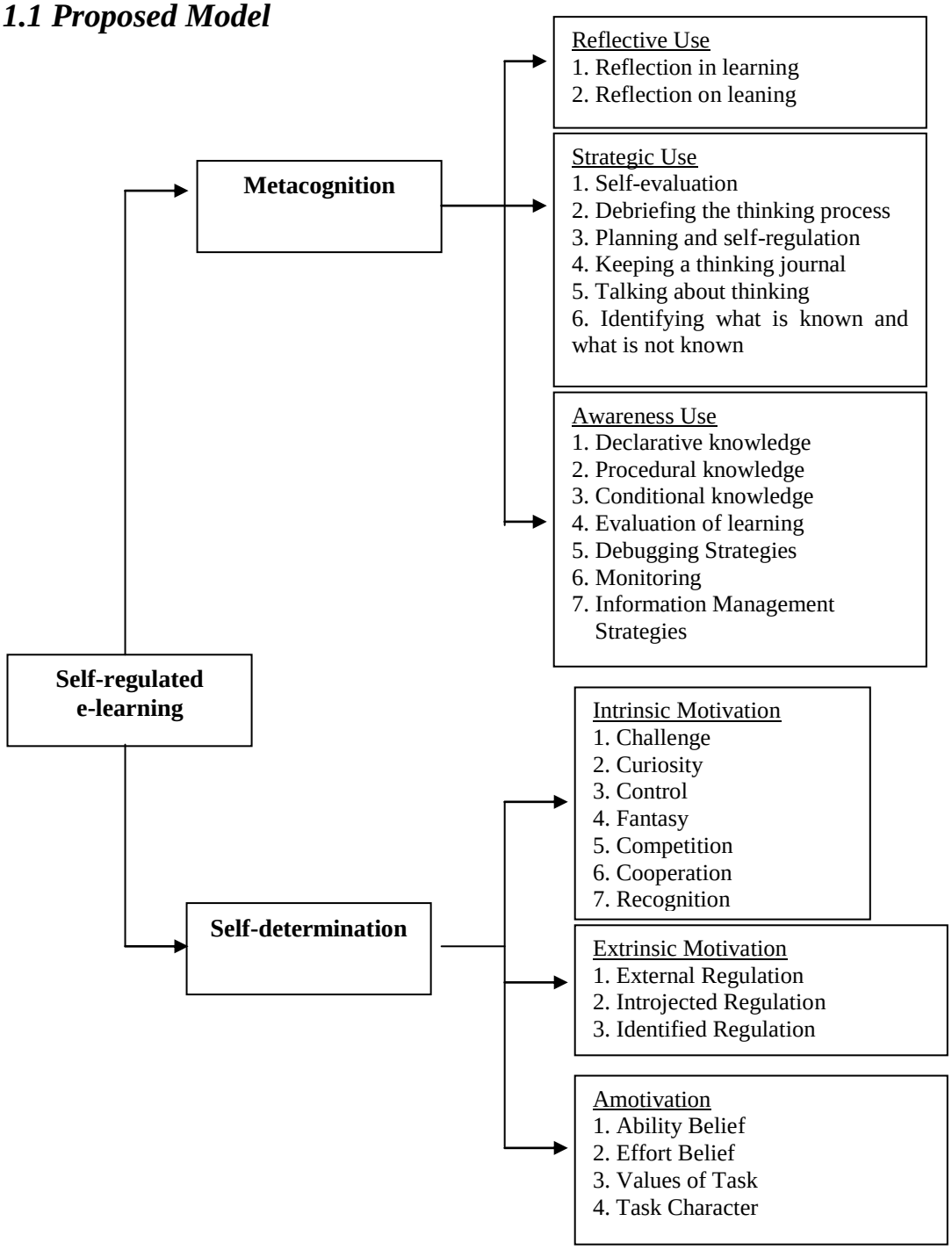

Figure 2.0.1.1. Proposed Model of Self-regulated Learning in an E-learning Environment in a Malaysian University (developed by researcher, based on literature review)

2.2 Self-regulated learning

Self-regulated learning (SRL) has gained a deal of attention from researchers and theorists, particularly in the past twenty years in the field of education. The concepts of SRL originated from social cognitive theories (Bandura, 1991) and the term "self-regulated" can be used to describe any learning that is guided by metacognition (Flavell, 1979) and motivation to learn. Three aspects of SRL are proposed by Zimmerman (1986): metacognitive self-regulation, motivational self-regulation and behavioural self-regulation. SRL has also been an area of wide-ranging international theoretical concern and debate among educators, policy makers and education researchers (Baggetun & Wasson, 2006; Winne & Jamieson-Noel, 2002; Zimmerman, 1989, 1990, 2008; Zimmerman & Schunk, 2001). It is clear that many of these notions have focused on the ability of students to transform mental abilities into academic performance skills (Zimmerman, 2008). In other words, students should be able to independently direct their own learning.

The ways by which students learn and how they successfully negotiate their learning have always been the concern of educators (Artino, 2007; Barak, 2004). Over the decades, the focus of learning theory has, shifted from behaviourism (response to stimuli), to cognitivism (complex cognitive processing) and more recently to constructivism (creating own meaning from own experience). From another perspective, one could say that the origin of knowledge has shifted from empiricism to rationalism. The learning focus on empiricism is basically about controlling the environment to maximise learning. On the other hand, rationalism focuses on students reflecting on what they already know and exploring what is in their mind. It seems that many of these studies, according to Kramnick (2007), are saying that students have not been given enough "space" to explore in the past but, with the shift in learning pedagogy, students should be encouraged to create their own understanding from their own meaning and from their past experience. This point is also greatly emphasized in this study.

In order for students to shift their thinking and approach to learning from behaviourism to constructivism, reflection must take place. Sandars (2009) defines reflection as "a metacognitive process that creates a greater understanding of both

the self and the situation so that future actions can be informed by this understanding" (p. 685). According to Dewey (1963), reflection is a natural human tendency which allows students to make sense of learning derived from their experiences. Being able to engage in reflection is considered to be the highest level of metacognition. This is because reflection is necessary for the understanding and controlling of the learning process. Also at a high level of metacognition are Strategic use and Awareness use (Zimmerman, 1986). The driving force behind Reflective use, Strategic use and Awareness use is seen as motivation and vice versa. Thus, students must have certain kinds of motivation in order for them to perform metacognitively and vice versa. As the current study is examining how to develop self-regulated learning in an e-learning environment in a Malaysian university, self-regulated learning (SRL) was chosen as the main underlying theory for this study.

Self-regulated learning (SRL) has gained a great deal more attention in the past decade (Legault, Green-Demers, & Chung, 2007; Legault, Green-Demers, & Pelletier, 2006) and as a result it also has inspired many new ideas. One problem noted from the literature is that self-regulated learning and self-directed learning are terms used synonymously by many theorists, thereby leading to some confusion. Kasworm (2007) was one of the first to address this issue. In a similar vein to self-regulated learning, Kasworm (2007) states that self-directed learning can be viewed as a "set of generic, finite behaviours; as a belief system reflecting and evolving from a process of self-initiated learning activity" (p. 1). The key descriptors to note here are behaviour, reflecting and self-initiated learning. These can be translated and compared to self-regulated learning as behaviourally, metacognitively and motivationally active learning (Zimmerman, 1986).

According to Kuhl and Kraska (1994, p. 5401), "self-directed learning has created some confusion in that many related concepts are often used interchangeably or in similar ways". In conjunction with this, Steffens (2006) also points out that there are terms used to describe self-directed learning that are clearly similar to those used in describing self-regulated learning. These terms are: independent study, individual study, self-directed learning, self-education, self-guided learning, self-instruction, self-planned learning, and self-teaching. In addition, other labels

found in the literature to describe the self-regulated learning process are "self-planned learning", "self-instruction", "self-teaching", "self-study", and "autonomous learning" (Knowles, 1975 p.18). In addition to these, Dixon, Baba, Cozens, and Thomas (2007) use the terms "self-directed / [and] independent learning" (p.385) interchangeably. In most cases, it seems that self-regulated learning and self-directed learning (SDL) are considered to mean the same thing.

Knowles (1975), one of the first researchers in the field of self-directed learning, describes self-directed learning as "a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (p.18). Also, according to Harding, Vanasupa, Savage, and Stolk (2007) self-directed learning includes:

1. Motivation to Learn
2. Cognition
3. Metacognitive Strategies
4. Persistence.

The classification above is not completely logical since students need motivation to be persistent and also metacognition is taken to mean "cognitive monitoring" (Flavell, 1979). Surely cognitive and metacognitive strategies should not be separated. Extrinsic motivation and intrinsic motivation both encourage persistence. The two constructs of metacognition and self-determination will inform the theoretical framework for this study. In addition, the self-directed learning concepts have been incorporated into the development of theory in this study. However, the theoretical framework in this study is still based on self-regulated learning where individuals are behaviourally, metacognitively and motivationally active in learning (Zimmerman, 1986).

According to Zimmerman (1986), self-regulated learners are "Metacognitively, motivationally, and behaviourally active participants in their own learning process" (p. 308). A metacognitively self-regulated learner is a person "who plans, organizes, self-instructs, self-monitors, and self-evaluates" (p. 308). Motivationally

self-regulated learners "perceive themselves as competent, self-efficacious, and autonomous" (p. 308). Since this study took place in an e-learning environment, the third construct (behaviourally active) for self-regulated learning would be the e-learning environment. "Behaviourally active" is defined by Zimmerman (1986) as applying to a person who "selects, structures, and creates environments that optimize learning" (p. 308).

In addition to Zimmerman's definition (see Zimmerman, 1986; Zimmerman, Neil, & Paul, 2001 p.15), Steffen (2006) believes that self-regulated learning, "can help describe the ways that people approach problems, apply strategies, monitor their performance, and interpret the outcomes of their efforts" (Paris & Winograd, 2001, p.3 cited in Steffens, 2006). Zimmerman and Tsikalas (2005) further describe three phases of SRL: Forethought – goal setting and planning; Performance – learning strategies self-instruction, and self-recording; and Self-reflection – self-judgment and self-reflection. In this study, the term SRL was used to include both SRL and SDL in order to develop a theoretical framework with the sub-constructs of metacognition and self-determination.

Zimmerman (1990) points out that self-regulated learners (SRL) proactively seek and master information for a given task. Moreover, when faced with obstacles, students try to find a way to succeed and hence view acquisition as a systematic and controllable process where they accept greater responsibility for their achievement outcomes. This study attempts to identify those variables that will support Malaysian tertiary students to be proactive in their learning, allow them to find ways to succeed when faced with obstacles, and take control of their acquisition of knowledge and learning outcomes. This creates a situation where they accept greater responsibility for their own learning within their e-learning environment.

According to Nückles, Hübner, and Renkl (2008), self-regulated learning can also influence one's ability to have control and influence over one's learning processes and they suggest that learning protocols should encourage the application of sophisticated cognitive and metacognitive learning strategies. This is why the e-learning environment is important in this study because it enables students to construct their own learning procedures. This study looked at how the e-learning environment could be changed by students' use of metacognition and motivation (self-determination). The influence of motivation on self-regulated learning will be discussed later in this chapter.

2.2.1 Self-Directed Learning (SDL)

It is important to examine exactly what SDL is since the concept of SRL in this study will be used to include both SRL and SDL concepts. This section begins with a definition of SDL followed by a detailed investigation into relevant concepts. A discussion of the incorporation of e-learning into self-regulated learning will be presented and finally, the instruments and scales for measuring SDL variables will be presented.

SDL, unlike SRL, is "a general term for an approach rather than for any specific medium or method" (Guglielmino, Long, & Hiemstra, 2004, p. 20). For example, self-directed learning often involves a mix of the following media:

1. Books
2. Computer-based training
3. Multimedia CD-ROM
4. Intranet- or internet-based delivery
5. Workbooks
6. Video, audio, etc.

Also, the techniques, tools, and resources for SDL learners include:

1. Planning tools
2. Individual study techniques
3. Personal reflection tools
4. Individual skill development

5. Group study techniques
6. Using the communicative community (Hiemstra, 2005).

The SDL approach can be traced back to Greek philosophers Socrates, Plato and Aristotle. According to Guglielmino, Long and Hiemstra (2004), the self-direction movement was initiated in colonial America which prized self thought (as cited in Timmins, 2008). In her findings, she stated that initially SDL was to facilitate student/teacher relationships and was not seen as a fully independent student activity. Also, there was no consistent use of SDL across the country and the allocation of time devoted to curricula within her field - nursing education - was unclear. On the other hand, Hiemstra (1994) argues that SDL "... can involve various activities and resources, such as self-guided reading, participation in study groups, internships, electronic dialogues, and reflective writing activities" (Hiemstra, 1994, p. 1). In the current study, the "facilitator" has been extended to include the e-learning environment. There is no "one solution fits all" in terms of student learning, and time allocation is mainly dependent on the situation as "self-direction is best viewed as a continuum or characteristic that exists to some degree in every person and learning situation" (Hiemstra, 1994, p. 1) .

Other important contributors to SDL knowledge and ideas are Houle (1961), Tough (1979); Houle's doctoral students, Knowles (1975) and Guglielmino (1977). In her 1997 dissertation, she developed the Self-Directed Learning Readiness Scale (SDLRS). Spear and Mocker's (1984) work on organizing circumstances showed how important it is to understand a learner's environmental circumstances in promoting self-directed learning. Also, at the annual International Symposium on Self-Directed Learning in 1987, "Long and his colleagues successfully presented many publications on SDL" (as cited in Hiemstra, 1994, p. 3). On the other hand, although there were many similar publications at that time, more recently the research focus has shifted to SRL with most scholars considering Zimmerman as its main proponent (Azevedo, 2005a, 2005b; Baggetun & Wasson, 2006; Zimmerman, 1986, 2008; 1988).

Importantly for the current study, there are also scholars examining how SRL and e-learning can be related (Azevedo, 2005b; Banyard, Underwood, & Twiner, 2006). The low cost of e-learning with the associated large amount of free resources, flexibility, and variety available through the World Wide Web (WWW), make it very attractive for instructors and students to communicate, deliver, and learn (Ng, 2008). This is especially convenient for students who can learn anywhere and anytime. In general, e-learning serves as a modern tool to help acquire knowledge through the WWW. According to Heimstra (1994) initiative plays an important role in e-learning and in a similar approach to the three phases of SRL as outlined by Zimmerman and Tsikalas (2005), students are expected to be responsible for, "planning, implementing, and even evaluating the effort" (Hiemstra, 1994, p. 1). These ideas will be covered in the proposed framework of self-regulated learning where metacognition, self-determination and e-learning environments will be carefully examined.

Self-Directed Learners are those who are able to "control and take responsibility for their own learning" (Ng, 2008 p.24). According to Candy (as cited in Ng, 2008 p.27), self-directed learning can be considered as the awareness of alternative choices and being able to pursue a learning goal without being affected by external factors. Awareness use, being one of the three important factors in metacognition, will be examined more closely in order to embed metacognitive knowledge and regulation (Schraw & Dennison, 1994) within the proposed framework. Candy also stressed that self-directed learning is a vital part of the digital revolution because of its flexibility since it gives students the freedom to select material from a diversity of resources.

The SDL approach suggests the use of techniques, tools, resources, and media which can clearly be categorized as the behaviourally active component of SRL. Students are encouraged to actively "select, structure, and create environments that optimize learning" (Zimmerman, 1986, p. 308) within an e-learning environment. Furthermore, the results of using the SDL approach often confirm the usefulness of the SRL method. In an important and relevant study by Harding, Vanasupa et al. (2007), perceptions of Self-Directed Learning were measured by the Competencies of Self-Directed Learning Scale (CSDL) and the Self-Directed Learning Perceptions

Scale (SDLPS) to assess students' readiness to direct their own learning and to make use of available learning resources. Motivation was measured by the Situational Intrinsic Motivation Scale (SIMS) where a quasi-control group and traditional students were compared. Results showed that there was evidence of the use of self-regulated learning strategies across all groups. The 1997 Self-Directed Learning Readiness Scale (SDLRS) was designed to assess the extent to which individuals perceive themselves to possess skills and attitudes frequently associated with self-directedness in learning.

SDL has come a long way since the time of the ancient Greek philosophers. Over the years, the concepts have remained but the applications and contexts have shifted significantly. SDL theory and practice remain most important in the development of the framework in this study. Thus, the concepts of self-regulated learning will be used to include self-regulated learning and self-directed learning in order to develop the theoretical framework for this study.

2.2.2 Motivation

According to Zimmerman (1986), motivation is when students "perceive themselves as competent, self-efficacious, and autonomous" (p. 308). The term "perceive" means to become aware of something through the senses. Sense includes both external motivation and internal motivation and this can be seen as "the ability to respond to an range of change in the environment, mechanical, chemical, thermal or electromagnetic" (H.S. Barrows & R.M. Tamblyn, 1980, p. 2). Also, the word "competent" in this context means capable of doing something and self-efficacy is basically a student's belief in their ability to succeed. In short, motivation means that students become aware, through the senses, that they are capable of doing something and believe in their ability to succeed. In order to look at motivation holistically, there is also a need to include variables that include "amotivation". Ryan and Deci (2000b) defined this as "the state of lacking the intention to act" (p. 72). This variable is particularly important to this study because we examine the variables that de-motivate students. This study will adopt Self-Determination Theory (SDT) in order to examine all the variables concerned with motivation: external motivation; internal motivation and amotivation.

Self-Determination Theory (SDT) which includes external motivation, internal motivation and de-motivation, will be discussed in detail later in this chapter.

2.3 Metacognition

This section discusses in detail metacognition and the three main sub-constructs of reflection, strategy and awareness.

Metacognition can be conceptualised as thinking about thinking, or knowing "what we know" and "what we don't know" (Blakey & Spence, 1990, p. 1). The concept of "metacognition" was first used by Flavell (1976, p. 232) to "refer to one's knowledge concerning one's own cognitive processes and products or anything related to them". The learning-relevant property of information or data was one example of it. He further defined metacognition as, "among other things, to be the active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive objects or data on which they bear, usually in the service of some concrete goal or objective" (p.232). Kuhn (as cited in Wolfgang, 2008) categorised metacognition into two main categories. They are "knowledge about the mental world" (p. 116) and "knowledge about memory"(p. 116). Similarly, Thomas and Mee (2005, p. 222) define metacognition as, "one's acquired world knowledge that has to do with cognitive matters". They classified them into: declarative, procedural and conditional knowledge. These three variables are part of the sub-construct of awareness use (Schraw & Dennison, 1994) which has been used in the process of developing the framework in this study.

It has been thought for a long time by many researchers that the use of metacognition can be associated with higher intelligence. This can be seen in the works of Allon, Gutkin and Bruning (as cited in 1994) where they assert that there is a strong connection between metacognition and intelligence. According to Sternbert (as cited in Allon, et al., 1994, p. 93), the two major components of intelligence are: cognitive or nonexecutive processes, and metacognitive or executive processes. Cognitive processes that derive from intelligence determine the effectiveness of how an individual learns and uses new information. Also, serving as an equal partner in intelligence functioning, metacognition processes can direct

and receive feedback from the cognitive processes. Metacognition is one of the most important elements of self-regulated learning as learners constantly ask themselves what and how to achieve their goals (2005). Lin, Schwartz and Hatano (2005) suggest the deciding factor of whether to provide immediate or delay feedback should focus on "model of desired performance" (p. 257).

Instructional technologists and facilitators are continually encouraged to assist students to work together and participate as a team involving all the stakeholders involved. This concept is based on constructivism and rationalism as discussed previously. Fink (2003) points out that learners should be encouraged to be more active participants, that is, behaviourally active. It is also noted by Zimmerman (as cited in Stacey, 2001) that to fully experience a well-designed e-learning experience, it is important to provide motivation which would then lead to more engagement with the content. In addition to engaging with the content, students should engage in metacognition to go beyond shared experiences and rote learning to "ma[k]e sense of new knowledge and create meaning" (Stacey, 2001, p. 5) for themselves. Stacey (2001) further defines the metacognitive process as "… awareness that learners are thinking about the learning strategies they are using during learning activities". According to Fogarty (as cited in Swartz & Perkins, 1990, p.52) metacognitive learning can be categorised into four levels: tacit use, aware use, strategic use and reflective use. In addition, Swartz and Perkins (as cited in Schunk, 2000) further explain these four levels:

1. Tacit Use. The individual performs a kind of thinking such as decision-making without thinking about it
2. Aware Use. The individual is engaging in a conscious type of thinking, being aware that s/he is doing so
3. Strategic Use. The individual organizes his or her thinking, consciously using particular strategies that enhance its efficacy
4. Reflective Use. The individual reflects upon his or her thinking before and after, or even in the middle of, the process, pondering how to proceed and how to improve (p. 52).

The concept of tacit use or knowledge was not used in this study because tacit knowledge is very difficult to identify. Indeed, Janik (1988) note that the tacit element cannot be studied scientifically. Further, Polanyi (1967) who is considered to be the father of tacit knowledge, only defines tacit knowledge as "we can know more than we can tell" (p. 1).

2.3.1 Metacognitive reflection

Reflection is one of the three sub-constructs comprising metacognition. It consists of both reflection in learning and reflection on learning.

"Reflection is a metacognitive process that creates greater understanding of self and situations to inform future action" (Boud, Keogh, & Walker, 1985a, p. 19). This is an important concept in understanding e-learning as such learners have to truly understand what they are learning and also have to constantly reflect on their learning at a distance. Such behaviour will cultivate a reflective approach in learning as well as allow students to come to grips with technology supported by peer discussion groups and instructors from a distance. "Reflection is an important human activity in which people recapture their experience, think about it, mull it over and evaluate it" (Boud, et al., 1985a, p. 18). Further, the authors identify two components: "the experience and the reflective activity based upon the experience"(p. 18). Experience is what Luppicini (2003) said is a form of reflection on action. Also, reflection is necessary to uncover the tacit knowledge that impacts upon an individual's life actions and it also leads to the source of ideas where connections are formed between thought and unnoticed action (as cited in Kaberman & Dori, 2009, p. 406). According to Adey and Shayer (2009), "Students learned to reflect on the thinking they were engaged in, to bringing it to the front of their consciousness, and to make an explicit tool that may then be transferred into a new context" (p. 685). The trigger for such reflection is "usually an event or situation and the outcome of the process is increased understanding or awareness" (as cited in Luppicini, 2003). There is also an increasing number of studies of metacognitive reflection in the medical field (Sandars, 2009, p. 685).

Tesser's (1988) model incorporates both "reflection" and "comparison" processes involved in the maintenance of positive self-evaluation. Comparison processes allow one to benefit psychologically by drawing favourable comparisons between the self and relevant others, especially between the self and one's friends. Reflection processes, on the other hand, allow one to share in the positive attributes of close others such as friends (Weiner, 1985 p.548). In the process of reflection among friends, strangers and the surroundings, in most cases, the success of friends is more threatening than that of strangers. Also, people with relatively popular friends are likely to conveniently overestimate their own popularity compared with those with less popular friends. "People with relatively popular friends tended to make more self-serving estimates of their own popularity than did people with less popular friends" and "….these results clarify how objective patterns of interpersonal contact work together with cognitive and motivational tendencies to shape perceptions of one's location in the social world" (Zuckerman & Jost, 2001 p.208).

One of Donald Schön's (1967, 1985, 1991) great contributions to learning theory was to make the concept of 'reflection' central to an understanding of what professionals do. The notions of reflection-in-action, and reflection-on-action were central to Donald Schön's efforts. The former is sometimes described as 'thinking on our feet'. It involves looking to our experiences, connecting with our feelings, and attending to our theories in use. It entails building new understandings to inform our actions in a situation that is unfolding. Reflection, being the highest level of metacognition, looks at the recapturing of students' experience so that they can further think about it and mull it over and evaluate it.

2.3.1.1 Reflection in learning

According to many authors, reflection in learning has often been associated with Problem-based Learning (PBL). PBL recognises how students continue to change when they reflect during learning. This is supported by Schön who agrees that reflection during learning helps with thinking and inferring about learning. Similarly, from the PBL point of view, students' past experience will influence how they complete future activities.

Boud, et al. (1985b) notes that experience alone is not a sufficient condition for effective learning. Because of this, they ask: what are the special thing(s) that enable students to gain maximum benefit from the situations they are in? In addition, how can students apply their experience in new situations? With these questions in mind, Boud, et al. (1985b) suggest that although reflection can be very difficult, perhaps if we can sharpen our consciousness of what reflection in learning can involve and how it can be influenced, then we may be able to improve our own practice of learning and help those with whom we learn.

In practice, reflection-in-learning is referred to as part of the problem-based learning (PBL) approach (Martin, et al., 2005). This is especially important for medical/health, engineering and IT students as those students require problem solving skills instead of just knowing conceptually how to solve a problem. They need to be trained to solve problems 'on the spot' as they arise and a problem-based learning approach allows for this kind of practice. But how it can be influenced remains unclear even though Jonassen's (1999) work identifies that the first step in a constructivist learning environment is to simulate real-world problems and later model, coach and scaffold students through the process. In line with this, Martin, et al. (2005) suggest a more holistic approach to clients with an emphasis on quality of care with the use of realistic case studies which, when explored through PBL strategies, facilitate deep learning. Martin, et al. (2005) further argue that PBL would allow "presence" and an immersive environment that, in turn, "stimulates a reflective process where knowledge is synthesized through a re-evaluation of the experience by undertaking association, integration, validation and appropriation" (p. 30).

According to Schön (1983), reflection in learning is about the process occurring during learning engagement which leads to further adjustment in action. It is important in the current study to include the "how and what" elements that will influence reflection in the learning under examination. In the process of sharpening their consciousness, students need to have constant reflection as the way they learn is continuously changing. Also, it is important to know that there is recognition of students' prior learning that will continue to change as they simulate real-world problems. It is also important to know that their past experience will tend to take control of how they engage in future activities.

2.3.1.2 Reflection on learning

Reflection on learning is one of the two sub-constructs of reflection. It is a way of reflection where one stands outside him/herself and analyses one's own performance (Kolb, Boyatzis, & Mainemelis, 2000).

A reflective journal is a common tool used by educators around the world to enable students to review their own learning. According to Lew and Schmidt (2007), there have been many positive reports on the beneficial effects of journal writing. These include a general improvement in writing skills and encouragement of the recording of reflection. These assume that students will become better aware of their own learning achievements.

One of the obstacles in teaching within an online environment is to develop trust among students and facilitators. To address this issue, active involvement and enagagement are important for both students and teachers/faciltators. Reflective writing has been one of the ways to actively involve students in learning in the belief that reflective writing would enhance freedom to express ideas and feelings without fear of punishment and judgement. Reflective journaling uncovers what "students think about what they have learned and facilitates the intergation of new materials" (Langley & Brown, 2010, p. 13). This in turn allows students to know their own progress and performance - in other words, to assess their progress and be confident in what they are doing. Also, collaboration plays an important role in enhancing progress. This is because collaboration will enable not just self-reflection, but also assist their peers and faciliators to help students to reflect online. communciations and online discussions. The writing of reflective learning journals is seen as a vehicle for students to interact with each other and discuss course content (Langley & Brown, 2010).

2.3.2 The use of Metacognitive Strategies

Metacognitive strategies include such activities as self-evaluation, debriefing the thinking process, planning and self-regulation, keeping a thinking journal, talking about, thinking and identifying what is known and what is not known.

According to Flavell (1976), storage and retrieval as opposed to memory are emphasized because "purely internal, in-the-head storage and retrieval processes are only part of what we should be concerned with here" (p. 233). The "how, where, and when" (p. 233) for external storage and retrieval should be a major part of the consideration in the process of designing instruction for e-learning as Flavell (1976) states that "people take notes on things and make notes of things; they exploit the capacious and leak proof memories of books, tape recorders, videotapes, films, and computers; they get other people to help them store and retrieve information, both internal (e.g., in other peoples' heads) and externally" (p.235). It is critical to draw attention to the importance of memory and how it relates to learning (Budson, et al., 2005; Butler, Karpicke, & Roediger Iii, 2008; Cook, Marsh, & Hicks, 2006; Flavell, 1979; Koriat & Ma'ayan, 2005; Martin & Jones, 2006; Meeks, Hicks, & Marsh, 2007; Metcalfe & Kornell, 2005; Stine-Morrow, Shake, Miles, & Noh, 2006; Strack, Förster, & Werth, 2005; Sutton & Shettleworth, 2008). In addition, Carr, Alexander, et al. (1994) assert that most students are quite accurate when they use internal strategies.

On the other hand, external strategies appear to be the most unreliable in comparison to the retrieval and internal strategies and they are least likely to be used by students (Carr, et al., 1994). Carr, et al. (1994) also conclude that metacognition is beneficial for students, but more particularly "when both the metacognitive demands and task demands are developmentally appropriate and within [students'] capabilities" (p. 593). Carr, et al. (1994) find that, "[t]he relationships between metacognition and external strategy use and metacognition and retrieval are not so strong" (p. 593). Despite all the awareness of and beliefs about the benefits of metacognition, according to Moely (as cited in Carr, et al., 1994), teachers rarely seem to provide metacognitive information to the classroom when teaching mathematics. On the other hand, according to Li and Munby (1996), "metacognition is considered by most educators to be an element of many cognitive learning tasks" (p. 199)

It is important that online learners know the metacognitive strategies that they are using in order to know how to learn. Blakey and Spence (1990) acknowledge that "learning how to learn, developing a repertoire of thinking processes which can

be applied to solve problems, is a major goal of education" (p. 2). Related to this, Palincsar and Brown (1984) developed the concept of teaching knowledge about strategies. Also, Wolfgang (2008) believes that learners should discover their own set of strategies and teachers should play a role in conveying strategy-utility information as well as information about how, when and where to use particular strategies. Metacognition plays an important role in the process of retrieval strategies where the basic metacognitive strategies according to Dirkes (as cited in Blakey & Spence, 1990) are as follows:

1. Connecting new information to former knowledge
2. Selecting thinking strategies deliberately
3. Planning, monitoring, and evaluating the thinking process (p. 1).

Apart from the metacognitive strategies used by students as they learn, we also need to look at how students behave when they are faced with an entirely new situation and, importantly, where they cannot recall any prior relevant formal knowledge. According to (Blakey & Spence, 1990), when life presents situations that cannot be solved by learned responses, metacognitive behaviour is brought into play. Metacognitive skills are needed when habitual responses are not successful (Blakey & Spence, 1990, p. 2). To support metacognitive behaviour, Blakey & Spence (1990) argue for six levels of Strategic Use which are involved in developing strategies for metacognitive behaviours:

1. Self-evaluation
2. Debriefing the thinking process
3. Planning and self-regulation
4. Keeping a thinking journal
5. Talking about thinking
6. Identifying what is known and what is not known.

Memory ties closely to metacognitive Strategic Use and both instructors and students play an important role in developing effective e-learning environments to produce effective e-learners. These six levels of Strategic Use will be discussed in the following section.

2.3.2.1 Self-evaluation

Self-evaluation with respect to metacognitive strategies is that self-evaluation which focuses on those thinking processes which enable students to be more independent thinkers with the skill to transfer learning strategies to new situations. Self-evaluation as part of metacognitive strategies includes knowing what one already knows and what one intends to know. Blakey and Spence (1990) suggest the making of a list which is a conscious effort to decide and make decisions about things " to verify, clarify and expand, or replace with more information" (p. 5). These processes involve identifying "what you know" and "what you don't know". On the other hand, Xu (2009), Kaderavek, Gillam, Ukrainetz, Justice, and Eisenbert (2004) question the reliability of students' assessments of their own metacognitive knowledge skills; also, their self-assessment of cognitive abilities may be inaccurate due to the tendency to underestimate themselves to their peers. One important part of online self-evaluation is online self-assessment and although it is a widely used concept, it does involve very different notions and consequences (Ibabe & Jauregizar, 2010). According to these authors, self-assessment has three components: reflective questions, self-rating and self-testing. Although used interchangeably, reflective questions concentrate more on a prompt for students to reflect on their learning and to be critical about their learning; whereas in self-rating, with no right and wrong answers, students appraise their current knowledge of achievement; and alternatively, in self-testing, with clear right and wrong answers, students can easily check their answers against the provided test items. If students do not have enough knowledge to begin with, the process of reflective questions will not be as useful. Similarly, if students try to summarize what they have learned in the course in order to examine their understanding of what they have learned, it might require extensive subject knowledge input from their facilitators. Another more controllable and effective way to undertake the reflective questions, self-rating and self-testing activities is to communicate with their classmates to find out whether what they are learning is different from what others are learning. Also, proofreading of assignments a couple of times before submitting them to the instructor is another way to self-evaluate.

Importantly in an e-learning environment, students can have access to self-assessment exercises where and when they like. One of the advantages of

online self-assessment is that in general, questions are corrected automatically and instantaneously which allows immediate, precise and impartial feedback to the students' responses (Ibabe & Jauregizar, 2010). Also, according to Ibabe and Jauregizar (2010), students with weak subject knowledge might need more time to complete their tasks. This means that supplying hints to help students think more deeply about the problems and prompting to recall previous knowledge, will be important for such students. Nonetheless, the feedback responses are still likely to be faster compared to those in a non-online environment.

E-learning students need to apply what they have learned to new situations and this also depends on several self-evaluation processes. One of the real challenges arises when students give up on trying (amotivation). Blakey and Spence (1990) suggested that "guided self-evaluation experiences" enable students to be more independent in creating checklists. Transfer of learning strategies to new situations occurs when students recognize and apply the similarity between different learning activities to new situations (Blakey & Spence, 1990). Self-evaluation also depends on individual personal processes like "self-efficacy, goal setting, and knowledge of standards and self-observed responses" (Zanov & Davison, 2010, p. 7). On the other hand, unfavourable self-evaluation of learning progress may lead to total withdrawal or create a feeling of helplessness. According to Zimmerman (2010), this may happen "when learners no longer try because they expect their responses to be futile" (p. 8). For the purposes of this study, this is defined as amotivation and will be discussed later in this chapter.

Zimmerman and Tsikalas (2005) found that in computer-based learning environments (CBLEs) text prompts and collaborative workspaces assist students to evaluate the quality of their work and judge their own learning. In order to help students to judge the quality of questions posted online, students were encouraged to "post their questions to a workspace, critique their peers' questions according to a specific set of criteria, and view critiques" (p. 269). Last but not least, students were shown to have evaluated what they have learned, and assessed the test results based on their prior learning (Israel, Bauserman, & Block, 2005).

The research indicates that self-evaluation is a very positive feature of e-learning because students can evaluate themselves and make corrections

accordingly and more immediately. This is not without some drawbacks, as students will benefit only if they have enough similar or related knowledge that they can transfer from previous experiences. To overcome these problems, facilitators should encourage students' perception of self-evaluation so that they are mindful of exactly what they are doing and the process required.

2.3.2.2 Debrief thinking process

The "debrief thinking process" is a process used to monitor and apply related ideas to other learning situations which in return, develops skills which will not become obsolete and additionally further enable e-learning students to be aware of their own thinking.

The debrief thinking process involves the development of an awareness of those strategies which e-learning students can apply to other learning situations. Blakey and Spence (1990) recommended the use of a three-step method whereby the teacher guides the students to review the activity, whilst gathering data on thinking processes and feelings. Then, the group classifies any related ideas, and identifies the thinking strategies used. Finally, they evaluate their success, discard any inappropriate strategies, and identify those valuable for future use. This three-step method serves as the basis for further theoretical development of the debriefing thinking process in the current study.

There is also a need to look more closely at how to develop metacognition through the debriefing thinking process. Thus, it is important for facilitators to help students to develop skills which will not become obsolete but which in the future will enable students to cope with ever-changing situations, and foster the "development of good thinkers who are successful problem-solvers and lifelong learners" (Blakey & Spence, 1990, p. 4). Instructors should "monitor and apply their knowledge, deliberately modelling metacognitive behaviour to assist students in becoming aware of their own thinking" (Blakey & Spence, 1990, p. 4).

There has been much research and study about metacognitive strategy and in sum, a successful metacognitive intervention involves value free and reasonably well defined tasks in a stable environment with common learning goals and values both

from learners and instructors who are responsive to the need for the development of methods of metacognition for students (Zuckerman & Jost, 2001, p. 207).

In summary, it is an important aspect of this study to know exactly how e-learning students think about discussion activities. It is also important to know how they express their ideas and to recognize how students plan to achieve their future learning goals. Last, there is a real need to know how e-learning students make use of the debrief thinking process to develop those skills and strategies which can be applied to other multiple learning situations.

2.3.2.3 Planning and self-regulation

It is assumed that self-regulation can be achieved through an increase of responsibility by proper planning. In the process of increasing responsibility, e-learning students need to learn to estimate time requirements, organize materials and schedule procedures and practise these skills repeatedly. These skills will enable e-learning students to complete an activity and develop criteria for evaluation collaboratively with other students. Students must assume increasing responsibility for planning and regulating their own learning.

Students should practise planning for self-regulation within e-learning environments over a period of time to enable them to be more responsive; the key to this success seems to be repetition. The approach of the Victorian Curriculum and Assessment Authority (2009) to Problem-based Learning is to increase students' responsibility for planning and regulating their own learning. In addition, "teachers act as facilitators and coaches, enabling students to take responsibility for learning and developing higher order thinking skills" (Victorian Curriculum and Assessment Authority, 2009, p. 1). Furthermore, such a PBL approach enables students to estimate, organize and schedule their work within "real-world" simulated situations where problems are similar to those they will face in real-life.

There is also a need to encourage online students to plan and self-regulate as much as possible because these contribute to successful PBL or real-life learning. According to the McMaster model (Howard S. Barrows & Robyn M. Tamblyn, 1980), the concept of the PBL method involves three phases which are: "(i)

revealing the problem scenarios, (ii) finding information, and (iii) discussion and new knowledge application to the problems" (Zabit, 2010, p. 20). In the process of an instructor gradually increasing students' responsibility in planning and self-regulating their own learning, the instructor might be able to implement the three phases of the PBL method (Zabit, 2010, p. 20). This will enable students to become more capable planners and become self-regulated learners.

2.3.2.4 Thinking journals

One of the sub-constructs for Strategic Use is what is termed "thinking journals" another construct which allows students to reflect on their thinking. This method has been widely used in many fields of education to help lecturers understand their students better.

It is sometimes very difficult to know what students really think in a normal face-to-face teaching context and this becomes more complicated in e-learning environments as the facilitators do not know what the students are thinking. Because of this, the keeping of thinking journals can be even more important in order for facilitators to know how e-learners reflect upon their own thinking. Keeping a thinking journal is a metacognitive strategy to help students to "reflect upon their thinking, make note of their awareness of ambiguities and inconsistencies, and comment on how they have dealt with difficulties" (Blakey & Spence, 1990, p. 3). Writing and keeping journals is not an easy task as it requires conscious reflection and commentary (Smith, 1999, 2006). It is difficult for students to consciously reflect on what they are doing as sometimes they do not know if they are reflecting on the right thing. Because of this, the learning centre of the University of New South Wales recommends the use of a number of tools – a log book, learning diary, reflective notes, essay diary, peer review and self-assessment (The Learning Centre, 2010). Similarly, a journal can take any form as people maintain journals in different ways. It can be a diary recording, a research record, a dream book, a portfolio of professional accomplishments, a collection of electrical particles on computer disk or any audio tape or any combination of these (Monash University, 2009; Smith, 1999, 2006).

It is important for students to know of the ways to learn about themselves especially in e-learning environments. Smith (1999, 2006) described keeping a thinking journal as a way to learn about yourself and your world in your own private space of your life (Smith, 1999, 2006). Deepening understanding and reflection were the two things that a person who keeps a thinking journal should obtain. Similar to what Monash University proposed (2009), there are a few important things to keep in mind while writing journals and they are: to describe the thought; compile additional material; enact reflection and things to do (Smith, 1999, 2006). According to Lozauskas and Barell (1992), as students read, they usually generate many questions about the content. Facilitators often gain insight into their students' general thoughts through the thinking journals. In addition, the facilitator can examine students' understanding or misconceptions about important concepts. Thinking journals allow students to write down questions which they may be too embarrassed to ask in class and "many times students' questions and thoughts can be incorporated into traditional lectures. The students may then realize how important their ideas really are" (Lozauskas & Barell, 1992, p. 44).

In particular, the practice of keeping a thinking journal was used in Lozauskas and Barell's (1992) study as a means of encouraging students to reflect on what problems they were facing and how to resolve them. This type of journal also serves as a useful guideline to post questions during online discussion sessions. According to Collentine (2002), journals provide an excellent opportunity for students to make sense of and to learn from their mistakes. Facilitators can make use of journal writing which offers an alternative means to evaluate students' understanding, decision-making and validate their judgment in situations where direct observation of student performance is unrealistic such as in an e-learning environment. Moreover, in this case it is important to write the journal in a particular manner. For example, the writing is carefully structured rather than being in a free-response format.

Although journal writing is very useful, it is also important for facilitators and instructional technologists to understand how e-learning students reflect and are aware of their own ambiguities and inconsistencies. In real life, facilitators would have to suggest solutions to resolve students' difficulties after reading students'

journals. This process can be very time consuming but it is important in this study to examine whether students consciously reflect on what they are doing, as sometimes they do not know if they are reflecting on the right thing. Because of this, the current study concentrates on discovering whether students are writing down how they learn. Different learning strategies are also important for students to understand their strategies and how these need to change in e-learning environments. Metacognition strategies that encourage e-learning students to look back at their notes and past assignments will overcome the situation where they do not know if they are reflecting on the right thing.

2.3.2.5 Talking about thinking

Talking about thinking is to enable students to convert their implicit knowledge into explicit knowledge. This is important because only explicit knowledge can be examined rationally.

> When the mind is thinking it is talking to itself. Plato (428-348)

"Talking about thinking" in a metacognitive strategy sense that involves thinking aloud. This allows students to see how a skilled person (in this case a professional) solves real-world problems with their professional skills. Professional personnel (teachers/facilitators) can show their students how to convert implicit knowledge into explicit knowledge. Teachers' explicitly providing opportunities for students to construct metacognitive knowledge has always been one of the important elements in developing student's metacognition (Thomas & Mee, 2005).

The challenge here is how to convert implicit knowledge into explicit knowledge so that students can learn more about how to learn in an e-learning environment. This is because students cannot relate to facilitators and this makes the design of the instruction more complicated. However, students can always view videos or clips repeatedly and duplicate the exact procedures to overcome the problem of distance in order to convert implicit knowledge into explicit knowledge. Also, it has been shown that facilitators need to implement a "think aloud" process and this can be done by telling the students to "express verbally all thoughts that come to mind while performing the task online" (Ward & Traweek, 1993). This is

important for this study because only explicit knowledge can be examined rationally.

In order to capture the "think aloud" or "talk about" thinking behaviours, there is a need to use effective self-assessment strategies to capture ongoing thinking in a controlled environment (Zanov & Davison, 2010). The Articulated Thoughts in Simulated Situations (ATSS) instrument was developed by Davison, Robins and Johnson (1983) in 1982 to be used as a think-aloud assessment approach. The ATTS has been used by many researchers to uncover the thinking patterns of students. Banning (2008) believes that the think aloud approach is not just a proactive tool for teaching and learning, but is also useful as a research tool. For student learning in an online collaborative learning environment, the thinking aloud approach can be used as a group approach because it "focuses on interaction and active participation as a means to encourage the student to think critically" (Banning, 2008, p. 10). One of the common ways to talk about thinking is through thinking aloud and this technique prompts students to "verbalize their thought as they problem solve a case study or interpret a statement" (p. 10). As a qualitative data collection method, the main concept of the think aloud approach is "to gain access to student thought processes when investigating an important subject" (p. 10). This process will also provide insights into:

1. The types of question(s) that are asked
2. The train of thought, the ability to make connections and form bridges between core concepts and peripheral subjects
3. The use of prior knowledge and experiential learning to problem solve
4. The assessment of the challenges and difficulties encountered during reasoning (Banning, 2008).

These insights will be used as variables in this study to help design the questionnaire intended to evaluate the importance of students converting implicit knowledge into explicit knowledge.

2.3.2.6 Identifying what is known and what is not known

Identifying what is known and what is not known is, however the first notion for strategic use by e-learners because they will first have to know what they know and what they do not know in order to move up to the higher sub-construct of strategic use which has been discussed above. This process is especially important for e-learning students when they are doing project work as they need to identify at the beginning of the project all the necessary requirements of the project and make conscious decisions about their own knowledge base.

Most studies in "knowing what you know and what you do not" are concerned with reading and working with text (McTavish, 2008; Montague & Dietz, 2009). E-learning students need to make conscious decisions about their knowledge in order for them to be successful in their learning. Conscious decision-making starts from identifying what you know and what you do not know. Also, teaching students to utilise metacognitive strategies who will then monitor their own learning, starts from identifying what they know and what they do not know. Furthermore, according to Heller (1986), even students with a good command of language often fail to express their views. The later stage in conscious decisions includes the goal to "expand, or replace with more accurate information" (Blakey & Spence, 1990, p. 2).

The process of knowing what you know and what you do not can be measured by using the Heller "What I Know Sheet" (Kramarski & Michalsky, 2009, p. 417). The "What I Know Sheet" is divided into three (3) sections: what I already knew, what I now know and what I do not know. E-learning students will complete what they do not know and the other sections should be fairly automatic due to the use of a computer system. According to Blakey and Spence (1990), another way to find out if e-learning students make conscious decisions about their knowledge is to know the degree to which they are in control of their knowledge and learning. Thus, the conscious decision to review their past decisions when they acquire more information in their learning will increase the success of learning. Finally, in order to expand or replace their knowledge base with more accurate information, e-learners need to keep an open mind and be always prepared to expand their knowledge.

It is difficult for students to make conscious decisions about their knowledge and in e-learning environments this may be especially difficult. Also, according to Pollack (2007), e-learning students will be more satisfied when the environment matches their expectations and preferences. This aspect will be discussed later in a review of self-determination theory.

2.3.3 The use of Metacognitive Awareness

Metacognitive awareness is a skill whereby learners have knowledge about where and why to use particular learning procedures. Learners can be classified according to three levels, depending on their degree of metacognitive awareness:

1. Active, self-directed learners who know how they learn and are able to apply what they know to various learning situations
2. Average learners who work hard and have awareness of their learning strengths and weaknesses
3. Passive learners who have little awareness of how they learn and how to regulate their learning (Young & Fry, 2008).

There are many definitions of awareness use and in general it concerns e-learning students being aware of their own knowledge about cognition and regulation of cognition. This is then followed by Strategic Use in order to develop strategies for metacognitive behaviour and finally to achieve a measure of reflection that will "create greater understanding of self and situations to inform future action" (Boud, et al., 1985a, p. 19). In the development of metacognitive awareness processes, Yussen and Bird (1979) conclude that children's understanding of the influence of length, noise, age, and time on performance is "remarkably similar across the three cognitive domains of memory, communication, and attention" (p. 311). In conjunction with this, metacognition awareness is sometimes referred to as knowledge of cognition and regulation of cognition (Memnun & Akkaya, 2009; Schraw & Dennison, 1994; Schraw & Moshman, 1995; Sheorey & Mokhtari, 2001; Young & Fry, 2008). Memnun and Akkay (2009) acknowledge that metacognition awareness allows students to carry out studies in a planned and regular manner because they have the knowledge of their own cognitive processes which they are able to process concurrently with their other learning activities. Awareness was

also defined by Yong and Fry (2008) as knowledge about cognitive processes and regulation of cognition. Schraw and Dennison (1994) believe that metacognitive awareness allows "individuals to plan, sequence, and monitor their learning in a way that directly improves performance" (p. 460).

Other research has found that "[m]etacognitive knowledge plays a compensatory role in cognitive performance by improving strategy use" (Schraw & Dennison, 1994, p. 461). On the other hand, metacognitive awareness appears to be independent of intellectual ability and achievement. In addition, regulatory skills may be independent or even negatively related to domain knowledge. Further, it appears to be independent of the ease of comprehension (Schraw & Dennison, 1994). In line with Schraw and Dennison (1994), Guterman (2003) assumed and confirmed in his study that the increase of metacognitive awareness in learners was achieved by "well-planned guidance, built on prior knowledge, facilitates their learning and improves outcomes on a reading assessment task" (p. 633). In addition, metacognitive awareness is regarded as an important factor in increasing "learners' success in their learning throughout their life span, their creative and critical thinking, and building self-confidence" (p. 78). Also, Kuiper (2002) noted that metacognitive knowledge can help in the transition from novice to professionals (self-regulated learners) which supports to some extent what the researcher is exploring in the current research.

Knowledge about cognitive processes and regulation of cognition, "have been theorized to be related to one another" (Young & Fry, 2008, p. 1). "[W]hat we know about our own cognitive processes" (p. 1) can be described as metacognitive knowledge. In addition to Schraw and Dennison's (1994) view on declarative, procedural and conditional knowledge, these constructs were further elaborated on by Yong and Fry (2008). Declarative knowledge is defined as "what we know about how we learn and what influences how we learn" (p. 1); procedural knowledge includes "our knowledge about different learning and memory strategies/procedures that work best for us" (p. 1); and conditional knowledge refers to, "the knowledge we have about the conditions under which we can implement various cognitive strategies" (p. 1). These definitions of declarative, procedural and conditional knowledge were classified by Schraw and Dennison (1994) as

knowledge about the cognitive and, together with the construct of regulation, will form the sub-constructs for awareness use for this study.

Another part of the sub-construct framework is metacognitive regulation which further facilitates the control of learning and memory. In relation to this, Schraw and Dennison (1994) stated that metacognition regulation "facilitate[s] the control aspect of learning" (p. 460). Although Yong and Fry (2008) neatly re-grouped metacognitive regulation into planning, monitoring, and evaluating, in recent years, metacognition regulation has been more carefully defined in order to facilitate the control aspect of the e-learning environment. Because of this, in this study the researcher will follow the work of Schraw and Dennison (1994). Schraw and Dennison (1994) grouped metacognitive regulation into a more elaborate framework which included the concepts of planning, monitoring, information management strategies, comprehension monitoring, debugging strategies, and evaluation. In this study, these constructs enable a more detailed analysis of how students regulate or facilitate the control aspect of learning.

Later, Schraw and Moshman (1995) further defined planning as the process of planning out a cognitive task by selecting appropriate strategies and cognitive resources. They also defined monitoring as the awareness of progress through a cognitive task and the ability to determine one's performance. Finally, they saw evaluating as involving looking at the outcome and determining if the learning outcome matched the learning goals and if the regulation processes used were effective (Schraw & Moshman, 1995).

There are many international research studies which refer to the Metacognitive Awareness Inventory(MAI) by Schraw and Dennison (1994) which was developed mainly as an inventory that would be "suitable for adolescents and adults" (p. 461). Young and Fry (2008) further defined metacognitive awareness as knowledge about what we know about our own cognitive process and regulation of cognition. Metacognitive awareness also allows individuals to plan, sequence, and monitor their own learning in a way which directly improves performance (Schraw & Dennison, 1994).

2.3.3.1 Declarative knowledge

Declarative knowledge enables the understanding of students' intellectual strength and weakness. It also enables the students to choose the kind of information which they think is important to them. In addition, declarative knowledge enables e-learning students to have a level of knowledge about their own skills, intellectual resources, and abilities as learners in an e-learning environment.

Declarative knowledge and procedural knowledge are often discussed together because they are closely related. This can be seen in Barnes, Camburn, Sanders, and Sebastian's (2010) work "as a practitioner applies new declarative knowledge in the work context, he or she develops procedural knowledge, which in turn can refine his or her understanding of declarative knowledge" (p. 244). In the process of acquiring new declarative knowledge during learning, students apply concepts and facts in the context and then reflect on the context within society. This is very important for the e-learning environment as students are often from different backgrounds. In the current study, it is assumed that students will develop new declarative knowledge by understanding and knowing information about their own strengths and weaknesses.

Similarly, novice learners in an e-learning environment would normally apply both declarative and procedural knowledge (Barnes, et al., 2010). This is because "as [students apply] new declarative knowledge in the work context, [they develop] procedural knowledge, which in turn can refine his or her understanding of declarative knowledge" (p. 244). In an e-learning environment where acquiring new declarative knowledge during learning is important, students apply concepts and facts in the particular context and then reflect on the context within their own respective environment or society. This encourages students "to change what they do and the way they think" (p. 245). Novice or less competent students would benefit from declarative knowledge being incorporated into e-learning as this will, "develop more effective cognitive structures for and connecting multiple practice-based situations" (p. 245).

Declarative knowledge is often used together with procedural knowledge as e-learning students apply new declarative knowledge in their learning and in the course of their work they will develop procedural knowledge, which in turn refines their understanding of declarative knowledge.

2.3.3.2 Procedural knowledge

Procedural knowledge is concerns knowledge about how to implement certain learning procedures or strategies. Procedural knowledge is knowing "how" to do things (Schraw & Moshman, 1995) or "knowing how" (Lew & Schmidt, 2007, p. 125). Schraw and Dennison (1994) defined procedural knowledge as "knowledge about how to implement learning procedures" (p. 474). Its distinctive feature is that it can be applied directly to a task. Instructional technologists or facilitators need to know precisely what to say when students ask for help on how to do things. Over time, facilitators should also assess their students' procedural knowledge by asking questions such as：Have you used strategies that have worked in the past to help you solve your current problem? By doing so, a facilitator is directly helping e-learning students to identify their own procedural knowledge. This can be seen in Yong and Fry's (2008) work as they defined procedural knowledge as "our knowledge about different learning and memory strategies/procedures that work best for us" (p. 1).

In addition to using facilitator assistance, it is also important for e-learners to know how they utilize cognitive strategies in order to be successful in their learning. According to Meeks, Hicks, and Marsh (2007), procedural knowledge relates to knowing how to perform particular cognitive strategies. This is especially important because, in this study, learners are from different backgrounds and operate at great distances. In the practical use of procedural knowledge, it can be referred to as "how to successfully accomplish something in a particular context" (2010, p. 244). Also, one advantage of having procedural knowledge is that it can involve hands-on experience, the actual practice of problem-solving. It is about knowing our own strategies and how to perform particular cognitive strategies to stimulate our memory strategies/procedures that work best for us. It was described by Murphy (2008) as knowing how to stimulate a learning activity or how to present an alternate perspective.

Instructional design normally involves coding and designing. From the computer science perspective, Basjes (2002) argues that it is important to store as much information regarding the scope as possible because of the conditions applied to a procedure. Similar to Barnes, et al. (2010), Meeks, Hicks, and Marsh (2007), Schraw & Moshman (1995), and Moores, Chang and Smith (2006); Basjes (2002) defined procedural knowledge as "knowledge about how, when and why to do something" (Basjes, 2002, p. 13). This is particularly important for online problem-solving performance (Schraw & Moshman, 1995). In short, apart from the technical knowledge of operating the computer, one needs to be able to visualize and therefore see one step ahead in order to be a successful online learner. This is particularly important for e-learning students because they can make use of their strategies that have worked in the past and 'select' what strategies they want to use when they study a new topic. Given the nature of the process of e-learning (e.g. more flexible response times), it is also highly desirable that students learn to ask for help, given that help is readily available.

2.3.3.3 Conditional knowledge

Conditional knowledge is knowledge about the "why" and "when" aspects of cognition.

It is important for online learners to be able to have the "why" and "when" knowledge as the facilitator often requires them to work on their own. E-learning students need to know why they are using certain strategies and when to use them to maximize their learning. Conditional knowledge is knowing the "why" and "when" aspects of cognition (Schraw & Moshman, 1995). Schraw and Dennison (1994) defined conditional knowledge as "knowledge about how to implement learning procedures" (p. 474). Also, e-learning students need to know which combinations of cognitive strategies will yield the best results. Young and Fry (2008) defined conditional knowledge as "the knowledge we have about the conditions under which we can implement various cognitive strategies" (p. 1). According to Meeks, Hicks, and Marsh (2007), conditional knowledge refers to 'why to use' and 'when to use' one's cognitive strategies. Also, "Conditional knowledge is the knowledge we have about the conditions under which we can implement various cognitive strategies" (Young & Fry, 2008). In an e-learning environment, different

students would prefer different learning techniques depending on situations which allow them to select the most appropriate type of strategies to better regulate their e-learning. This can be seen in Schraw and Moshman's (1995) work who further explain conditional knowledge as "the relative utility of cognitive procedures" (p. 353). In order to help e-learning students to identify conditional knowledge, Schraw and Dennison (1994) identify some of its indicators: I learn best when I know something about the topic; I use different learning strategies depending on the situation; I can motivate myself to learn when I need to; and I know when each strategy I use will be most effective (as cited in Murphy, 2008).

Chandy and Masra (1987) noted in their research that conditional knowledge by itself may not appear to be useful, but "as a simulation proceeds, conditional knowledge can, sometimes be converted to knowledge" (p. 9). In Schraw and Moshman's (1995) study, they found that conditional knowledge continues to develop at least through middle childhood. Although children in kindergarten showed conditional knowledge, they still acquired less knowledge when compared to older children. This pattern is similar when comparing older children to adults; both were able to "selectively allocate their attention based on conditional task demands" (p. 353). But as for adults, according to Justice and Weaver-McDougall, "found a positive relationship between knowledge about the relative effectiveness of strategies (i.e., conditional knowledge) and strategy use (i.e., regulation of cognition)." (as cited in Schraw & Moshman, 1995, p. 353).

The next section will discuss metacognition regulation which further facilitates the control of learning and memory.

2.3.3.4 Evaluation of learning

Evaluation of learning enables e-learning students to sit back and evaluate their performance and their effectiveness of their learning strategies.

E-learning students are expected to be able to understand and evaluate their own learning after completion of tasks. Schraw and Dennison (1994) defined evaluation of learning as the "analysis of performance and strategy effectiveness after a learning episode" (p. 474). According to Csikszentmihalyi (1975, p. 1), key

words for the evaluation process include: “appraises, compares, concludes, contrasts, criticizes, critiques, defends, describes, discriminates, evaluates, explains, interprets, justifies, relates, summarizes, supports” (Csikszentmihalyi, 1975, p. 1). Similar to this, Yong and Fry (2008) defined evaluation of learning as “taking a look at the outcome and determining if the learning outcome matches our learning goals and if the regulation processes we used were effective” (p. 1). According to Schraw and Dennison (1995), metacognitive knowledge and regulatory skills like planning are related to evaluation. These include knowing how well we did once we finish a test. This is important for e-learning students as they need to know what they have done wrong and what they need to do to rectify any errors. A summary of what e-learning students have learned is also important to reflect what they understand. E-learning students should always ask themselves if they have accomplished their goals after each session, and if they have considered all options after they have solved the problem(s) (Schraw & Moshman, 1995). These would improve the evaluation process of online learners.

In the process of assessing e-learning students’ evaluation of learning for metacognition awareness used in this study, it is important to know if they are able to summarise what they have learnt. Students can also tell if they did well in their examination by using these evaluation skills. Evaluation, being the highest level of the cognitive process, also involves e-learning students asking themselves how well they have accomplished their goals. Last but not least, students should also be able to ask themselves if they have considered all options after a problem has been solved.

2.3.3.5 Debugging strategies

Debugging strategy enables the e-learning student to go back and debug or correct his/her understanding and performance mistakes.

Most of the time, e-learning students will ask if they are doing the right thing. If the e-learning environment had a function which alerts those learners who have problems, it would be a way of cultivating debugging strategies in students. This could be done by looking at the way they respond to a task. Schraw and Dennison (1994) defined debugging strategies as “strategies used to correct comprehension and performance errors” (p. 474). Debugging strategies include e-learning students

being able to ask for help when they do not understand certain things. Furthermore, they need to know when to change their strategies when they do not understand and also re-evaluate their assumptions when they are confused. Apart from asking for help and changing strategies, e-learning students have to know when to stop and go back to further study the topic(s) which is causing the confusion. They also need to go back over information that is not clear to them (Schraw & Moshman, 1995). This is important as, most of the time, students do not want to go back over material they have already covered.

Debugging strategies are about going back to what students have done and trying to find the problem. According to Clements and Nastasi (1976) logos, graphics, explicit error messages and comprehensible editing are things instructional technologists can include to engage e-learning students in the debugging process. More importantly, e-learning students must first realise that they do not understand something they have just studied and want to go back and debug the problem. This feeling of not understanding something is a metacognitive experience which is "any conscious cognitive or affective experiences that accompany and pertain to any intellectual enterprise" (Flavell, 1979, p. 906). The two examples given by Flavel were, a "sudden feeling that you do not understand something another person just said" (p. 906) and "you may experience a momentary sense of puzzlement that you subsequently ignore, or you may wonder for some time whether you really understand what another person is up to" (Flavell, 1979, p. 908). Similar to this, metacognitive experience also refers to "designers' comprehension and consciousness about their cognitive activities and cognitive process [which] reflects the awareness and unawareness about cognitive activities, and shows in the form of affective experience" (Liang, Jiang, Zhao, & Wang, 2007, p. 149).

Metacognitive experience triggers e-learning students to go back to debug the problem after realising that they do not understand something they have just studied. This will further activate the debugging strategies to enable e-learning students to go back and debug and correct their understanding and performance mistakes. In this study, it is important to know if students in an e-learning environment use debugging strategies. This can be done by establishing if students ask others for help when they do not understand something, change strategies when they fail to understand, re-evaluate their belief when they get confused and stop and go back over new information that is not clear.

2.3.3.6 Monitoring

Monitoring enables e-learning students to examine their own work to ascertain whether they are on the right track in their learning. In the e-learning environment, this is extremely important because students will be required to monitor their own learning.

In order to monitor and apply teachers' knowledge and assist e-learning, students need to be aware of their own thinking. Schraw and Dennison (1994) defined monitoring as the "assessment of one's learning or strategy use" (p. 474). Similarly, Yong and Fry (2008) defined monitoring as, "the awareness of our progress through a cognitive task and our ability to determine our performance" (p. 2). As well as metacognition, monitoring is necessary for the e-learning environment. This will enable e-learning students to "enhance or accelerate learning" (Csikszentmihalyi & Rochberg-Halton, 1981, p. 99). Also, the monitoring process enables e-learning students to self-report on their own work. This device enables students' cognitive and affective states to be measured. (Csikszentmihalyi & Larson, 1984). Self-reporting can be used to test students to see if they retain important information during learning. In this study, e-learning students should continuously ask themselves if they understand the course content. E-learning students will also monitor their own results to make sure they are obtaining the grades they need. One of the ways for e-learning students to check their understanding is to stop regularly so as to self-report and remediate if necessary.

2.3.3.7 Information management strategies

Information is everywhere in the e-learning environment. Students need to know where to find it and use it in an appropriate way. In order to do this, they must use information technology.

Schraw and Dennison (1994) defined information management strategies as skills and strategy sequences used on-line to process information more efficiently. Examples are "organizing, elaborating, summarizing, and selective focusing" (p. 354). These include e-learning students knowing when to slow down when they encounter important information regarding their learning. It is important for online learners to pay due attention to the meaning and significance of the new information. E-learning students also need to know what helps them most in learning, such as visual cues like drawing pictures or diagrams. Also, putting new information into their own words is important as e-learning students constantly do not have much chance to clarify their thoughts as they would in a face-to-face environment. To overcome this problem, it is highly recommended that e-learning students be able to process new information, express it in their own words and store it for future use. Apart from having strategies to manage information, online learners will also have to be constantly aware that what they are reading is adding to what they already know (Schraw & Dennison, 1994). In a constructivist learning environment, if online learners cannot relate to the new learning material, constructivist learning will not occur (Jonassen, 1999; Lefoe, 1998; Murphy, 1997; Stacey, 2001). It is important for facilitators to be aware of what their online learners already know in order to facilitate the cultivation of new knowledge.

E-learning students require extensive Information Technology (IT) knowledge. There are also many definitions from the Information Technology (IT) field such as, "an IT strategy is a strategic business tool used to structure a future path and addresses the use and management of IT resources, business IT relationships both internal and external and the flow and storage of information throughout the organisation" (Gartlan & Shanks, 2007, p. 115). Studying online often creates amotivation and the design of e-learning should try to break the activity down into smaller steps. The design of e-learning materials should also encourage learners to create their own examples to make information they have acquired more meaningful.

Many journal articles share the same view that the IT strategies must align with the overall organisational strategies (Riekert, 2000; York University, 2001). The similarity among IT strategies and online information management strategies for this example is that online learners should focus on overall, rather than specific, meaning (Schraw & Dennison, 1994).

E-learning students are encouraged to utilize information technology resources to facilitate the cultivation of new knowledge. In the process of managing information, it is important that e-learning students be able to retain information. Next, the researcher will discuss the principle of Self-Determination Theory (SDT) in detail.

2.4 The Principle of Self-Determination Theory (SDT)

Self-regulation consists of two major constructs. They are metacognition and self-determination. Self-determination is "a macro-theory of human motivation, personality development, and well-being" (Ryan, 2009, p. 1). Self-Determination Theory (SDT) has developed and researched in five mini-theories which are: Cognitive Evaluation Theory (CET); Organismic Integration Theory (OIT); Causality Orientation Theory (COT); Basic Needs Theory (BNT) and Goal Contents Theory (GCT) (see Ryan, 2009). Self-determination consists of intrinsic motivation, extrinsic motivation and amotivation (absence of motivation). Self-determination is the driving force behind e-learning students to apply metacognition. It is assumed in this study that e-learning students will apply metacognition skills if they are motivated by either or both intrinsic and/or extrinsic motivation. There is a need to know how to bring e-learning students from amotivation back to either intrinsic or extrinsic motivation.

This study focuses on e-learning environments and the second construct for self-regulated learning which is self-determination. "Behaviourally active" is defined by Zimmerman (1986) as the ability to "select, structure and create environments that optimize learning" (p. 308). In other words, students will select, structure and create environments that optimize their own learning. In this study, the environments will be e-learning environments. Self-determination should be

viewed as multi-dimensional with three main dimensions (Barkoukis, Tsorbatzoudis, Grouios, & Sideridis, 2008). The breakdown of these three dimensions can be divided into seven sub-dimensions: Intrinsic Motivation (to know, to accomplish and to experience stimulus), Extrinsic Motivation (external regulation, introjections and identification) and Amotivation (Ryan & Deci, 2000b). In the self-determination theory, behaviour can be effectuated through intrinsic motivation (IM) which is related to pleasure and interest-related motives; extrinsic motivation (EM), on the other hand, is correlated to instrumental motives; and amotivation means an absence of motivation.

There is a need to know how self-determination helps e-learning students apply metacognition. The Self-determination Theory (SDT) is a rather broad theory of human motivation. SDT postulates that "type" of motivation is the predictor of outcomes which can be determined by the degree to which basic needs are satisfied (Moller, Deci, & Ryan, 2007). SDT predicts and confirms that positive outcomes are associated with the satisfaction of basic needs and being autonomous. Studies also show that students tend to become more autonomous when e-learning environments are autonomy supportive, respecting students' viewpoints and providing choice. SDT focuses on social-contextual conditions which facilitate the natural processes of self-motivation and healthy psychological development (Ryan & Deci, 2000b, p. 68). There is an overlap between metacognition and self-determination especially in terms of the social-contextual conditions. A huge part of metacognition (thinking about thinking) consists of students' past experiences and background, and this will come from the self-determination of the social-context. In other words, e-learning students will self-determine or make use of their past experience and learning strategies to make decisions about what they study and how they should reflect upon their study.

There are advantages and drawbacks in every theory and self-determination theory is no exception. According to Grolnick and Ryan; Deci, Vallerand, Pelletier, and Ryan (as cited in Legault, et al., 2006), "Self-determination has been associated with various positive outcomes, such as greater cognitive flexibility, conceptual understanding, and active information processing as well as better academic performance and academic self-concept" (p. 568). On the other hand, the negative

outcomes included “depression, narcissism, negative effect, and physical symptoms” (p. 568). In short, intrinsic motivation influences cognitive and affective states in the e-learning environment. Extrinsic motivation gives rewards or punishments in the e-learning environment. Amotivation simply means lack of motivation. In the process of designing e-learning environments which utilise motivation for metacognition, it is essential to have e-learning environments which utilize self-determination which will then motivate students to monitor their own thinking about thinking, knowing “what we know” and “what we don’t know” (Blakey & Spence, 1990, p. 1). Also, from the self-determination perspective, the self-regulated e-learning in this study will generate e-learners who are more cognitively flexible and conceptually more understanding of what they are doing. Active information processing is also one of the characteristics of self-regulated e-learning students as well as better academic performance. The most important e-learning improvement through self-determination is the incorporation of mental process (cognitive) and emotional responses. This is heavily influenced by social judgment. It is hoped that this study will suppress amotivation and eliminate depression, conceit and negative behaviour and promote self-concept learners (Bong & Clark, 1999). Also, there are many ways to stimulate e-learning students, but this becomes more complicated when students are scattered all over the world with diverse cultural backgrounds as is the case in Malaysia. As already mentioned, SDT contends that the “type” of motivation is the predictor of outcomes and therefore, it is “essential for all people, regardless of sex, ethnicity, socioeconomic status, or cultural values”(Moller, et al., 2007, p. 807).

2.4.1 Extrinsic motivation

The three “types” of motivation as predictors of outcomes are: extrinsic motivation, intrinsic motivation and amotivation. Extrinsic motivation is classified as integrated regulation, identified regulation, introjected regulation and external regulation.

Integrated regulation is the one least influenced by external motivation factors but rather utilises more internal motivation and autonomy. This is because integrated regulation requires modes which are more compatible with the students' values and needs (Ryan & Deci, 2000b). This is important and yet difficult for facilitators and instructional technologists who have to design something that matches e-learning students' values and needs. E-learning has always been designed as a "one size fits all" solution, "at a time, place and pace that is suitable and convenient to individual learners" (Naidu, 2006, p. 4). There is a need to design and deliver albeit at a distance, e-learning programs to suit the individual learner. This is necessary because of the cultural and background differences of the e-learners which play an important role in their motivation. This customisation is possible with the use of today's powerful computer technology.

Identified regulation is where learners utilise less autonomy with more external influence. Identified regulation is when e-learning students value and understand the importance of the activity, and they fully endorse doing it (Ryan & Deci, 2000b). In most cases, students will choose to do certain activities because they are important to them (Fullagar & Mills, 2008). There should be activities that enable e-learners to make choices because this will allow them to choose different activities that suit them.

Introjected regulation consists of behaviour intended to avoid guilt or obligation or to enhance one's ego (Ryan & Deci, 2000b). E-learners do what they think good students would do to obtain good grades. Facilitators inspire and encourage e-learning students by giving them examples of other good students' work.

External regulation is the least autonomous where the actions of e-learners perform are to satisfy external demands. External demands can be grouped under the two main categories of rewards and punishments. E-learning students are trying their best to obtain rewards (gaining extra marks) and to avoid punishment (losing marks). In the work environment, external regulation can be seen as the possibility of losing one's job.

Extrinsic motivation consists of four categories which range from selecting the best matched values and needs to actions to satisfy external demands. Therefore, there is a need to look at how to utilise external factors to encourage motivation in e-learning students in order to cultivate metacognition. Detailed discussions are provided in the following paragraphs.

2.4.1.1 Integrated Regulation

Integrated regulation is the most independent and self-determined form of extrinsic motivation (Legault, et al., 2007). This is one of the most important regulations for external motivation in e-learning students to be successful. This is because the more autonomous the person's motivation, the more persistent s/he will be in trying to achieve success (Ryan, 2009). In addition, students will tend to favour instructions that equate to their values and needs. As Ballmann and Mueller (2008) state, integrated regulation operates when activities are most congruent with an individual's values and needs. This is far more important when students are at a distance. Facilitators must motivate e-learning students one way or another. With this, there is a need to first look at individual e-learners' values and needs and then the facilitator can further customise motivation for certain learners. Integrated regulation can become part of self-expression because integrated regulation shares commonalities with intrinsic motivation, but the absence of intrinsic reasons makes it external (Barkoukis, et al., 2008; Legault, et al., 2007). In addition, identified, integrated and intrinsic forms of regulation have been combined under the category of autonomous motivation in some studies. According to Ryan and Deci (2000a), the relevant regulatory processes for integrated regulation are "congruence, awareness and synthesis with self" (Ryan & Deci, 2000b, p. 72). It occurs when personally endorsed goals, values and needs are fused with the self and become part of self-expression. However, integrated regulation shares a common attribute with intrinsic motivation (e.g., feelings of free choice and more importantly a feeling of autonomy) but this type of behaviour is still considered extrinsic because it is done to attain separate outcomes rather than inherent enjoyment (Legault, et al., 2007, p. 734; Ryan & Deci, 2000b). In other words, behaviour is performed for external reasons. An example of integrated regulation in education would be "I study because I enjoy learning."

Integration regulation is the most self-determined form of extrinsic motivation. Although integration regulation shares common attributes with intrinsic motivation behaviour, it is still performed for external reasons or from a lack of intrinsic reasons. E-learners in most cases are in this category as most of them are performing for good grades with autonomy being a direct result of hard work. This study will look at how integrated regulation is an important factor among Malaysian e-learning students.

2.4.1.2 Identified Regulation

Indentified regulation is a process where learners recognize and accept the principal value of behaviour (Deci & Ryan, 2000). This process allows e-learning students to more fully internalize their regulation and more fully accept their own cultural value.

E-learning students who show a strong indication of using identified regulation will be conscious of improving their understanding in any e-learning situation. Identified regulation is a process where the internalization of extrinsic motives becomes regulated through indemnification or because they are valued or seen as more important than introjection. This is because identification regulation regulates through a more autonomous form of extrinsic motivation. Also, behaviours are valued consciously and considered important and, thus, engagement of goal or regulation is perceived as chosen by the individual (Barkoukis, et al., 2008). E-learning students want to improve their understanding in any e-learning situation because they consciously remind themselves that understanding is the most important behaviour in e-learning. Behaviour would become more difficult to identify where externally governed behaviour becomes self-governed. This is an important regulation as e-learning students may identify their regulation by telling themselves, "I've chosen to study tonight because it is something important for me" (Vallerand, et al., 1992, p. 1007). This is because when e-learning students identify with a regulation, they engage in an activity that matches their personal values, goals and identities. By identifying this congruence, e-learning students accept the regulation as their own and feel greater autonomy.

Identification is a more self-determined type of extrinsic motivation than is introjected regulation because behaviours are valued and engagement is perceived as congruent with a student's individual self. Therefore, identification regulation is a, "self-determined or autonomous form of extrinsic motivation in which the personal identifies with the personal importance of a behaviour" (Ballmann & Mueller, 2008, p. 91).

2.4.1.3 Introjected Regulation

Introjected regulation is a process of intrapersonal control. Introjected regulation is not totally external but rather proceeds through internal pressure and restraint and begins to show results (to have external perceived locus of causality); it is a relatively controlled form of regulation (Legault, et al., 2007; Ryan & Deci, 2000b). E-learning students might choose to do their assignment the night before the due date to avoid guilt. Furthermore, this also shows that they have done their assignment and all their classmates have also done it. Doing the assignment the night before the due date will generate the assumption that they have passed the course. This example shows that e-learning students avoid guilt and enhance their ego. In addition, regulations are "within the person, but still relatively external to the self" (Deci & Ryan, 2000, p. 236).

Introjected regulation means that e-learning students behave in a certain way because they want the instructor to think that they are good students. According to Ballmann and Mueller (2008), introjected behaviours are to avoid guilt or to enhance contingent self-worth and to enhance one's ego. From the example above, at the end of the day, those who did their assignment the night before the due date will tell their juniors not to do this because of a feeling of guilt. There is often competition within a class, and an e-learning student wants others to think that he/she is skilful. This introjected regulation generates significant pressure and restraint but the e-learner is beginning to internalise the reasons for his/her actions (Barkoukis, et al., 2008; Legault, et al., 2007).

Introjected regulation internalises the reasons for a student's actions because "more 'internalised' involvement where the learners with an activity only begins at this state and the self is 'more' involved". (Barkoukis, et al., 2008, p. 40). Another example of introjected regulation is when students attend university because parents want them to do so or to avoid the feeling of guilt.

2.4.1.4 External Regulation

External regulation utilises the least amount of self-determination or autonomy. With this, e-learning students perform actions mainly to pass their examination.

According to Barkoukis, Tsorbatzoudis, Grouios and Sideridis (2008), the contrast between intrinsic motivation and extrinsic motivation is the involvement in an activity to obtain rewards. With the extrinsic form of motivation, the student is engaged in activities because of external or internal pressures; behaviour operates as a means to an end and not for its own sake in this instance. Deci and Ryan (2000) view extrinsic motivation under the self-determination theory as a multidimensional construct that consists of: external, introjected, indentified and integrated regulation. Furthermore, the actions for external regulation have an external perceived locus of causality; introjected regulation is somewhat external; identified regulation is somewhat internal, and integrated regulation shares commonalities with internal motivation with the absence of intrinsic reasons and perceived locus of causality (Barkoukis, et al., 2008; Deci & Ryan, 2000).

Although e-learning requires a significant degree of intrinsic motivation in order for the student to enrol, there is even more external regulation to satisfy external demands as classes proceed. E-learning students' motivation is purely instrumental as to which actions are performed to satisfy external demands like obtaining rewards and avoiding penalties (Ballmann & Mueller, 2008; Legault, et al., 2007). E-learning students might be very highly motivated internally to sign up for an online course but, down the road due to workload, family or academic obligations, they will most likely perform only to satisfy external demands. Some students sign up for an e-learning class because they believe they might get into trouble if they do not. Students typically "experience externally regulated behaviour as controlled or alienated" (Ryan & Deci, 2000b, p. 72). E-learning students might think that there

are certain things that they should do so that the teacher will not punish them. They might browse the internet and look for the answers for their assignment, or simply because there is a rule that they will have to have 20 references for each assignment. If they do not do so, they might obtain a lower mark in their assignment. In this case, their externally regulated behaviour is controlled or alienated by the rules and the environment. Furthermore, this behaviour is not likely to transfer to other e-learning courses due to the different environment. As Deci and Ryan (2000) state, "externally regulated behaviours are predicted to be contingency dependent in that they show poor maintenance and transfer once contingencies (rewards or penalty) are withdrawn" (p. 236).

Facilitators can offer positive motivations such as rewards where marks and other forms of incentive are the most obvious example. Facilitators can also use negative motivations such as threats of punishment and "academic blackmail" or coercion for their e-learning students. At any given time, extrinsic motivation is crude, easy and often ineffective. According to Ryan & Deci (2000b), extrinsic rewards can lead to inferior learning as students might focus only on the output and fail to see the whole picture which ultimately means they learn less and pay less attention to their social well-being. Facilitators might also want to pay attention to competition during learning as awards are also extrinsic rewards. Competition is, in general, extrinsic because there is no enjoyment of the intrinsic rewards of the activity; it encourages students to triumph over others.

2.4.2 Intrinsic Motivation (IM)

From the point of view of the flow theory (Csikszentmihalyi, 1975) rewards are not the goal of the students but rather the activity itself is a goal and the moment-by-moment record (Fullagar & Mills, 2008). Intrinsic motivation is the innate feeling of engagement, pleasure and satisfaction of obtaining a goal which can be felt by students moment-by-moment without expecting reward.

The psychology field has long been procrastinating about the existence of intrinsic motivation. Behaviourist theorists believe in behaviour that occurs due to past experience in gaining positive reinforcement as reward. There have been some attempts to explain internal motivation as being based on biological demands, needs and rewards. But, it was not until the cognitive revolution in the 1960s that a proper paradigm of viewing intrinsic motivation emerged. Nonetheless, intrinsic motivation remains a very important construct of self-determination. According to Barkoukis, Tsorbatzoudis, Grouios, and Sideridis (2008) intrinsic motivation refers to "the engagement in an activity for the pleasure and satisfaction of performing it" (p. 39). They believe that the key behaviours for intrinsic motivation are that one would voluntarily participate without experiencing external or internal pressure and without expecting rewards. In the adult e-learning environment, all of these are motivational factors which might motivate them to sign-up. All of these factors are related to a global construction where intrinsic motivation can be categorized into three different specific motives, intrinsic motivation to know, to accomplish, and to experience stimulation (Barkoukis, et al., 2008). In the e-learning environment, the intrinsic motive to know refers to, "engagement in an activity for the pleasure and satisfaction that one experiences while learning, exploring or trying to understand something new"; intrinsic motivation towards accomplishment refers to, "engagement in an activity for the pleasure and satisfaction derived when trying to excel, to reach a new standard or to create something new"; and the intrinsic motive to experience stimulation represents "involvement with an activity for the experience of fun, excitement, and positive sensations" (Barkoukis, et al., p. 40).

A sub theory within SDT, Cognitive Evaluation Theory (CET) aims to specify factors that explain variability in intrinsic motivation in terms of social and environmental factors and by using language in assumptions that intrinsic motivation, being inherent, shall flourish if circumstances permit (Ryan & Deci, 2000b). This theory is based on the effects of rewards, feedback and other external events on intrinsic motivation. CET urges social-contextual and optimal challenges. The theory states, first, "that social-contextual events (e.g., feedback, communication, rewards) inspire feelings of competence during the action which can enhance intrinsic motivation for that action. Accordingly, optimal challenges, effectively promoting feedback and freedom from demeaning evaluations were all found to

facilitate intrinsic motivation" (Ryan & Deci, 2000b, p. 70). Malone and Lepper (1987) already provide a detailed breakdown of intrinsic motivation, which divide it into two categories (individual and interpersonal) which have their appropriate subcategories.

Intrinsic goal orientation is defined by Keller and Suzuki (2004) as "engage[ment] in actions that are personally interesting and freely chosen". Malone and Lepper (1987) group intrinsic motivation into individual and interpersonal factors. Under individual factors, they further divide them into *challenge, curiosity, control and fantasy*. The interpersonal factors include: competition, cooperation and recognition. Malone and Lepper (1987) believe human being engagement is most directly influenced by extrinsic rather than intrinsic motivation. However, extrinsic motivators would reduce long-term interest and intrinsic motivation should be in place to cultivate long-term retention and independent learning. In other words, intrinsic and extrinsic motivations are both mutually inclusive and important in the process of engaging tertiary students in e-learning especially in the development of self-regulated learners. This can also be seen in the ARCS model where Keller and Suzuki (2004) used extrinsic and intrinsic motivation to establish the relevance of the instruction to learner goals and learning styles.

2.4.2.1 Challenge

Challenge is seen to be a powerful factor in influencing intrinsic motivation. E-learning students are expected to attain and achieve a certain kind of "challenge" quality to be considered self-determined. Goals, level of certainty, performance of feedback and self-esteem are the four factors for challenge (Malone & Lepper, 1987; Vockell, 2010). According to Vockel (2010), one of the most powerful individual factors influencing intrinsic motivation is a challenge – i.e. when students pursue tasks that are challenging. This happens when they direct their activities towards personally meaningful goals. When those goals are uncertain, students are challenged. It is believed that self-efficacy and self-evaluation nourish intrinsic motivation. The challenge comes from having a goal and not knowing whether successful attainment is guaranteed. When identifying the challenge factor of intrinsic motivation, Malone and Lepper (Malone & Lepper, 1987) listed four guidelines:

1. Set personally meaningful goals
2. Make attainment of goals probable but uncertain
3. Give en route performance feedback
4. Relate goals to learners' self esteem.

Instructional technologists and facilitators help e-learning students to set their own personal meaningful goals. This can be achieved by asking students to write down what they want to achieve as goals. To help e-learning students further, instructors can list the study objectives. In the process of including a list of objectives, Allen (2003) suggested the list of objectives to be meaningful and able to recall students' memorable experiences. However, Allen (2003) did not encourage instructional technologists to list objectives because most students do not read them. Short-term and long-term goals can be incorporated into e-learning equipment or come from the instructor or learners themselves. Short-term goals have immediate and persuasive impact, the attainment of these motivates students to strive for long-term goals. Personal relevance can be increased by:

1. Making clear the links between the activity and competencies or outcomes valued by the learner
2. Relating material to a fantasy or imaginary context that the learner finds emotionally appealing
3. Eliciting interpersonal motivations such as cooperation, competition or recognition that appeal to the learner (Vockell, 2010, p. 1).

"Make attainment of goals probable but uncertain" (Malone & Lepper, 1987, p. 370) is the next thing to do to promote individual challenge. The key word is feedback. No matter what facilitators do, they must facilitate feedback. "Put learner at risk" (p. 169), Allen (2003) suggested in his seven magic keys that facilitators need to put students at some measurable risks and provides structures that avoid the potential perils of doing so, such as:

1. Allowing learners to ask for the correct answers
2. Allowing learners to set the level of challenge
3. Complimenting learners on their attempts
4. Providing easier challenges after failures
5. Providing multiple levels of assistance (Allen, 2003, p. 171).

Putting students at risk is fine, but facilitators must facilitate feedback as the e-learning course progress. E-learners are often learning in isolation and performance of feedback is very important to keep them motivated. Related to this, according to Vockell (2010) performance of feedback is "most effective when it is clear, frequent, constructive and encouraging" (p. 2).

2.4.2.2 Curiosity

In the process of promoting curiosity in the e-learning environment, instructional technologists and facilitators should include features to stimulate learning and motivate e-learners. These contexts should also be detailed and easy to understand so as to engage learning.

According to Talib (2009), curiosity has been identified as the inner drive that motivates people to learn and investigate. It directs people to explore information about an object or idea. In the development of the self-regulated e-learner, Kashdan (as cited in Talib, 2009) identifies that curiosity was an individual, innate drive towards self-regulation. This will drive e-learners in their learning to adapt to distance learning and achieve success in their e-learning environment. In general, curious e-learning students are expected to be naturally motivated, adapt and repeatedly discover ways of problem solving, because "curiosity is the most direct intrinsic motivation for learning" (Malone & Lepper, 1987, p. 235).

2.4.2.3 Control

Intrinsic motivation also depends on control, or the appearance of control of the environment by the learner (Malone & Lepper, 1987). Control depends on contingency, choice and power (Malone & Lepper, 1987). The concept of control is a foundation of traditional analyses of intrinsic motivation (Malone & Lepper, 1987). There are two general concepts which Malone and Lepper (1987) define and the amount of control a person has in a particular environment depends on:

1. The range of outcomes that the environment provides
2. The extent to which the probability of each outcome is contingent upon (i.e., can influenced by) responses available to the person in that environment.

Empowering learning environment are those in which options are rich, and dependent upon the response of the learner. Perception of control is an important psychological variable of interest. In terms of environment, Malone and Lepper (1987) further categorise them as:

1. Contingency: outcomes dependent on students' responses
2. Choice: apparent and salient to the students
3. Power: taking advantage of the motivational benefits of perceived control to create environments in which students' actions have "powerful effects".

Motivation through control can be summarised:

1. Contingency: making clear the cause-and-effect relationships by establishing a goal and its reward
2. Choice: enabling students to believe that the work will lead to powerful effects
3. Power: allowing students to choose what they want to learn and how they want to learning it.

2.4.2.4 Fantasy

Malone and Lepper (1987) define fantasy as environments that which "evokes mental images of physical or social situations not actually present" (p.240). Fantasy is also a key to creating intrinsically motivating activities such as games. Using fantasies, mental images and situations that are not actually present can stimulate students' behaviour (Malone & Lepper, 1987). Further, fantasies can help the learner to understand new problems or information by relating the new information to currently held knowledge (Malone & Lepper, 1987). Fantasy can be categorised:

1. Endogenous fantasy: instructional environment in which fantasy depends on the skill being learned
2. Exogenous fantasy: skill being learned and the fantasy depend on each other
3. Emotional aspects of fantasy: provide imaginary characters with whom the students can identify
4. Cognitive aspects of fantasy: provide students with leverage for better understanding of new information by relating it to past knowledge.

Motivation through fantasy can be summarised thus:

1. Make a game out of learning
2. Help learners imagine themselves using the learned information in real-life settings
3. Make the fantasies intrinsic rather than extrinsic (Malone & Lepper, 1987).

2.4.2.5 Competition

Students gain a certain amount of satisfaction by comparing their performance to that of others (Malone & Lepper, 1987). This type of competition can occur naturally as well as artificially. Competition can be summarized as:

1. Competition occurs naturally as well as artificially
2. Competition is more important for some people than for others
3. People who lose at competition suffer more than the winners who profit
4. Competition sometimes reduces the urge to be helpful to other learners (Malone & Lepper, 1987).

2.4.2.6 Cooperation

Students feel satisfaction by helping their classmates achieve their goals (Malone & Lepper, 1987). Cooperation can be summarized as:

1. Cooperation occurs naturally as well as artificially
2. Cooperation is more important for some people than for others
3. Cooperation is a useful real-life skill
4. Cooperation requires and develops interpersonal skills (Malone & Lepper, 1987).

2.4.2.7 Recognition

Students feel satisfaction when others recognize and appreciate their accomplishments (Malone & Lepper, 1987). Recognition can be summarized as:

1. Recognition requires that the process or product or some other result of the learning activity be visible
2. Recognition differs from competition in that it does not involve a comparison with the performance of someone else (Malone & Lepper, 1987).

2.4.3 Amotivation

The e-learning environment is rather difficult to design due to the physical distance of learners. Without face-to-face communication, facilitators do not see their facial expressions and therefore do not know how e-learners are feeling. On the other hand, e-learners do not have the opportunity to ask questions directly in most e-learning environments. This situation is exacerbated when e-learners are not motivated.

There are many reasons for e-learners to feel unmotivated as amotivation refers to "the absence of a contingency between one's actions and outcomes" (Barkoukis, et al., 2008, p.40). Amotivated students normally cannot predict the results of their behaviour and also the motivation behind it. They may feel detached from their action and therefore invest less effort and energy into accomplishing it. Unpredictable behaviour and detachment from their actions are the two key concepts instructional technologists and facilitators should pay attention to. It is important to know e-learners' background as mentioned in an earlier section to predict their behaviour. When students are detached from their actions, the facilitator is the first one that should detect it. Facilitators must be able to identify the categories of amotivation in order to overcome the problem. In addition to this, "Academic amotivation is a complex phenomenon, partly because its boundaries stretch beyond the education domain to the broader social context in which the student is situated" (Legault, et al., 2006 p.569). In conjunction with this, Green-Demers, Legault, Pelletier and Pelletier (2008) developed The Academic Amotivaiton Inventory (AAI) to measure the multidimensional nature of the academic amotivation construct: deficits in ability beliefs; deficits in effort beliefs; lack of academic values and

unappealing characteristics of academic tasks which are based solely on Legault and colleagues' (2006) taxonomy. Amotivaiton is categorised into four (4) categories namely: ability beliefs; effort beliefs; Value of Task and Task Character.

According to Ryan and Deci (2000b), social-contextual events can enhance intrinsic motivation that are conducive toward feelings of competence during action. Furthermore, optimal challenges, effectance-promoting feedback, and freedom from demeaning evaluations were all found to facilitate intrinsic motivation and these effects were mediated by perceived competence. Feelings of competence will not enhance intrinsic motivation for e-learners unless they are accompanied by a sense of autonomy or feeling the internal perceived locus of causality. It is also important that facilitators are able to develop interpersonal affiliation where facilitators care about the e-learners. In the design of an e-learning environment, immediate contextual support is needed to support inner resourced autonomy and also, "[family members]and friends are key figures in students' interpersonal sphere, their influence may be most important in relatedness issues" (p. 570).

Discontentment and feelings of frustration are among the most prominent academic reasons for amotivation and, it is important to know how social antecedents influence such motivational deficits (Legault, et al., 2006). Discontentment and feelings of frustration are the intermittent feelings of PhD research students and yet, there are so many graduates yearly. PhD students may have different categories of self-determination and metacognition that dominate their research or we can say different social antecedent.

Sub-constructs for amotivation are distinct features, but they also share a common core and are expected to overlap to a moderate extent (Legault, et al., 2006). The taxonomy Legault, Green-Demers et al. (2006) proposed was based on Pelletier, Dion et al. (1999) where they retained 2 of their four dimensions (Ability Beliefs and Effort Beliefs). Both Strategy Beliefs and Helplessness were omitted. Legault, Green-Demers et al. (2006) proposed four (4) different classes of reasons to explain motivation towards social antecedents and academic consequences:

1. Ability Beliefs
2. Effort Beliefs
3. Value Placed on the Task
4. Task Character (p. 258).

2.4.3.1 Ability Beliefs

Ability beliefs involves self-appraisal and when e-learners pay less attention, it leads to poor academic engagement. In terms of ability beliefs, it can be either poor belief in academic ability or low perception of competency.

Instructional technologists and facilitators must take self-appraisal into consideration to engage e-learners when designing an e-learning environment. Ability beliefs are, "students' self-appraisal of their ability to carry out the required academic tasks" (Legault, et al., 2006, p. 568). It is a concept borrowed from the self-efficacy theory where e-learners have an expectation about their ability and apply appropriate strategies in order to execute a task. An e-learning environment should enable a full range of possible strategies for e-learners. This enables e-learners to carry out academic tasks. It is also believed that when self-efficacy is dubious, failure is higher and vice-versa (Legault, et al., 2006). E-learners exposed to uncertainty have a lot more doubts. If a full range of possible strategies for e-learners to carry out an academic task is provided, the likelihood of dubious self-efficacy is minimal. It can also be achieved by increasing the belief in students of positive achievement because, "poor belief is a driving component of academic disengagement" (p. 568). Similar to this, Barkoukis, Tsorbatzoudis, Grouios and Sideridis (2008) also share the same view as they wrote, "the belief concerning the lack of ability to perform an activity" (p. 40) will yield poor ability beliefs. Ability beliefs in general can be either:

1. Poor belief in academic ability
2. Attributing their academic difficulties to low perceived competence (Chua, 2009).

Although students' self-concept of ability has also been identified as a defining factor in academic motivation (e.g., Eccles et al., 1993; Skinner et al., 1990) in the e-learning environment. Green-Demers et al., (2008) believe this form of amotivation happen when students hold low self-efficacy expectation about schoolwork as well as, "when their academic ability self-concept is poor or ill defined (p. 865).

The design of an e-learning environment should enable high self-efficacy (the belief that one is capable of performing in a certain manner to attain a certain goal) expectation and well defined self-concept (the idea or the mental image one has of oneself and one's strengths, weaknesses, status, etc). In addition to the range of possible strategies it is also important to know their own capability belief, individual strengths and weaknesses.

2.4.3.2 Effort Beliefs

Effort beliefs involves desire and capacity for their e-learning. Effort beliefs represent the desire and capacity to invest the energy in what e-learners believe they can initiate or maintain for the academic tasks in an e-learning environment. E-learning students may still lack motivation even if they are aware of requirements and have positively appraised as their afore-mentioned ability efforts. Because of this, Skinner et al. (as cited in Legault, et al., 2006) believed that ability and effort must be considered together and they are both predecessors for school performance. To successfully implement an e-learning environment instructional technologists and facilitators must fully instigate Ability and Effort Beliefs. This is because according to Legault et al., (2006), although e-learning students may be aware of what is required to fulfil their academic requirements as well as positively appraising their ability to do so, nonetheless, they may still be academically unmotivated. The desire to exert effort is the key component towards successful effort beliefs in e-learning.

It becomes more complex when e-learning students do not believe that they are capable of initiating or maintaining the effort required to do well in an e-learning environment. This might be due to the fact that these e-learners have lost faith in, "the adopted strategies [which] will not produce the desired outcomes" (Barkoukis,

et al., 2008, p. 40). To keep e-learners motivated, the design of the e-learning environment must continually use different strategies to help distance learners to cope with the ever changing environment. This is especially important as e-learners are often learning alone. Also, encouragement to exchange beliefs of one's strategies adopted among themselves plays an important role in strengthening their effort and beliefs.

2.4.3.3 Value of Task

The value placed on the task has been known as individual values in relation to the task at hand and the values permit the prediction of behaviour. In addition to this, not valuing an activity, not feeling an integral part and lack of inner-acceptance of students are among the drawbacks for Value of Task. It also causes serious motivational deficit (Legault, et al., 2006).

It is important that the e-learning experience must be an integral component for e-learners. "When the task is not an integral component of a student's life, or if, in effect, is not important to the student, amotivation may result" (p. 569). Also, Barkoukis et al., (2008) believe that the value placed on a task is, "the belief that the activity is too demanding for the individual" (Barkoukis, et al., 2008, p. 40). In the e-learning environment, e-learners can see the value of learning and appreciate the learning if concepts are introduced to them progressively. This will further engage them in learning and then guide them towards more learning. It is very important to let e-learners feel values are related to the task. If this happens, e-learners will tend to excel in their e-learning course. In the e-learning environment, it is highly desired for facilitators to pay attention to each individual because values are the key to understanding academic behaviour (Green-Demers, et al., 2008). It is hoped that facilitators know all their e-learners in order for them to tailor the delivery methods so that they are an integral part of e-learners' life. On the other hand, this may consume a lot of time and effort. To overcome this issue, facilitators might want to group their e-learners into appropriate groups to provide activities that are congruent to values and related tasks.

Apart from the importance of value placed on a task, it is also important even if motivation is not extrinsic in origin. This is because willingness together with a sense of volition come from an undertaking which is valued and internalized (Legault, et al., 2006). E-learning students will not have integrated the behaviour as an expression of self without an inner acceptance of the activity. Further, the challenge is that "activities that are incongruent with self-expression are more difficult to maintain, and academic amotivation may be characteristic of school activities that are not expressions of one's self or of one's values" (Legault et al., 2006, p. 569). The e-learning environment which enables facilitators to group e-learners into appropriate groups helps promote willingness and the aforementioned sense of volition. This enables e-learners to share their similar values and to work together. By doing this, e-learning activities can be more effective. The grouping process is useful in the e-learning environment especially when e-learners need good reasons to perform any task which requires effort. If the task is unimportant to the student, amotivation may occur as "insubstantial academic values might also have more far-reaching repercussions by laying a foundation for the desire to drop out" (Legault, et al., 2006, p. 569).

2.4.3.4 Task Character

Although not all school tasks are the same, Task Character indicates one of the "features of the academic task that may lead to amotivation" (Legault et al., 2006, p. 569). Also, "the unappealing characteristics of the academic task may indeed lead to academic disengagement" (p. 569). In addition, if the qualitative experience of the activity does not engage or stimulate e-learners, it is most likely that they will not be motivated towards completing the task as Green-Demers, Legault, Pelletier and Pelletier (2008) state, "When a task is perceived as void of interesting or stimulating qualities, that is, if it is seen as boring and tedious, it is unlikely to engage students and may constitute a factor in amotivation" (p. 865). Pleasure and behaviour also play an important role in the Task Character. It is important that e-learners do not do the same thing over and over again. This can reduce pleasure and lead to amotivated behaviour. Pleasure, from the neurobiological point of view, is described as "a state or feeling of happiness and satisfaction resulting from an experience the one enjoys" (Esch & Stefano, 2004, p. 235). And behaviour is described as "a consequence of being responsive to one's social roles and

relationships" (Timothy Church et al., 2008, p. 1200).

The e-learning environment should enable students to feel happy and satisfied as a consequence of an experience they enjoy which is a result of a response to one's roles and relationships in society. This is related to the positive characteristics of a task which provides a variety of exciting learning materials with stimulating assignments to bring about excitement in e-learning.

2.5 Summary

The theoretical foundation of the study is self-regulated learning which consists of two main constructs: metacognition and self-determination. Both of these constructs are comprised of two or more sub-constructs. This chapter explained the meaning of these constructs and sub-constructs. These meanings underpin the process of instrument development applied in the empirical investigation.

The following chapter presents the research methodology and associated matters.

CHAPTER THREE

METHODOLOGY

3.1 Overview

This chapter begins with the presentation of four research questions. This is followed by a description of the methodology and general research approach used in this study. The design of this study involves the use of quantitative research methodology. The development of an instrument specifically designed to focus on self-regulated learning in an e-learning environment was used to collect data from 327 university students in Malaysia. The use of a qualitative research approach was used for the pilot testing of the questionnaire. All participants (N = 8) were Malaysian students who were asked to first complete the questionnaire followed by an interview with the researcher. Ethics approval had been obtained from Curtin University. Questions were asked regarding how to clarify the meaning of particular items and how to make the statements in the questionnaire more concise. The quantitative phase is explained next and includes data collection and analysis procedures using the Rasch model.

3.2 Research Questions

The key research questions which guided the study were:

1. Can self-regulated learning in an e-learning environment in a Malaysian university be measured?
2. What are student perceptions of their e-learning and their e-learning environment?
3. What aspects of e-learning were easy for the students to affirm and which were difficult to affirm?
4. Does membership of particular groups (e.g. gender) account for variance in student e-learning perceptions?

3.3 Research Approach

The design of the present study was mainly quantitative. According to Fraenkel and Wallen (2003), quantitative research deals with variables that can be quantified by numbers.

The quantitative approach is theory-based and deductive by nature (Wiersma & Jurs, 2005). A deductive approach begins with a general theory (Hall, 2010); a researcher will then continue with a broad theory to construct his/her own theory. This can also be seen as establishing a set of research questions; research questions are then further tested for verification against the data collected from the findings. The research questions are then answered according to the data. At the end, the theory is discussed in the light of the empirical findings.

3.4 Pilot Study

A survey instrument of Self-regulated Learning in an E-Learning Environment (SRL-EL) (Appendix 3.5) was developed by the researcher to collect information about participants' metacognition and self-determination. The questionnaire was developed using material derived from or based on the theory and research of self-regulated learning and e-learning. In particular, the key authors who informed the SRL-EL were Zimmerman (1986), Ryan and Deci (2000b), Schön (1983), Blakey and Spence (1990), Schraw and Dennison (1994), Collins (2001), Malone and Lepper (1987) and Legault, Green-Demers and Pelletier (2006). The instrument comprised 118 items with a four category response scale:

1. (4) – All of the time (every time)
2. (3) – Most of the time (60% - 70%)
3. (2) – Some of the time (30% - 59%)
4. (1) – Little or none of the time (below 30%).

Before the main data collection, a pilot test of the questionnaire (Appendix 3.4) was conducted using a sample of eight Malaysian students. Students were recruited from Curtin University as well as a Training and Further Education College (TAFE). All the participants involved in the pre-testing of the questionnaire used English as their second language, as do all Malaysian university students (the proposed sample

for the final instrument).

During the pilot testing of the questionnaire, each participant was asked to complete the questionnaire on self-regulated e-leaning environments. After completing the questionnaire, each participant was asked to provide verbal feedback on several aspects. The aspects were adapted from (Bell, 1987, 1993, 1999, 2005):

1. How long did the questionnaire take to complete?
2. Was there any word that you did not understand?
3. Did the questions make sense? If not, how could those statements be improved?
4. Were the questions easy to understand?
5. In the case of questions referring to similar information, how could the questions be worded differently?
6. If similar questions were found, how could we make them different?
7. Do you have any other comments about the questionnaire?

The pilot questionnaire took between thirty to sixty minutes for the students to complete. However, most students finished within 30 minutes. Students were allowed enough time to complete the questionnaire, and then they were asked to provide feedback about the questionnaire for a few additional minutes. Resulting from this feedback and taking into account that English is not Malaysians' first language, a number of linguistic amendments were made. Each respondent had fewer questions and improvements to ambiguous statements as amendments were made right after each interview. Due to this, questions arising from ambiguous words and unclear statements were greatly reduced. This was confirmed by the last respondent's statement that "the level [of difficulty] is not that high" which meant the English was very easy to understand. Also, the time taken to answer the questionnaire was shortened to 15 minutes because, as mentioned, amendments were made right after each interview. An educational technology expert's opinion was also sought which resulted in many items being removed as they appeared to be repetitive. The problems faced in interviews could be categorised into:

1. Problems understanding the word(s)
2. Similar/repeated questions
3. Questions that were not easy to understand

4. Miscellaneous.

In response to the problems mentioned, amendments were made to the wording of the questionnaire. These can be categorised into:

1. Word(s) changed
2. Word(s) added
3. Rephrased
4. Removed
5. No change.

The modifications suggested by the pilot sample for the instrument development will be presented in Chapter 4, section 4.2.

3.5 Participants

Convenience sampling (Hartas, 2010) was employed in this phase. Participants in this study were university students who volunteered to participate anonymously. All the students who participated in the present study were enrolled in at least one class of formal study at a public university. Most of the participants were aged 18 and older.

Participants who answered the questionnaire were recruited from schools and departments at the Universiti Sains Malaysia which run course units that have large student numbers. Each class had more than one hundred students (see Table 3.6.1) and these departments were also chosen because e-learning methodology was highly utilised within them. In addition, the student participants in these schools also had access to the latest Internet, video and multimedia resources.

Table 3.6.1
Characteristics of the sample

Departments from where participants were drawn	
Engineering	1
Computer Science	17
Management	59
Humanities	52
Mathematics	18
Industrial Technology	28
Education	77
Art	18
Biology	39
Others	18
Participants by Gender	
Male	= 104
Female	= 223
Did not indicate gender	= 0
Participants by Class Group	
Group 1	= 172
Group 2	= 125
Group 3	= 168
Total Number of Participants	= 465
Total Number of Incomplete Questionnaires	= 138 (328 - 465)
Total Number of Participants who Completed the Questionnaire	= 327

3.6 Instrument Administration

The instrument was administered in a lecture theatre at specific times arranged by lecturers. The decision to use a pen-and-paper-based questionnaire instead of an online version was intended to improve the response rates (Weis, Frei, & Axhausen, 2008).

It was considered very important that students understood the structure of the questionnaire before they answered. Therefore, in order to guide them through and have them answer truthfully, logically and consistently, detailed instructions were given in each lecture theatre.

3.7 Analysis of the Data

Responses from the questionnaire were entered into an Excel file using the response category codes (1, 2, 3, 4). The data was then analysed using IBM-SPSS and Rasch Unidimensional Measurement Models (RUMM 2030) program (RUMMLAB, 2007).

To begin with, due to the multivariate nature of the data, Exploratory Factor Analysis (EFA) with Varimax rotations was used to identify items with strong correlation between their data. A 28-factor solution was generated with eight factors having Eigen values greater than 1.0. Next, the factors were operationally defined using the terminology in the original theoretical model. The eight factors were *Ability and Effort Beliefs*, *Reflection*, *Introjected Regulation*, *Task Character*, *Strategic Use*, *Value of Task*, *Stimulus Response* and *Recognition*.

Data from the eight factors were then analysed by RUMM2030 to test fit to the Rasch model. Summary test-of-fit statistics were estimated for all eight factors to determine the global fit to the measurement model. The thresholds of the response patterns for each item were then checked to ensure that the response categories for the item were used consistently and logically. Next, the residual for each item was examined to see if the observed scores fitted those predicted by the measurement model. The item-trait interaction that indicates the consistency of the expected item "difficulty" for all students was calculated. Finally, the person frequency distributions for groups of students classified according to gender, age, year, ethnicity and school were scrutinised for all eight factors.

3.8 Instrument Refinement – SRL-EL

The instrument was refined following administration and data analyses. Data obtained from Self-Regulated Learning in the e-Learning Environment (SRL-LE) questionnaire provided a record of participants' metacognition and self-determination. These included how participants viewed their own learning, how they perceived their learning strategies, how metacognition and self-determination affected their learning, how internal motivation promoted learning, how external motivation supported learning and how to overcome and motivate students that were

not motivated at all.

3.9 Ethics Approval

To obtain approval to conduct research involving human subjects from a Malaysian university, the researcher had to demonstrate to the Curtin University Human Research Ethics Committee that the strict ethical guidelines had been addressed.

As required by the Ethics Committee of Curtin University, detailed information about the study and consent forms were attached to each interview and questionnaire outlining the purpose of the research and the rights of all participants (See Appendix 3.3). These statements clearly indicated that all participants were voluntary and could withdraw at any time without prejudice.

In particular, for the SRL-EL questionnaire, the information was clearly written on the front page indicating that by answering the questions, they agreed to participate in the survey, confirmed that their participation was totally voluntary and they had not been influenced in any way to participate. The questionnaire was also anonymous (see Appendix 3.5). With regard to the interviews conducted, the information was clearly written on the front page indicating that names were not required and individuals were to remain anonymous. In addition, research results would be published without the individual names of students. It was clearly articulated that if any participant wanted, s/he could obtain a copy of the results and ask any question about the study by contacting the researcher or supervisor. Students were assured that all information would be treated confidentially and is highly protected (see Appendix 3.3).

If publications are to arise from this study, only the aggregate of findings will be reported. All interviews will be recorded and all interviewee information will be kept confidential. The use of a digital recorder was required to record verbal protocol analysis of participants. All original data would be retained at the School of Education at Curtin University. The researcher and the School would take full responsibility for ensuring appropriate safety for the data.

Having met these ethical requirements, the researcher was granted approval by Curtin University to conduct research involving human subjects (see Appendix 3.6).

3.10 Summary

This study utilised quantitative methods to collect data on self-regulated learning in an e-learning environment. This study involved the development of a conceptual model and a questionnaire based on Reflective Use (reflection in learning and reflection on learning), Strategic Use (self-evaluation, debriefing of the thinking process, planning, keeping a thinking journal, talking about thinking and identifying what is known and what is not known), Awareness Use (declarative knowledge, procedural knowledge, conditional knowledge, evaluation of learning, debugging strategies, monitoring and information management strategies) , Extrinsic Motivation (external, introjected, identified and integrated regulation), Intrinsic Motivation (challenge, curiosity, control, fantasy, competition, cooperation and recognition) and Amotivation (ability beliefs, effort beliefs, values of task and task character).

The study involved a sample of university students (n=327) from the Universiti Sains Malaysia who completed the Self-Regulated Learning in an e-Learning Environment questionnaire. Questionnaire data was analysed with the computer program Rasch Unidimensional Measurement Model (RUMM 2030) (RUMMLAB, 2007) to create a measure.

CHAPTER FOUR

RESULTS

4.1 Overview

This chapter begins by identifying how the pilot study processes specifically informed the final SRL-EL questionnaire. This is then followed by the results of the analysis of the quantitative data from a sample of Universiti Sains Malaysia students (N = 327) using the computer software IBM SPSS (SPSS for Windows) and Rasch Unidimensional Measurement Models (RUMM2030) (RUMMLAB, 2007). More specifically, the results were obtained by an exploratory factor analysis whereby a statistical method was used to describe variability among observed variables in terms of a potentially lower number of unobserved variables called factors (Costello & Osborne, 2005). Finally, the results of eight Rasch model analyses are provided.

4.2 Pilot Study

The results of the pilot study are presented in the following sections. These also show the modifications made to refine the instrument.

4.2.1 Expert Advice and Responses

An educational technology expert provided advice on questions 1, 2, 6, 7, 9,15, 16, 19, 26, 31, 35, 38, 41, 46, 47, 49, 50, 52, 56, 57, 62, 63, 64, 65, 66, 68, 68, 73, 74, 76, 77, 78, 79, 81, 82, 83, 94, 95,99, 100, 103, 107, 113,117, 118, 120, 123, 125, 126, 127, 129, 131, 133, 134, 138 and141; and the heading "Reflective on learning".

Question 2 (*The way I learn is continuously changing*) was recommended to be rephrased. After referring to the literature review and feedback from respondent(s), question 2 was changed to "*As I am learning, I may change the way I learn*". Also, questions 1, 6 7, 15, 16, 19, 26, 31, 35, 38, 41, 46, 47, 49, 50, 52, 56, 57, 62, 63, 64, 65, 66, 68, 68, 73, 74, 76, 77, 78, 79, 81, 82, 83, 94, 100, 117, 118, 123, 126, 127,

129, 131, 133, 134 and 138 were recommended by the educational technology expert to be deleted. After referring to the literature review, questions 1, 6 7, 15, 16, 19, 26, 31, 35, 38, 46, 47, 49, 50, 52, 56, 57, 62, 63, 64, 65, 66, 68, 68, 73, 74, 76, 77, 78, 79, 81, 82, 83, 94, 100, 117, 118, 123, 126, 127, 129, 131, 133, 134 and 138 were removed, except for 41. The naming of one of the constructs "Reflective on learning" was changed to "Reflecting on learning". Also, it was recommended that question 9 (*Looking back at my learning enables me to make judgements about how my success in e-learning*) be rephrased. After consulting the literature review and feedback from respondent(s), question 9 was changed to "*Looking back at my learning enables me to know how successful I am*" (question 67 at present). Similarly, following recommendations and feedback, and after further reference to the literature review, the following changes were made to the phrasing of questions:, Question 95 (*I make personally meaningful goals in e-learning*) was changed to "*I set personally meaningful goals*" (question 60 at present). Question 99 (*Sudden change of computer images in e-learning stimulates my learning*) was changed to *"Providing different sound and images stimulates my learning*" (question 64 at present). Question 103 (*My e-learning materials are consistent*) was changed to "*My e-learning materials encourage me to keep learning*" (question 67 at present). Question 107 (*I was made to believe hard work will lead to powerful effects in future*) was changed to "*I was made to believe that my work had a powerful impact on my future*" (question 71 at present). Question 113 (*I lose motivation if class competition decreases*) was changed to "*I am very motivated when there is competition*" (question 78 at present). Question 120 (*I am happier when instructor gives my works recognition as oppose to comparing my works with others*) was changed to "*I am happier when the instructor recognises my work*" (question 84 at present). Despite recommendations for change the following were not changed following respondent feedback and consulting of the literature review: Question 125 (*Because that is what I am supposed to do*) and Question 141 (*Because I want to associate with classmates*) The next section presents problems encountered by respondents.

4.2.2 Problems encountered by respondents

The problems encountered by respondents included misunderstanding word(s), similar/repeated questions, words not easy to understand, and other difficulties.

4.2.2.1 Problems Understanding the Word(s)

Respondents had problems understanding the following word(s):

1. Question 5: “dictate”
2. Question 8: “strengthen”
3. Question 9: “judgement”
4. Question 13: “critical perspective”
5. Question 18: “proofread”
6. Question 28: “accomplish”
7. Question 33: “reconsider”
8. Question 36: “prior”
9. Questions 39 * and 40*: “conscious decision”
10. Question 40*: “accurate”
11. Question 41*: “I aim but fail”
12. Question 48*: “judgement”
13. Question 50: “strategies”
14. Question 58: “compensate”
15. Question 60*: “pace”
16. Question 65: “encounter”
17. Question 73: “grade”
18. Question 75: “capable”
19. Question 77: “establish”
20. Question 84: “periodically”
21. Question 88: “pausing”
22. question 92: “assumptions”
23. Question 98: “accomplish”
24. Question 102: “attain”
25. Question 106: “stimulate”
26. Question 108: “comprehensive”
27. Question 109: “consistent”

28. Question 115: “visualise”
29. Questions 112 and 124 “interpersonal”
30. Question 125: “visible”
31. Questions 127 and 144: “admire”
32. Question 130: “trouble”
33. Question 132: “tell”
34. Question 137: “ashamed”
35. Question 147: “associate”
36. Question 148: “delivery methods”
37. “Amotivation” in the title
38. Question 151: “succeed”
39. Question 154: “surpass”
40. Question 156: “workload”
41. Question 158: “hold no interest”
42. Question 162: “not excited”
43. Question 165: “not stimulating” .

* indicates more than one problem in the same question

4.2.2.2 Similar/Repeated Questions

Respondents felt these questions were similar or repeated:

1. Question 55 was a repeated question
2. Question 65 was identical to Question 24.
3. Question 25 and 26 were similar questions
4. Question 37 and 38 were similar questions
5. Question 55 was similar to Question 49
6. Question 79, 80, 87 were similar questions
7. Question 93 and 95 were similar questions
8. Question 135, 136 and 139 were similar questions
9. Question 138 was a repeated question
10. Questions 155, 156, and 158 were similar questions
11. The words “not excited” and “not stimulating” for Questions 163 and 165 respectively were similar.

4.2.2.3 Not easy to understand

Respondents felt:

1. Question 4 was difficult to understand
2. Question 5 was confusing
3. Questions 21, 22 and 23 were very long and look the same
4. Questions 25 and 26 according to respondent(s) were the "same thing"
5. In Question 33, the word "conscious" needed more elaboration
6. Questions 37 and 38 "actually is the same"
7. Question 41 was difficult to understand
8. Question 48 was not easy to understand
9. The logic use of the word "automatic" for question 53
10. The words "smaller steps" for question 71
11. Question 160 was not easy to understand
12. Question 85 was not clear
13. The use of the word "review" instead of "go back" for Question 92 would be more Malaysian as suggested by one of the interviewees
14. Question 114 was not clear
15. Question 115 was confusing
16. The word "school" was not suitable for university students for question 153
17. Question 157 was a bit odd.

4.2.2.4 Other Deficiencies

Respondents:

1. Felt Questions 117 to 124 were all statements
2. Did not see the point of Question 121
3. One of the respondents liked Question 132 because it was very Malaysian
4. There was a typographical error in Question 137
5. One of the respondents did not agree with the word "classmate" for Question 145. This respondent would not follow his/her classmate but instead would follow his/her friend, an elder or family member
6. From my observation, one of the respondents read through Question 53 quite slowly, so the sentence structure might not be so direct.

There were 43 problems understanding the word(s), 11 similar/repeated questions, 17 not easy to understand, and six other shortcomings.

4.2.3 Amendments made

In this section the amendments to the instrument are presented. These amendments include word(s) changed, word(s) added, observation, rephrased, removed, and no change.

4.2.3.1 Word(s) Changed

Respondents had problems with words and as a result either more commonly used words or more "Malaysian style" words were used. The list of problems together with the changes is presented below.

1. Respondent(s) had a problem understanding the word "dictate" for Question 5. As a result, "take control" was used
2. Respondent(s) had a problem understanding the word "judgement" for Question 9. As a result, "succeed" was used
3. Respondent(s) had a problem understanding words "critical perspective" for Question 13. As a result, "significant viewpoint" was used
4. Respondent(s) had a problem understanding the word "accomplish" for Question 28. As a result, "achieved" was used
5. Respondent(s) had a problem understanding the word "prior" for Question 36. As a result, "achieved" was used
6. Respondent(s) had a problem understanding the word "compensate" for Question 58. As a result, "offset" was used
7. Respondent(s) had a problem understanding the word "encounter" for Question 65. As a result, "come across" was used
8. Respondent(s) had a problem understanding the word "capable" for Question 75. As a result, "ability" was used
9. Respondent(s) had a problem understanding the word "periodically" for Question 84. As a result, "regularly" was used
10. Respondent(s) had a problem understanding the word "pausing" for Question 88. As a result, "stopping" was used
11. Respondent(s) had a problem understanding the word "assumptions" for

Question 92. As a result, “belief” was used

12. Respondent(s) had a problem understanding the word “attain” for Question 102. As a result, “achieve” was used
13. Respondent(s) had a problem understanding the word “comprehensive” for Question 108. As a result, “detail” was used
14. Multiple respondent(s) had a problem understanding the word “imagine” and “visualise” for Question 115. It was first replaced by “visualise” and then changed back from “visualise” to “image” after considering the more common words used in Malaysia
15. Respondent(s) did not agree with the word “yell” used in Question 132. As a result, the word “punish” was used
16. Respondent(s) had a problem understanding the word “workload” for Question 156. As a result, “schoolwork” was used.

4.2.3.2 Word(s) Added

Respondent(s) had problems understanding the word “grade” for Question 73. As a result, the word “result” was added.

4.2.3.3 Observation

From the researcher’s observation, respondent(s) read through Question 53 (*I am willing to make use of help with my learning when there is help available*) quite slowly. This may be due to the complex sentence structure. As a result, question 53 was rephrased as “*I am willing to ask for help when there is help available*”.

4.2.3.4 Rephrase

Respondents had problems with sentences and as sentences were rephrased. The list of problems together with the changes is presented below:

1. Respondent(s) felt that Question 4 (*Depending on what I am experiencing, now I complete activities might be different in the future*) was not so clear. After gathering valuable information from respondents, a decision was made to modify this question to: *The experience I gained changed my learning habits*
2. Respondent(s) felt that Question 5 (*My experience during learning shapes whether or not I change how I learn*) was also confusing. After

gathering valuable information from respondents, this question was rephrased as: *My past and present experience will dictate how I complete future activities*

3. Respondent(s) felt that Questions 21, 22 and 23 were very long and appeared to be the same. Hence, Question 21 (*My e-learning discussion activities allow me to tell how I came to a certain conclusion*) was modified to: *My e-learning discussion activities allow me to express how I arrived to my conclusions*. Also, following respondents' feedback, , Question 22 (*My e-learning activities help me to recognise how I plan for achieving my learning goals*) was rephrased as: *My e-learning activities help me to recognize how I plan to achieve my future learning*. Also, a decision was made to modify Question 23 (*My e-learning activities enable me to know what strategies to be applied to other learning situations*) and was being replaced by: *My e-learning activities help me to know which strategies can be applied to other learning situations*
4. Questions 25 (*I set specific goals before I begin a task in e-learning*) and 26 (*I ask myself questions about the material before I begin*) according to respondent(s) were the "same thing". Other opinions from respondent(s) were sought and respondent(s) commented that Question 25 was clear but Question 26 was not. So, Question 26 was altered to: *I make note of important materials before I begin*
5. The word "conscious" in Question 33 needed more elaboration because respondent(s) interpreted it as "careful or something like that". This question was rephrased as: *I think about the question I have asked*
6. Respondent(s) thought "Conscious decision" in question 39 was not cleared and needed to be rephrased. (*I make conscious decisions about my knowledge*). "Direct", "critical", "aware" and "clear" were among a few words suggested during the interview with respondents but we agreed upon: *I am in control of my knowledge and one of the respondents replied* "I understand better in that kind of way"
7. The word "conscious" in Question 40 (*I verify my conscious decisions made before when I have more accurate information*) needed more elaboration as respondent(s) interpreted it as "careful or something like that". This question was rephrased as: *I am willing to review my past*

decisions when I get more information

8. Question 41 (*I am able to expand my knowledge as I get more accurate information*) was interpreted by respondent(s) as "I aim but fail". The solution was to rephrase this sentence as: *I am willing to keep an open mind and expand my knowledge when I get more information*
9. Question 48 (*I am a good judge of how well I understand something*) was not clear for respondent(s). Respondent(s) stopped and verbally read out "judgement" a few times. This question became: *I have good judgement when it comes to my level of knowledge*
10. Respondent(s) felt that there was a need to rephrase Question 160 because it was not easy to understand. As a result, the sentence "*Because I have no good reason to study*", was rephrased as "*Because I do not have any good reason to study*".

4.2.3.5 Removed

Respondents had problems with several words and as a result these were removed. The list of problems together with the changes is presented below:

1. According to respondent(s), Questions 37 (*I am able to assess the challenges and difficulties encountered during reasoning*) and 38 (*I am able to assess the difficulties encountered during reasoning*) "actually is the same". Hence, a decision was made remove question 38
2. Respondent(s) felt that Question 55 (*I find myself using helpful learning strategies automatically*) was a repeated question. Therefore, it was removed
3. Respondent(s) felt that Question 61 (*I know when each strategy I use will be most effective*) was quite similar to one of the previous questions. There was some overlapping in the framework. "Planning and self-regulation" under *Strategic Use* was referring to estimate time requirements, organizing materials, and scheduling procedures necessary. "Procedural knowledge" was referring to knowledge about how to implement learning procedures. Similar to "Procedural knowledge" "Planning" referred to planning, goal setting, and allocating resources prior to learning. After referring back to the literature review and feedback from an educational technology expert, "Planning" was removed from the

questionnaire. With regard to this decision, all questions which were under "Planning" were removed. These questions included 24-28 with a total of 5 questions

4. Respondent(s) felt that Question 138 was a repeated question. As a result, Question 138 has been removed.

4.2.3.6 No Change

Although respondents had problems with understanding words, some of these words were not changed. The list of problems together with the decision for not changing words is presented below:

1. Respondent had a problem understanding the word "strengthen" in Question 8 (*I use references or other literature to strengthen my point of view in e-learning activities*). Although the same respondent suggested replacing this word with "stronger", however, the majority of respondents had no problem with this word. As a result, this word was not replaced
2. Respondent had a problem understanding the word "proofread" in Question 18 (*I proofread my assignments a couple of times before submitting them to my instructor*). This word was not replaced because the majority respondents did not find this world difficult
3. Respondent had a problem understanding the word "strategies" in Question 50 (*I try to use strategies that have worked in the past*). This word was not replaced because other respondents did not find this world difficult.
4. Respondent had a problem understanding the word "establish" in Question 77 (I establish personal contact with my classmates to satisfy my social needs). This word was not replaced because the majority of respondents did not find this world difficult
5. Respondent had a problem understanding the word "accomplish" for Question 98 (*I ask myself how well I accomplished my goals once I'm finished*). This word was not replaced because the majority of respondents did not find this world difficult
6. Respondent had a problem understanding the word "stimulate" for Question 106 (*Sudden change of audio in e-leaning stimulates my learning*). This word was not replaced because the majority of respondents did not find this world difficult

7. Respondent had a problem understanding the word “consistent” for Question 109 (*My e-learning materials are consistent*). This word was not replaced because the majority of respondents did not find this world difficult
8. Respondent had a problem understanding Question 114 (*I make a game out of learning*). This question was not replaced because the majority of respondents did not find this question difficult to understand
9. Respondent had a problem understanding the word “interpersonal” for Question 123 (*Cooperation requires interpersonal skills*). This word was not replaced because the majority of respondents did not find this world difficult
10. Respondent had a problem understanding the word “interpersonal” for Question 124 (Cooperation develops interpersonal skills). This word was not replaced because the majority of respondents did not find this world difficult
11. Respondent had a problem understanding the word “visible” for Question 125 (*I am more motivated if recognition is visible to others*). This word was not being because the majority of respondents did not find this world difficult
12. Respondent had a problem understanding the word “admire” for Question 127 (I like people to admire me). This word was not replaced because the majority respondents did not find this world difficult
13. Respondent had a problem understanding the word “admire” for Question 145 (*Because I admire classmates doing well in it*). This word was not replaced because the majority of respondents did not find this world difficult
14. Respondent had a problem understanding the word “trouble” for Question 130 (*Because I will get into trouble if I don’t*). This word was not replaced because the majority of respondents did not find this world difficult
15. Respondent had a problem understanding the word “ashamed” for Question 138 (*Because I would feel ashamed if I do not*). This word was not replaced because the majority of respondents did not find this world difficult
16. Respondent had a problem understanding the word “associate” for Question 147 (*Because I want to associate with classmates*). This word was not replaced because the majority of respondents did not find this world difficult

17. Respondent had a problem understanding words “delivery methods” for Question 149 (*Because I can tolerate and accept difference in classroom delivery methods*). These words were not replaced because the majority of respondents did not find this world difficult
18. Respondent had a problem understanding the word “succeed” for Question 151 (*Because I don’t have the knowledge required to succeed in this class*). This word was not replaced because the majority of respondents did not find this world difficult
19. Respondent had a problem understanding words “hold no interest“” for Question 158 (*Because, for me, school holds no interest*). These words were not replaced because the majority of respondents did not find this world difficult
20. Respondent had a problem understanding words “not stimulating” for Question 165 (*Because my school work is not stimulating*). These words were not replaced because the majority of respondents did not find this world difficult.

Sixteen words were changed, one word(s) added, one observation, 10 were rephrased, 4 were removed, and 21 had no change.

4.3 Questionnaire Administration Results

4.3.1 Descriptive Statistics

The data derived from 118 items scored 1, 2, 3 or 4, with missing data being defined as *missing* values. Additionally, demographic data was collected (e.g. gender and age). Data was provided by 327 respondents and processed by the computer program IBM SPSS Statistics 19 (SPSS for Windows).

4.3.1.1 Sample characteristics

The respondents comprised 223 females and 104 males (see Figure 4.3.1.1.1). The respondents comprised 68.2% females and 31.8% males (see Table 4.3.1.1.1 and Figure 4.3.1.1.1).

Table 4.3.1.1.1

Gender

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1.00	104	31.8	31.8	31.8
	2.00	223	68.2	68.2	100.0
	Total	327	100.0	100.0	

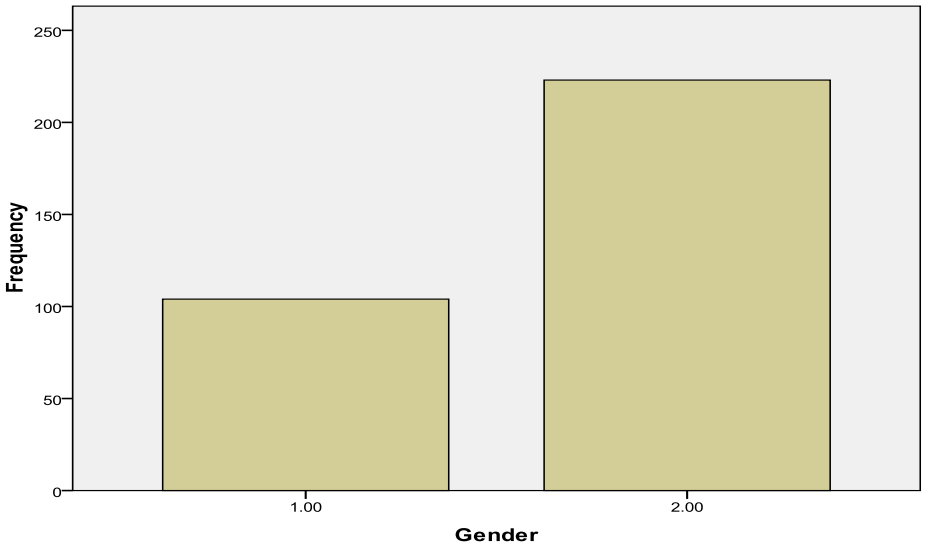

Figure 4.3.1.1.1. Gender

Of the 327 respondents, 175 were aged between 21-24 years; 145 respondents were aged between 17 – 20 years; 5 respondents were between 25-28; and the balance of 2 respondents were above 45 years old (see Figure 4.3.1.1.2). Of the total number of respondents, 53.5% were aged between 21-24 years old; 44.3 % were aged between 17 – 20 years; 1.5% were between 25-28; and the balance of 0.6% were over 45 years of age (see Table 4.3.1.1.2 and Figure 4.3.1.1.2).

Table 4.3.1.1.2
Age

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	17-20	145	44.3	44.3	44.3
	21-24	175	53.5	53.5	97.9
	25-28	5	1.5	1.5	99.4
	>45	2	0.6	0.6	100.0
	Total	327	100.0	100.0	

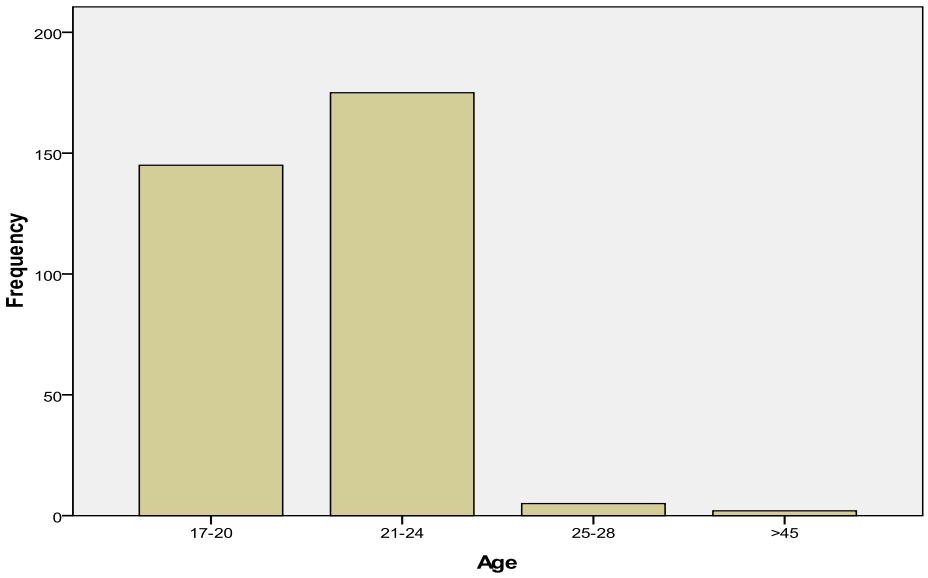

Figure 4.3.1.1.2. Age

Of the total number of respondents, 232 (70.9%) respondents were in their first year of study, 63 (19.3%) in their second year, 31 (9.5%) in their third year and one (0.3%) student was in their fourth year (see Figure 4.3.1.1.3). Respondents who were in their first year of study comprised 70.9% of the total, second year students 19.3%, third year students 9.5% and fourth year student 0.3% (see Table 4.3.1.1.3 and Figure 4.3.1.1.3).

Table 4.3.1.1.3

Year of study

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	1st Year	232	70.9	70.9	70.9
	2nd Year	63	19.3	19.3	90.2
	3rd Year	31	9.5	9.5	99.7
	4th Year	1	0.3	0.3	100.0
	Total	327	100.0	100.0	

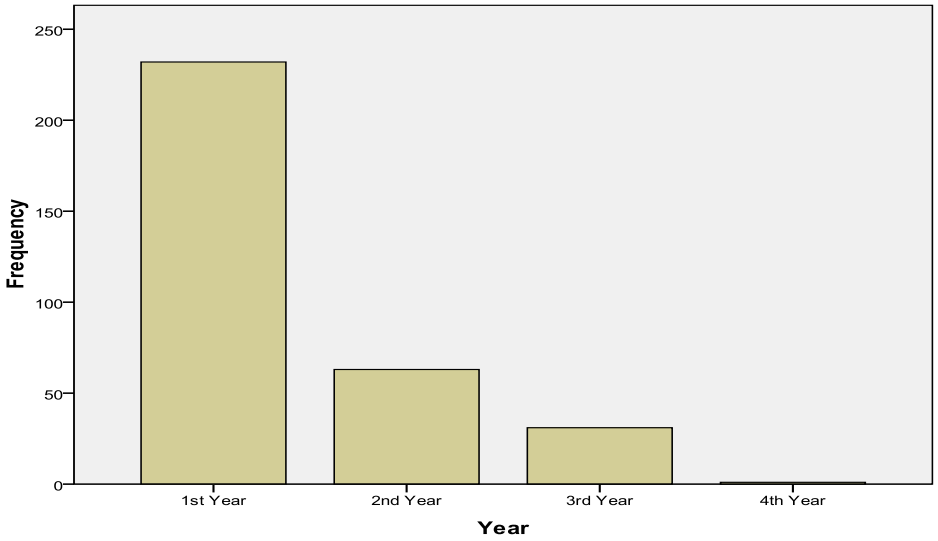

Figure 4.3.1.1.3. Year of Study

The majority of the respondents were Malay and Chinese, 165 and141respectively. Another 18 respondents were Indian and the remaining 3 respondents were European (see Figure 4.3.1.1.4). The percentage of Malay was 50.5%, Chinese was 43.1%, and Indian 5.5% and European 0.9% (see Table 4.3.1.1.4 and Figure 4.3.1.1.4).

Table 4.3.1.1.4

Ethnicity

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Malay/Native	165	50.5	50.5	50.5
	Chinese	141	43.1	43.1	93.6
	Indian	18	5.5	5.5	99.1
	European	3	0.9	0.9	100.0
	Total	327	100.0	100.0	

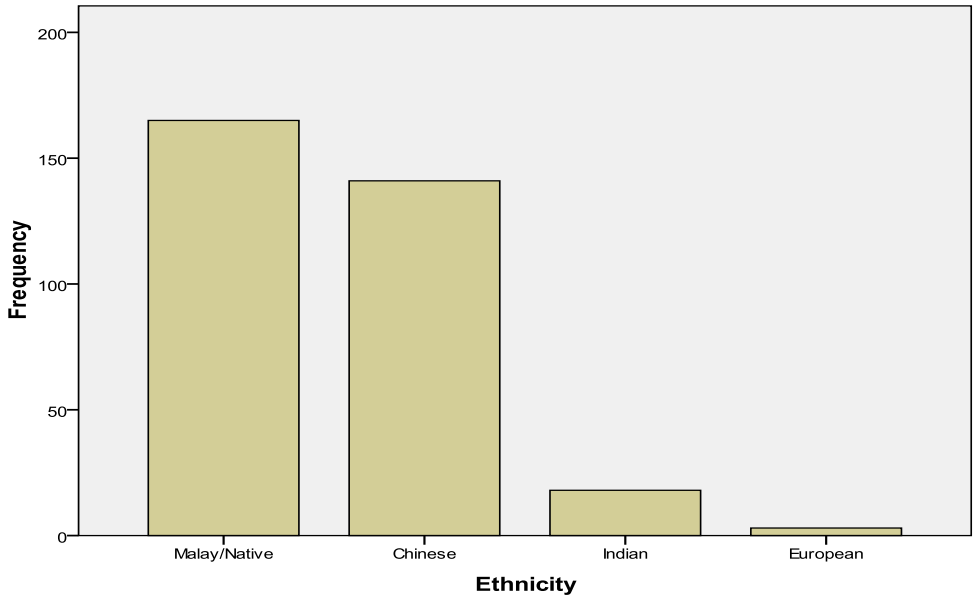

Figure 4.3.1.1.4. Ethnicity

Most of the respondents were from the School of Education (77), the School of Management (59), the School of Humanities (52), the School of Biology (39), the School of Industrial Technology (28), School of Mathematics (18), School of Art (18) and other schools (18). The lowest two numbers of respondents were from the School of Computer Science (17) and School of Engineering (1) (see Figure 4.3.1.1.5). The majority of the respondents, 23.5%, came from the School of Education; this was followed by the School of Management with 18.0%, the School of Humanities with 15.9%, the School of Biology with 11.9%, the School of Industrial Technology with of 8.6%, the School of Mathematics with 5.5%, the School of Art with 5.5% and other schools 5.5%. The lowest two numbers of

respondents were from the School of Computer Science with 5.2% and the School of Engineering with 0.3% (see Table 4.3.1.1.5 and Figure 4.3.1.1.5).

Table 4.3.1.1.5
School

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Engineering	1	.3	.3	.3
	Computer Science	17	5.2	5.2	5.5
	Management	59	18.0	18.0	23.5
	Humanities	52	15.9	15.9	39.4
	Mathematics	18	5.5	5.5	45.0
	Industrial Technology	28	8.6	8.6	53.5
	Education	77	23.5	23.5	77.1
	Art	18	5.5	5.5	82.6
	Biology	39	11.9	11.9	94.5
	Others	18	5.5	5.5	100.0
	Total	327	100.0	100.0	

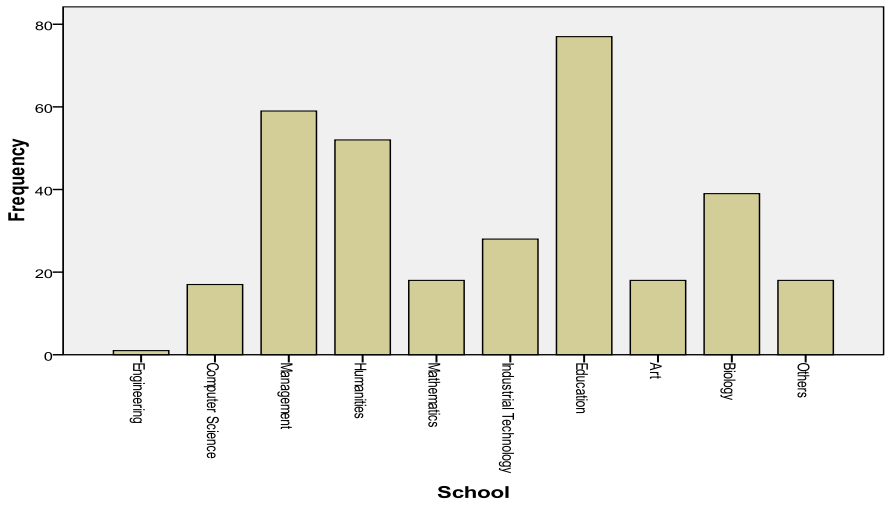

Figure 4.3.1.1.5. School

4.3.1.2 Descriptive Statistics for Items

The central tendency (mean) and the standard deviation of each item are presented in Table 4.3.1.2.1. Also, the minimum and maximum scores are presented in the same table.

Table 4.3.1.2.1
Descriptive Statistics for all items (N=327)

	N	Minimum	Maximum	Mean	Std. Deviation
Q1	326	1	4	2.29	0.97
Q2	326	1	4	2.35	0.77
Q3	326	1	4	2.64	0.93
Q4	325	1	4	2.70	0.94
Q5	324	1	4	2.39	0.92
Q6	324	1	4	2.36	0.91
Q7	323	1	4	2.32	1.02
Q8	325	1	4	2.35	0.83
Q9	324	1	4	2.15	0.88
Q10	325	1	4	2.44	0.87
Q11	326	1	4	2.44	0.87
Q12	324	1	4	2.66	0.87
Q13	325	1	4	2.70	0.79
Q14	322	1	4	2.86	0.93
Q15	319	1	4	2.39	0.93
Q16	324	1	4	2.22	0.96
Q17	323	1	4	2.05	1.00
Q18	324	1	4	2.79	0.83
Q19	323	1	4	2.55	0.84
Q20	323	1	4	2.57	0.94
Q21	325	1	4	2.42	0.87
Q22	325	1	4	2.31	1.15
Q23	325	1	4	2.33	0.96
Q24	325	1	4	2.66	0.89
Q25	325	1	4	3.01	0.89
Q26	324	1	4	2.87	0.76
Q27	325	1	4	2.47	0.84
Q28	324	1	4	2.66	0.73
Q29	324	1	4	2.49	0.86
Q30	323	1	4	2.72	0.75
Q31	322	1	4	2.69	0.80
Q32	323	1	4	2.88	0.66
Q33	324	1	4	2.81	0.80
Q34	323	1	4	2.64	0.81
Q35	323	1	4	2.50	0.82
Q36	323	1	4	2.57	0.79
Q37	322	1	4	2.86	0.71
Q38	321	1	4	2.66	0.80
Q39	321	1	4	3.03	0.71
Q40	321	1	4	2.54	0.79
Q41	322	1	4	2.81	0.84
Q42	323	1	4	2.82	0.93
Q43	322	1	4	2.69	0.86

	N	Minimum	Maximum	Mean	Std. Deviation
Q44	323	1	4	2.56	0.88
Q45	323	1	4	2.30	0.82
Q46	324	1	4	2.63	0.81
Q47	323	1	4	2.61	0.84
Q48	324	1	4	2.69	0.85
Q49	324	1	4	2.90	0.82
Q50	323	1	4	2.91	0.76
Q51	322	1	4	2.61	0.93
Q52	322	1	4	2.55	1.03
Q53	322	1	4	2.75	0.90
Q54	322	1	4	2.58	0.85
Q55	323	1	4	2.56	0.86
Q56	322	1	4	2.62	0.83
Q57	322	1	4	2.47	0.97
Q58	324	1	4	2.76	0.92
Q59	323	1	4	2.55	0.93
Q60	322	1	4	2.80	0.90
Q61	321	1	4	3.00	0.81
Q62	322	1	4	2.55	0.92
Q63	323	1	4	2.70	0.91
Q64	324	1	4	2.79	0.87
Q65	324	1	4	2.68	1.01
Q66	323	1	4	2.38	0.97
Q67	323	1	4	2.29	1.04
Q68	323	1	4	2.39	0.93
Q69	324	1	4	2.73	0.87
Q70	324	1	4	2.63	0.87
Q71	323	1	4	2.45	0.83
Q72	323	1	4	2.50	1.01
Q73	324	1	4	2.34	0.87
Q74	324	1	4	2.23	0.87
Q75	323	1	4	2.35	1.10
Q76	322	1	4	2.66	0.95
Q77	324	1	4	2.58	1.03
Q78	324	1	4	2.61	0.92
Q79	323	1	4	3.00	0.87
Q80	322	1	4	2.85	0.92
Q81	324	1	4	2.81	0.90
Q82	323	1	4	2.93	0.98
Q83	324	1	4	2.75	0.80
Q84	324	1	4	2.87	0.81
Q85	323	1	4	2.76	0.95
Q86	323	1	4	2.50	0.94
Q87	323	1	4	2.46	0.89

	N	Minimum	Maximum	Mean	Std. Deviation
Q88	324	1	4	2.47	0.89
Q89	324	1	4	2.17	0.96
Q90	324	1	4	2.32	1.13
Q91	323	1	4	2.35	1.04
Q92	323	1	4	2.19	1.06
Q93	323	1	4	2.18	1.03
Q94	324	1	4	2.50	1.00
Q95	324	1	4	2.78	0.86
Q96	323	1	4	2.76	0.89
Q97	323	1	4	2.12	1.04
Q98	324	1	4	2.53	0.96
Q99	323	1	4	2.54	0.85
Q100	323	1	4	2.51	0.81
Q101	323	1	4	2.80	0.83
Q102	322	1	4	2.76	0.88
Q103	323	1	4	2.14	0.87
Q104	323	1	4	1.85	0.92
Q105	323	1	4	1.84	0.95
Q106	323	1	4	1.85	0.83
Q107	323	1	4	1.89	0.90
Q108	322	1	4	1.87	0.89
Q109	324	1	4	1.98	0.87
Q110	323	1	4	1.70	0.77
Q111	323	1	4	1.88	0.95
Q112	321	1	4	1.66	0.85
Q113	318	1	4	1.80	1.06
Q114	318	1	4	1.62	0.86
Q115	319	1	4	1.71	0.98
Q116	319	1	4	1.65	0.97
Q117	318	1	4	1.73	0.93
Q118	319	1	4	1.46	0.83
Valid N (listwise)	304				

4.3.2 Exploratory Factor Analysis

4.3.2.1 The Analysis

A 28-factor solution was generated and items loading above 0.3 were identified. Those loading above 0.3 on two or more factors were placed on the factor with the highest loading provided the difference in the squared loading was ± 10% of the lowest. Loadings that met these criteria are presented in the rotated component matrix (see Table 4.3.2.1.1). Eight factors had four or more items loading >0.3.

Table 4.3.2.1.1

Rotated component matrix (N = 327)

Factor	2	4	6	8	17	18	19	23
Q1		.739						
Q2		.606						
Q3		.554						
Q4		.523						
Q5		.356						
Q6								
Q7		.635						
Q8					.838			
Q9					.521			
Q10		.525						
Q11		.532						
Q15					.726			
Q16					.770			
Q17					.560			
Q19		.402						
Q21		.558						
Q23					.568			
Q28					.419			
Q29					.521			
Q64							.418	
Q65							.685	
Q66					.436			
Q73							.806	
Q83								.511
Q84								.818
Q85								.547
Q86								.644
Q89			.772					
Q90			.853					
Q91			.355					
Q93			.461					
Q94			.511					
Q96							.362	
Q97						.498		
Q103	.769							
Q104	.775							
Q105	.763							
Q106	.692							
Q107	.780							
Q108	.801							
Q109	.762							
Q110	.569							
Q111						.753		
Q112						.846		
Q113						.761		
Q114						.748		
Q115				.888				
Q116				.899				
Q117				.902				
Q118				.870				

4.3.2.2 The Factors and Constituent Items

The respective items, their origin in the original instrument and their wording are presented in Tables 4.3.2.2.1 to 4.3.2.2.8. For example, Table 4.3.2.2.1 presents the eight items which loaded on Factor 2. These items were in the *ability belief and effort belief* sections of the original instrument and theoretical framework. Consequently, this factor was labelled *Ability and Effort Beliefs*. A similar process of operational definition was applied to the other seven factors. Since most of the respective items were grouped according to the original framework, many of the factors were named accordingly.

Table 4.3.2.2.1
Items comprising Factor 2 - Ability and Effort Beliefs

Item number	Stem Statement	Wording
103.	I will not sign up for an e-learning class:	Because I don't have what it takes to do well in this class
104.		Because I don't have the knowledge required to succeed in this class
105.		Because I'm not good at university
106.		Because the tasks demanded of me went beyond my abilities
107.		Because I'm a bit lazy
108.		Because I do not feel like doing it
109.		Because I am too busy with my homework
110.		Because I don't have the energy to study

Table 4.3.2.2.2

Items comprising Factor 4- Reflection

Item number	Stem Statement	Wording
1.	During or after e-learning:	The way I learn is continuously changing
2.		As I am learning, I may change the way I learn
3.		The experience I gained changed my learning habits
4.		My past and present experiences will take control of how I complete future activities
5.		I use references or other literature to strengthen my point of view in e-learning activities
6.		Looking back at my learning enables me to know how successful I am
7.		I step back from what I am doing in order to understand my progress in e-learning
10.		I try to be my own critic and look at my work from a significant viewpoint
11.		I summarize my learning in the course to examine my understanding of what I have learned
19.		I set specific goals before I begin a task in e-learning
21.		I organize my time to best achieve my goals in e-learning

Table 4.3.2.2.3

Items comprising Factor 6- Introjected Regulation

Item number	Stem Statement	Wording
89.	I sign up for an e-learning	So that the teacher won't punish me
90.	class:	Because that's the rule
91.		Because I want the instructor to think I am a good student
93.		Because I would feel ashamed if I do not
94.		Because it bothers me when I don't

Table 4.3.2.2.4
Items comprising Factor 8- Task Character

Item number	Stem Statement	Wording
115	I will not sign up for an	Because I find that studying is not excited
116	e-learning class:	I don't like studying
117		Because I have the impression that it's always the same thing everyday
118		Because my assignment is not stimulating

Table 4.3.2.2.5
Items comprising Factor 17- Strategic Use

Item number	Stem Statement	Wording
8.	During or after e-learning:	It's easier to understand my performance after I have finished the work on e-learning
9.		I find it easy to assess my progress while I'm still completing the work in e-learning
15.		My e-learning discussion activities allow me to express how I arrived to my conclusions
16.		My e-learning activities help me to recognize how I plan to achieve my future learning
17.		My e-learning activities help me to know which strategies can be applied to other learning situation
23.		I write down notes of the different learning strategies between class room environment learning and e-learning
28.		I am able to use my previous knowledge to solve problem during reasoning
29.		I am able to assess the challenges encountered during reasoning

Table 4.3.2.2.6
Items comprising Factor 18- Value of Task

Item number	Stem Statement	Wording
97.	I will not sign up for an	Because I follow my friends
111.	e-learning class:	Because, for me, school holds no interest
112.		Because studying is not valuable to me
113.		Because I have no good reason to study
114.		Because studying is not important to me

Table 4.3.2.2.7
Items comprising Factor 19- Stimulus Response

Item number	Stem Statement	Wording
62.	During or after e-learning:	I was given feedback on my performance as the e-learning course proceeded
64.		Providing different sounds and images stimulates my learning
65.		E-learning should have attractive features that motivated me
73.		The instructor helps me to imagine real-life application of learned material

Table 4.3.2.2.8
Items comprising Factor 23- Recognition

Item number	Stem Statement	Wording
83.	During or after e-learning:	I am more motivated if recognition is visible to others
84.		I am happier when the instructor recognises my work
85.		I like people to admire me
86.		I want classmates to think I am knowledgeable

4.3.3 Rasch Analysis

The respective data from each of the eight factors was subject to Rasch rating scale model analysis using the computer program RUMM2030 (RUMMLAB, 2007). For each factor, the following statistics or graphical displays were generated:

- Summary Test-of-Fit Statistics
- Threshold Map
- Individual Item Fit
- Item Characteristic Curves
- Personal-Item Threshold Distribution.

4.3.3.1 Factor 2 – Ability and Effort Beliefs

4.3.3.1.1 Summary Test-of-Fit statistics

In determining the global fit to the measurement model, the data were entered into RUMM2030 software (RUMMLAB, 2007) which estimates an item-person interaction and a person-item interaction. The item-person test-of-fit examines the response patterns for item across persons and the person-item test-of-fit examines the response pattern for person across items. This process enables the testing of how well the observed data fitted the requirements of the measurement model. In an ideal data fit for the measurement model, the mean should be approaching zero and

the standard deviation should be close to1.0. Furthermore, negative fit statistics indicate a response pattern that fits the model very closely and positive fit statistics indicate that other aspects are present such as 'noise' (see Andrich, 1985).

The item-student test-of-fit indicates that there is very good consistency of *Ability and Effort Beliefs* and item response patterns (see Table 4.3.3.1.1.1). This can be shown in the mean standardised item fit residual which is -0.65 and with SD 1.44, which are close to the ideal of zero and one. The mean standardised student-item fit residual is -0.63 and its SD is 1.62 which is very good. Negative fit statistics (-0.65 and -0.63) indicate response pattern that fits the model closely (see Andrich, 1985).

Table 4.3.3.1.1.1
Global fit statistics for Ability and Effort Beliefs in an e-learning environment

	Items		**Persons**	
	Location	Fit Residual	Location	Fit Residual
Mean	0.00	-0.65	1.44	-0.63
SD	0.29	1.44	1.80	1.62

Chi-square is not significant (<0.05) for the item-trait interaction statistic where, "the hierarchical ordering of the items varies across the trait, thus compromising the required property of invariance" (Pallant & Tennant, 2007, p. 5). In other words, data is multidimensional when the chi-square probabililty value is <0.05 (Young & Cavanagh, 2009). The result of Chi-square (0.00) (see Table 4.3.3.1.1.2) indicates that there is not a good collective agreement between *Ability and Effort Beliefs* in an e-learning environment for all item difficulties. This suggests that the data does not focus on "one attribute or dimension at a time" (Bond & Fox, 2007, p. 32) and is thus multidimensional.

Table 4.3.3.1.1.2
Item-trait Interaction

Total Item Chi Square	84.20
Total Deg. of Freedom	32.00
Total Chi-Square Probability	0.00

The Person Separation Index (PSI) is also used to estimate internal consistency reliability. According to Andrich and Schoubroeck (1989), this "index is constructed as the ratio of the estimated true variance among the persons and the estimated observed variance among the persons using the estimates of their locations

and the standard errors of these locations" (p. 483). The Index of Separation is considered true (a good measurement) if it is 0.9 or higher. This indicates the balanced-spread of measurements along the linear scale in comparison with the errors. And, "the ideal spread distribution of affirmation locations would result in an index approaching 1.0" (Young & Cavanagh, 2009, p. 8).

The Person Separation Index in Table 4.3.3.1.1.3 is 0.90 and this indicates a well-spread distribution along the linear scale. Based on the index in Table 4.3.3.1.1.3, the power of the test-of-fit is considered to be excellent.

Table 4.3.3.1.1.3
Person Separation Index

Separation Index	0.90
Power of Test-of-Fit	Power is EXCELLENT

4.3.3.1.2 Category Probability Curves and Threshold Map

The RUMM2020 provides response category curves for each item which makes it possible to view the extent to which the students selected the response categories logically and consistently. An example of Category Probability Curves showing the ideal ordering of response categories (thresholds) is shown in Figure 4.3.3.1.2.1 (Item 103). This was an item for which students were asked to rate their *Ability and Effort Beliefs* level for "*I will not sign up for an e-learning class because I don't have what it takes to do well in this class*". The probability of a category being chosen was plotted on the vertical axis and person location (respondent overall affirmativeness) was plotted on the horizontal axis. "Persons with ability to affirm more difficult items are located at the right of the horizontal axis and those with less ability lie to the left" (Young & Cavanagh, 2010, p. 8). Also, since the items were written in a negative form, the scores were reversed prior to data analysis. The reversed scores were (1) *All of the time* (*Curve 3*), (2) *Most of the time* (*Curve 2*), (3) *Some of the time* (*Curve 1*) and (4) *Little or none of the time* (*Curve 0*).

The category 0 curve indicates that a student located at -3.00 logits had a probability of choosing the *little or none of the time* category of around +0.77 logits. This probability decreases to +0.02 for students with affirmativeness of +1.00 logits (see Figure 4.3.3.1.2.1).

The category 1 curve indicates that the probability of students located at -3.00 logits answering *Some of the time* is +0.21, increasing to +0.60 for students scoring –-0.8 logits, and then decreasing to a probability of +0.05 for students located at +3.00 logits (see Figure 4.3.3.1.2.1).

The category 2 curve indicates that the probability of students located at -3.00 logits answering *Most of the time* is 0.00, increasing to +0.68 for students scoring +1.80 logits, and then decreasing to a probability of +0.45 for students located at +3.00 logits (see Figure 4.3.3.1.2.1).

The category 3 curve indicates that a student located at -0.07 logits had a probability of choosing the *All of the time* category of around 0.00. This probability increases to +0.45 for students with +3.00 logits affirmativeness (see Figure 4.3.3.1.2.1).

Curves 0 and 1 intersect at the person location of -1.75 logits. This is the point where there is an equal probability of selecting either category of - the threshold for *Little or none of the time* and *Some of the time* categories. The threshold (*Some of the time and Most of the time*) for Curves 1 and 2 is +0.30 and for Curves 2 and 3 is +3.00 (see Figure 4.3.3.1.2.1). These thresholds are ordered by increasing value and show the respondents were logical and not idiosyncratic in their choice of response categories.

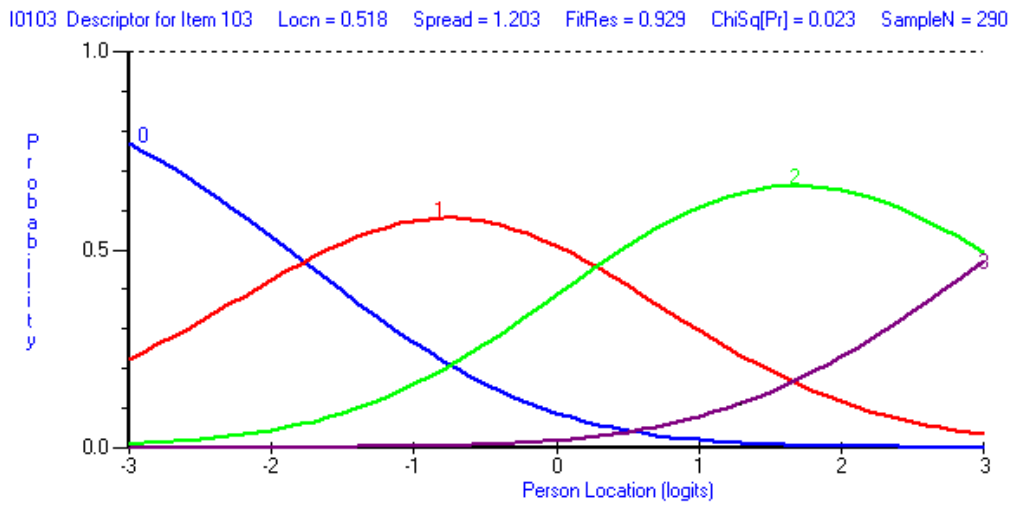

Figure 4.3.3.1.2.1. Category probability curves for item 103

The Category Probability Curves for Item 105 shows disordering of the thresholds (see Figure 4.3.3.1.2.2). This was an item in which students were asked to rate their *Ability and Effort Beliefs* level for "*I will not sign up for an e-learning class because I'm not good at university*". It was also reverse scored.

The threshold for Curves 0 and 1 is -0.50 logits and for Curves 1 and 2 is -0.8 logits and for Curves 2 and 3 is +1.60. These thresholds are not sequenced as would be expected if the students chose response categories in a logical manner. The students were confounded in their choice of the less affirmative response categories (see Figure 4.3.3.1.2.2).

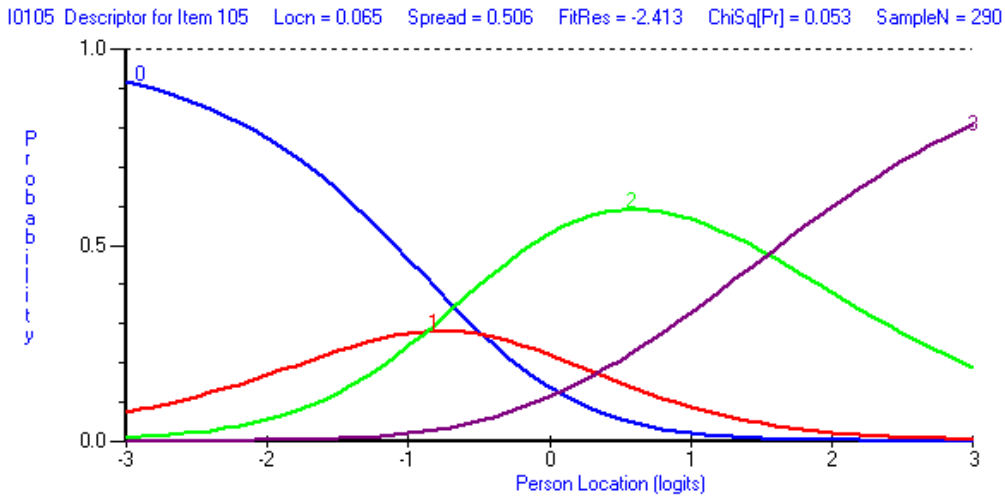

Figure 4.3.3.1.2.2. Category probability curves for Item 105

The threshold of the conceptual model for *Ability and Effort Beliefs* which consists of eight items will be examined. According to Pallant and Tennant (2007), "the pattern of threshold is to examine the disordering that may be affecting the fit" (p. 8). Also, threshold is used to inspect "the point between two response categories where either response is equally probable" (Pallant & Tennant, 2007, p. 6).

The Threshold map in Figure 4.3.3.1.2.3 provides a summary of the thresholds displayed in the eight Category probability Curves. The thresholds for Items 105 and 110 are not plotted because these were disordered (Item 105: *I will not sign up for an e-learning class because I'm not good at university* and Item 110: *I will not sign up for an e-learning class because I don't have the energy to study*).

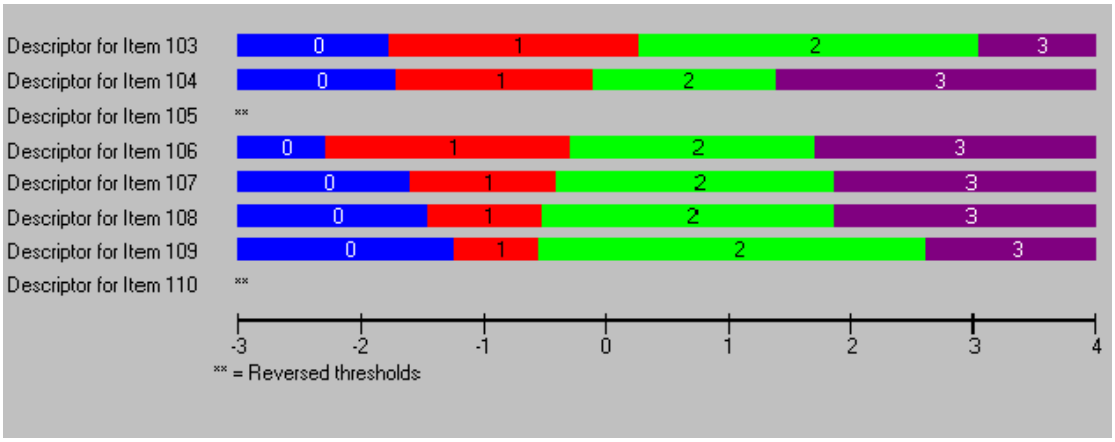

Figure 4.3.3.1.2.3. Threshold map for Ability and Effort Beliefs

4.3.3.1.3 Individual Item Fit and Item Characteristic Curves

Fit provides information on "how well items fit the underlying construct" (Bond & Fox, 2007, p. 35). Also, "fit indices help the investigator to ascertain whether the assumption of unidimensionality holds up empirically. Items that do not fit the unidimensional construct are those that diverge unacceptably from the expected ability/difficulty pattern" (Bond & Fox, 2007, p. 35). The common practice is to remove data for misfitting items or at the least to raise questions about external construct validity (Pallant & Tennant, 2007).

Table 4.3.3.1.3.1 summarises fit statistics for all eight items including the residuals. Residuals are the differences between the actual response and the response estimated from the Rasch measurement parameters. In other words, a raw residual is the difference between the observed and the expected response (see Bond & Fox, 2007). The residuals of Table 4.3.3.1.3.1 are derived from the raw residuals by standardising them. The fit residuals reported in RUMM are log transformed natural fit residuals. A good fit of residual is supposed to be within -2.5 and +2.5. From the Table 4.3.3.1.3.1, the items have acceptable residuals except for Item 108 (-2.58) which is slightly out of ±2.5 range. In general, the Table 4.3.3.1.3.1 shows that the items have a good fit to the measurement model.

Table 4.3.3.1.3.1
Individual item fit statistics (I=103,104,105,106,107,108,109 & 110, N= 290)

Item	Location	SE	Residual	Degree of Freedom	Chi-Square	Probability
103	0.52	0.10	0.93	249.88	11.30	0.02
104	-0.14	0.09	-1.93	249.88	15.74	0.00
105	0.07	0.09	-2.41	249.88	9.36	0.05
106	-0.29	0.10	0.41	249.88	8.67	0.07
107	-0.04	0.09	-0.46	249.88	10.01	0.04
108	-0.04	0.09	-2.58	249.01	5.28	0.26
109	0.28	0.09	0.32	250.74	10.92	0.03
110	-0.36	0.10	0.54	249.88	12.94	0.01

The mean of the three thresholds for each item is presented in the column labelled "Location". This is a measure of the difficulty the students had in affirming the item. The units are logits. The most difficult item to affirm was Item 103 (0.52 logits) and the easiest to affirm was Item 110 (-0.36 logits). Also a Chi-square is estimated for each item to show the interaction with the trait. When the data fits the model well, the probability value should be >0.05 or less when the Bonferoni adjustment is made.

An Item Characteristics Curve also shows a comparison between the observed and the expected scores. The curve is the distribution predicted by the model and the five dots are the observed scores for five class intervals (ability groups) of students. The vertical axis plots the expected value, the horizontal axis the students' scores for *Ability and Effort Beliefs*.

In Item 108 (Figure 4.3.3.1.3.1), students were asked to respond to the item: *I will not sign up for an e-learning class because I do not feel like doing it*. Each black dot represents the observed score for a group of students with the same ability for Item 108. When the observed scores closely follow the curve of expected values, the item is performing as expected, that is, the data fits the model. Item 108 shows a good fit to the measurement model with the probability >0.05 and with all students achieving the expected scores except for the second lowest group which is slightly under-performing and the highest group which is slightly over-performing.

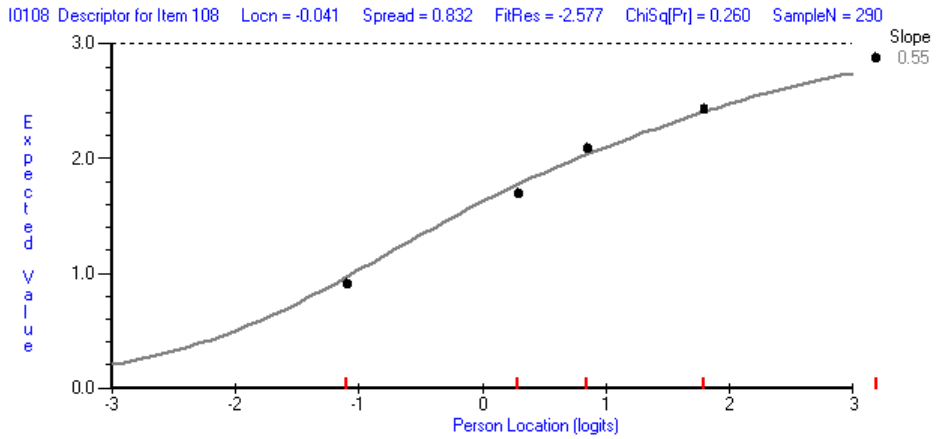

Figure 4.3.3.1.3.1. Item characteristic curves for item 108

4.3.3.1.4 Person-Item Threshold Distributions

According to Pallant & Tennant (2007), floor or ceiling effects are often the result of poor target measurement. That is, the distribution of item difficulties does not match the distribution of person affirmativeness. These are shown diagrammatically shown in Person-item Threshold Distributions (see Figure 4.3.3.1.4.1). The distribution of person is presented at the top half of the graph and the item thresholds are presented at the bottom half of the graph. The mean of person location is +1.44 logits. The respective threshold for eight items is distributed from "easy" on the left to "difficult" on the right.

In Figure 4.3.3.1.4.1, the logarithmic odds scale shows both item difficulty values from -2.50 logits (easy to affirm) to +3.25 logits (more difficult to affirm) with most questions ranged between -1.82 logits to +2.00 logits. The *Ability and Effort Beliefs* in an e-learning environment (distribution of person) measures from -1.80 logits (lower ability) to +4.80 logits (higher ability). The results of *Ability and Effort Beliefs* indicate a ceiling effect with the clustering of participants at the high end of the scale (indicating high levels of *Ability and Effort Beliefs*). Furthermore, the distribution of item thresholds indicates a shortfall in their distribution across the higher/"difficult" end of the construct (Figure 4.3.3.1.4.1) suggesting the potential for adding items which reflect levels of *Ability and Effort Beliefs* at the higher/"difficult" end of the scale.

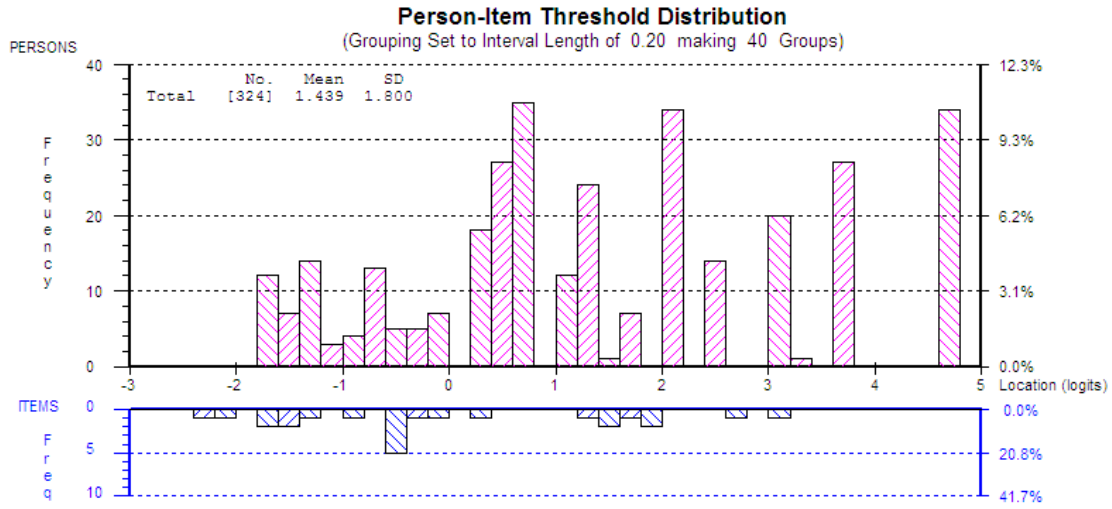

Figure 4.3.3.1.4.1. Person-item threshold distribution for Ability and Effort Beliefs in an e-learning environment scale

4.3.3.1.5 (a) Person frequency distribution – Gender

The *Ability and Effort Beliefs* scores for females and males are plotted in Figure 4.3.3.1.5.1. The female mean score was 1.53 (SD= 1.85) and the male mean score was 1.25 (SD= 1.69). The difference was not statistically significant (F=1.74, p>0.05).

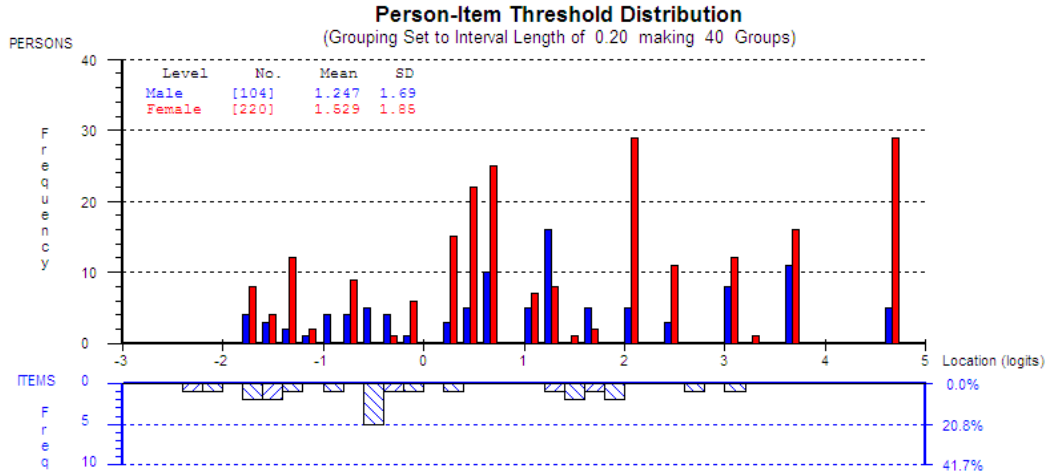

Figure 4.3.3.1.5.1. Person-item threshold distribution for Ability and Effort Beliefs in an e-learning environment scale by gender

4.3.3.1.5 (b) Person frequency distribution – Age

The *Ability and Effort Beliefs* scores for age between 17–20, between 21–24, between 25–28, between 29–32, between 33–36, between 37–40, between 41–44 and over 45 are plotted in Figure 4.3.3.1.5.2. The categories of respondents are:

Group 1: Age between 17-20 (Mean= 1.17, SD= 1.88)

Group 2: Age between 21-24 (Mean= 1.66, SD= 1.70)

Group 3: Age between 25-28 (Mean= 2.13, SD= 1.89)

Group 4: Age between 29-32 (no response received)

Group 5: Age between 33-36 (no response received)

Group 6: Age between 37-40 (no response received)

Group 7: Age between 41-44 (no response received)

Group 8: Age over 45 (Mean= -0.64, SD= 0.00).

The difference was not statistically significant (F=1.33, p>0.05).

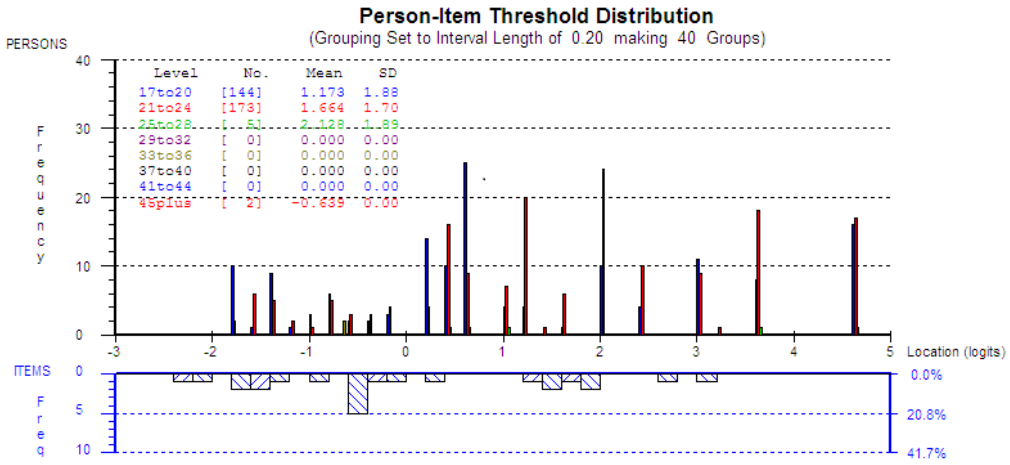

Figure 4.3.3.1.5.2. Person-item threshold distribution for Ability and Effort Beliefs in an e-learning environment scale by age

4.3.3.1.5 (c) Person frequency distribution – Year

The *Ability and Effort Beliefs* scores for first year, second year, third year, fourth year, fifth year and graduate year of study are plotted in Figure 4.3.3.1.5.3. The categories of respondents are:

Group 1: First year (Mean= 1.27, SD= 1.85)

Group 2: Second year (Mean= 1.82, SD= 1.54)

Group 3: Third year (Mean= 1.82, SD= 1.71)

Group 4: Fourth year (Mean= 4.61, SD= 0.00)

Group 5: Fifth year (no response received)

Group 6: Graduate year (no response received).

The difference was statistically significant (F=1.89, p>0.05).

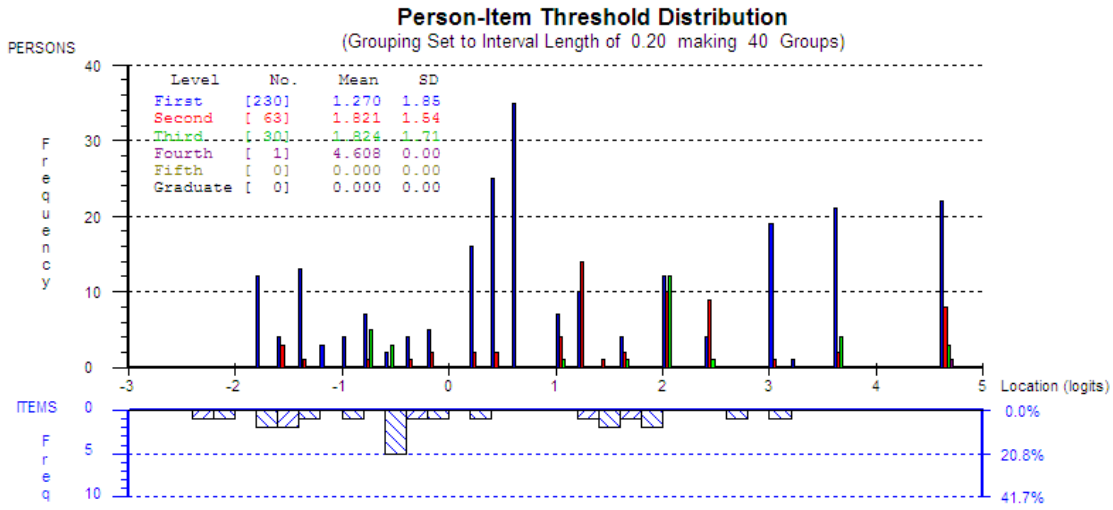

Figure 4.3.3.1.5.3. Person-item threshold distribution for Ability and Effort Beliefs in an e-learning environment scale by year

4.3.3.1.5 (d) Person frequency distribution – Ethnicity

The *Ability and Effort Beliefs* scores for Malay, Chinese, Indians, European, African, Middle Eastern and Others are plotted in Figure 4.3.3.1.5.4. The categories of respondents are:

Group 1: Malay (Mean= 1.03, SD= 1.60)

Group 2: Chinese (Mean= 1.75, SD= 1.88)

Group 3: Indian (Mean= 2.88, SD= 1.94)

Group 4: European (Mean= 0.59, SD= 0.31)

Group 5: African (no response received)

Group 6: Middle Eastern (no response received)

Group 7: Others (no response received).

The difference was statistically significant (F=4.37, p<0.05).

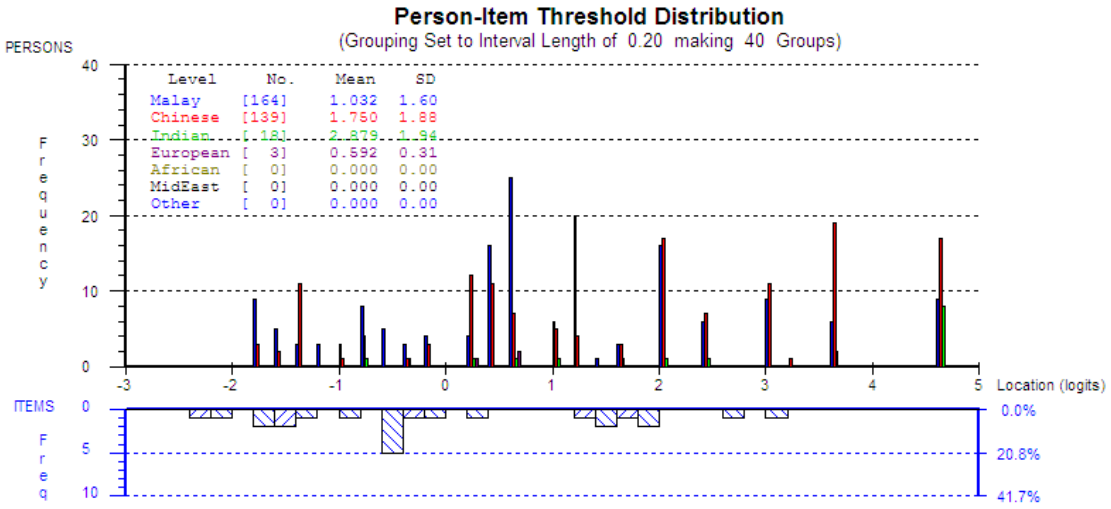

Figure 4.3.3.1.5.4. Person-item threshold distribution for Ability and Effort Beliefs in an e-learning environment scale by ethnicity

4.3.3.1.5(e) Person frequency distribution – School

The *Ability and Effort Beliefs* scores for Engineering, Computer Science, Management, Humanities, Mathematics, Industrial Technology, Education, Art and Biology are plotted in Figure 4.3.3.1.5.5. The categories of respondents are:

Group 1: Engineering (Mean= 0.23, SD= 0.00)

Group 2: Computer Science (Mean= 2.29, SD= 2.25)

Group 3: Management (Mean= 1.31, SD= 1.73)

Group 4: Humanities (Mean= 1.02, SD= 1.33)

Group 5: Mathematics (Mean= 1.79, SD= 1.99)

Group 6: Industrial Technology (Mean= 1.56, SD= 1.46)

Group 7: Education (Mean= 1.15, SD= 1.91)

Group 8: Art (Mean= 2.34, SD= 1.64)

Group 9: Biology (Mean= 1.47, SD= 1.83).

The difference was not statistically significant (F=1.87, p>0.05). However, the probability was only slightly above 0.05.

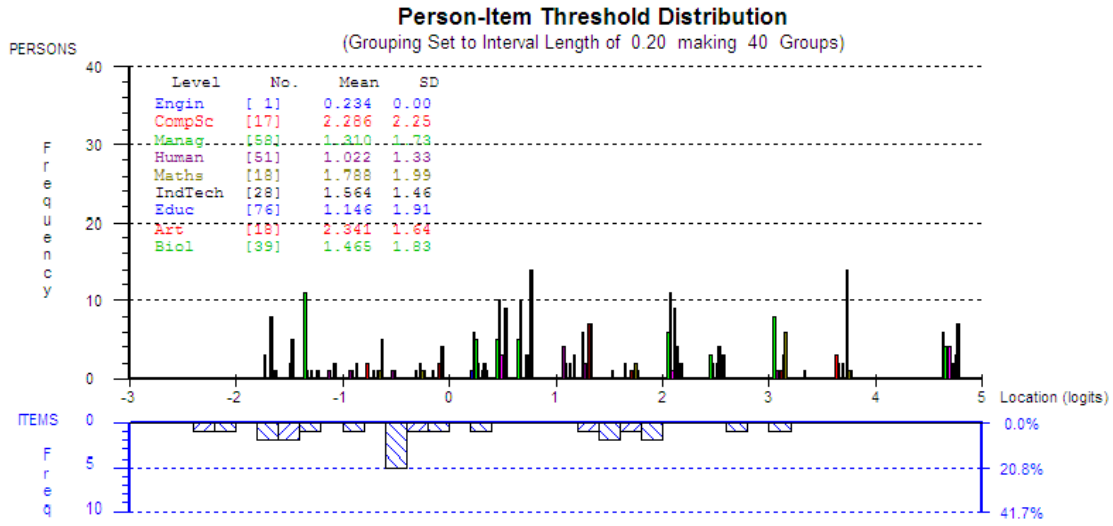

Figure 4.3.3.1.5.5. Person-item threshold distribution for Ability and Effort Beliefs in an e-learning environment scale by school

4.3.3.2 Factor 4 – Reflection

4.3.3.2.1 Summary of Test-of-Fit Statistics

The item-student test-of-fit indicates that there is good consistency of *Reflection* and item response patterns (see Table 4.3.3.2.1.1). This can be shown in the mean standardised item fit residual which is 0.23 and with SD 1.44, which are close to the ideal of zero and one. The mean standardised student-item fit residual is -0.33 and its SD is 1.34 which is good. A negative fit statistic (-0.33) indicates a response pattern that fits the model closely (see Andrich, 1985).

Table 4.3.3.2.1.1
Global fit statistics for Reflection in an e-learning environment

	Items		**Persons**	
	Location	Fit Residual	Location	Fit Residual
Mean	0.00	0.23	-0.13	-0.33
SD	0.28	1.45	1.02	1.34

The result of Chi-square (0.00) (see Table 4.3.3.2.1.2) indicates that there is not a good collective agreement between *Reflection* in an e-learning environment for all item difficulties. This suggests that the data does not focus on "one attribute or dimension at a time" (Bond & Fox, 2007, p. 32) and is thus multidimensional.

Table 4.3.3.2.1.2
Item-trait Interaction

Total Item Chi Square	269.365
Total Deg. of Freedom	44.00
Total Chi-Square Probability	0.00

The Person Separation Index in Table 4.3.3.2.1.3 is 0.83 and this indicates a relatively well-spread distribution along the linear scale. Based on the index in Table 4.3.3.2.1.3, the power of the test-of-fit is considered to be good.

Table 4.3.3.1.2.3
Person Separation Index

Separation Index	0.83
Power of Test-of-Fit	Power is GOOD

4.3.3.2.2 Threshold Map

The Threshold map in Figure 4.3.3.2.2.3 provides a summary of the thresholds displayed from the 11 Category Probability Curves. There were no disordered thresholds.

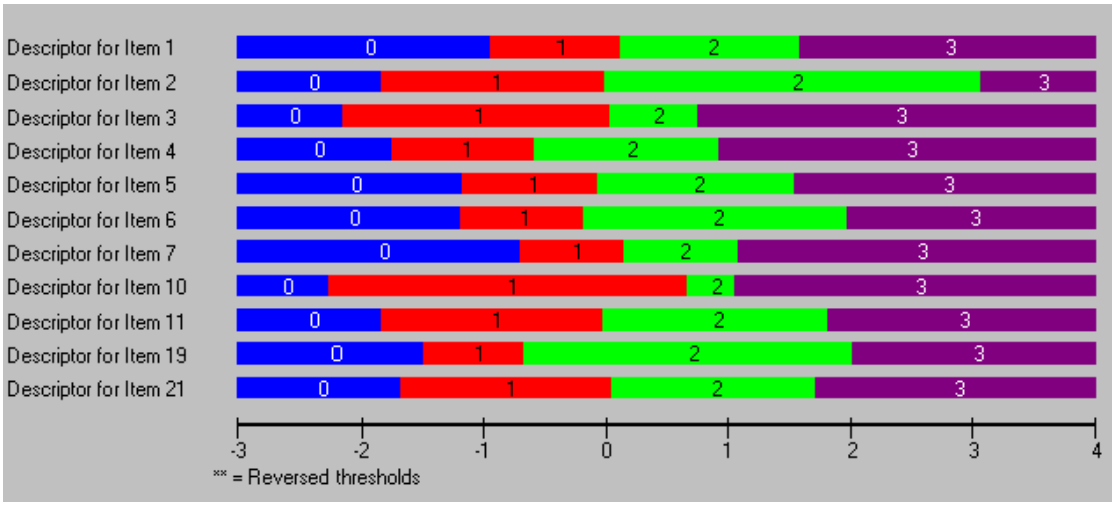

Figure 4.3.3.2.2.3. Threshold map for Reflection in an e-learning environment

4.3.3.2.3 Individual Item Fit

Table 4.3.3.2.3.1 summarises the fit statistics for all 11 items including the residuals. The items have acceptable residuals except for Item 19 (+2.75) which is slightly out of +2.5 range. In general, the Table 4.3.3.1.3.1 shows that the items have a good fit to the measurement model. Also, the difficulties of the items ranged from -0.47 logits (easy) to 0.40 logits (difficult).

Table 4.3.3.2.3.1
Individual item fit statistics (I=1, 2, 3, 4, 5, 6, 7, 10, 11, 19 & 21, N=326)

Item	Location	SE	Residual	Degree of Freedom	Chi-Square	Probability
1	0.25	0.07	-1.34	293.34	10.96	0.03
2	0.40	0.09	-1.14	293.34	7.74	0.10
3	-0.46	0.07	0.25	293.34	22.03	0.00
4	-0.47	0.07	0.44	292.44	9.05	0.06
5	0.10	0.07	2.49	291.54	29.86	0.00
6	0.20	0.08	0.05	291.54	11.98	0.02
7	0.18	0.07	0.63	290.64	41.23	0.00
10	-0.18	0.08	-1.43	292.44	16.39	0.00
11	-0.02	0.08	-1.09	293.34	24.82	0.00
19	-0.04	0.08	2.75	290.64	54.10	0.00
21	0.03	0.08	0.91	292.44	41.22	0.00

4.3.3.2.4 Person-Item Threshold Distributions

The mean of person location from Figure 4.3.3.2.4.1 is -0.13 logits. The respective threshold for 11 items is distributed from “easy” on the left to “difficult” on the right.

Figure 4.3.3.2.4.1, the logarithmic odds scale, shows both item difficulty values from -2.40 logits (easy to affirm) to +3.25 logits (more difficult to affirm) with most questions ranged between -1.50 logits to +1.30 logits. The *Reflection in an e-learning environment* (distribution of person) measures from -2.40 logits (lower ability) to +3.25 logits (higher ability). The results of *Reflection* indicate neither a floor nor ceiling effect with the clustering of participants in the middle of the scale (indicating well distributed).

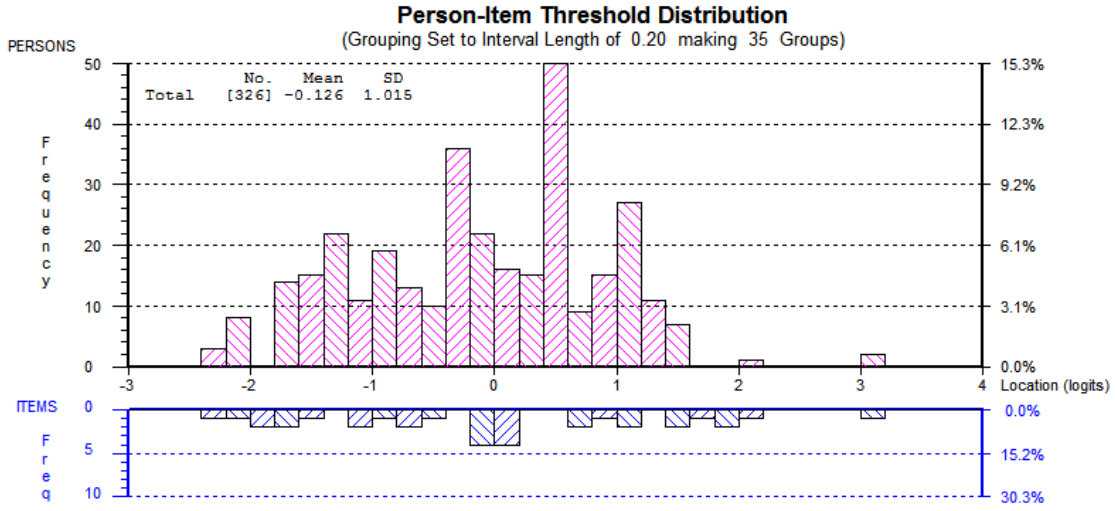

Figure 4.3.3.2.4.1. Person-item threshold distribution for Reflection in an e-learning environment scale

4.3.3.2.5 (a) Person frequency distribution – Gender

The *Reflection* scores for females and males are plotted in Figure 4.3.3.2.5.1. The female mean score was -0.14 (SD= 0.99) and the male mean score was-0.11 (SD= 1.07). The difference was not statistically significant (F=0.06, p>0.05)

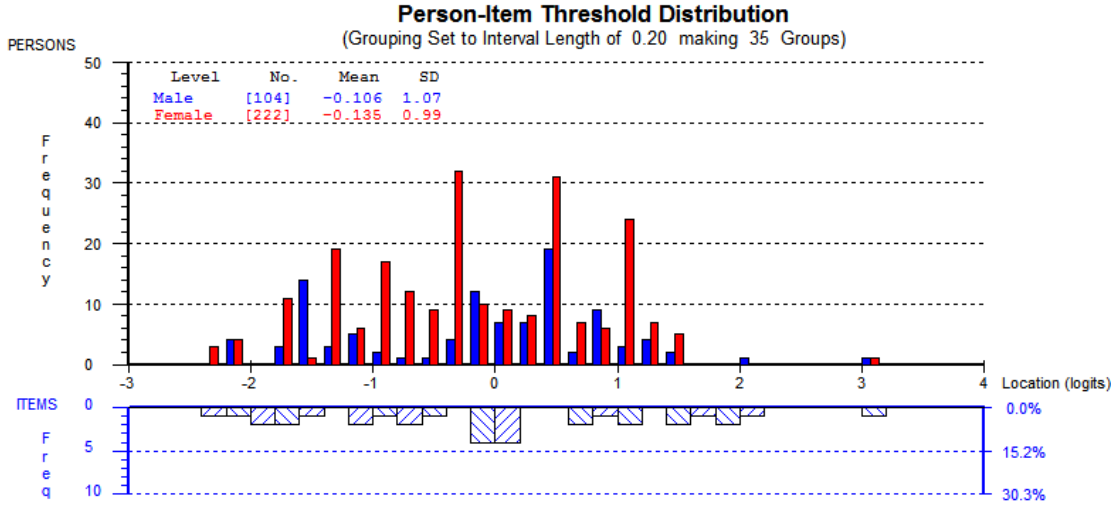

Figure 4.3.3.2.5.1. Person-item threshold distribution for Reflection in an e-learning environment scale by gender

4.3.3.2.5 (b) Person frequency distribution – Age

The *Reflection* scores for age between 17–20, between 21–24, between 25–28, between 29–32, between 33–36, between 37–40, between 41–44 and over 45 are plotted in Figure 4.3.3.2.5.2. The categories of respondents are:

Group 1: Age between 17-20 (Mean= 0.09, SD= 0.92)

Group 2: Age between 21-24 (Mean= -0.32, SD= 1.07)

Group 3: Age between 25-28 (Mean= 0.21, SD= 0.52)

Group 4: Age between 29–32 (no response received)

Group 5: Age between 33–36 (no response received)

Group 6: Age between 37–40 (no response received)

Group 7: Age between 41–44 (no response received)

Group 8: Age over 45 (Mean= 0.35, SD= 0.00).

The difference was not statistically significant (F=2.01, p>0.05)

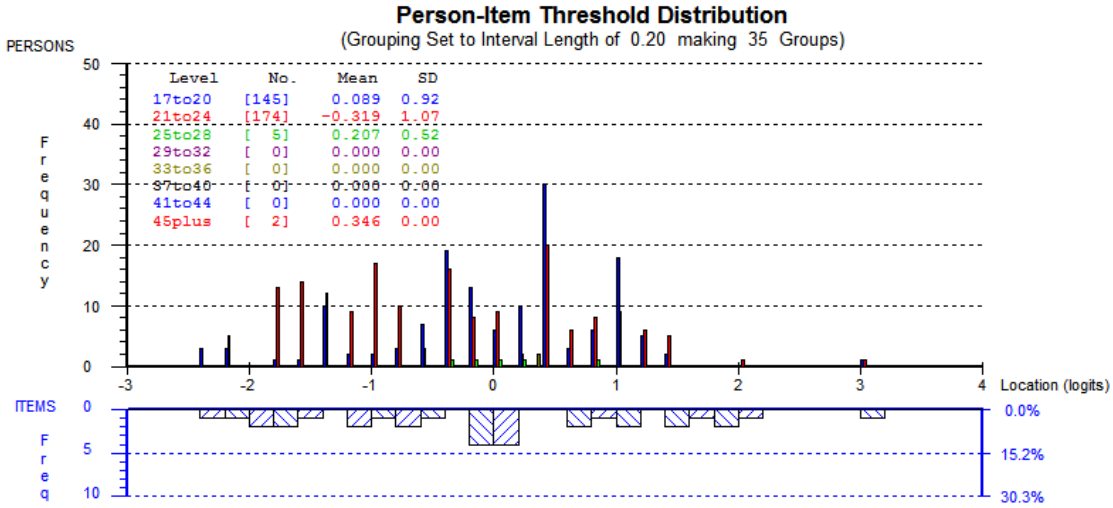

Figure 4.3.3.2.5.2. Person-item threshold distribution for Reflection in an e-learning environment scale by age

4.3.3.2.5 (c) Person frequency distribution – Year

The *Reflection* scores for first year, second year, third year, fourth year, fifth year and graduate year of study are plotted in Figure 4.3.3.2.5.3. The categories of respondents are:

Group 1: First year (Mean= 0.03, SD= 1.04)

Group 2: Second year (Mean= -0.48, SD= 0.90)

Group 3: Third year (Mean= -0.59, SD= 0.72)

Group 4: Fourth year (Mean= 0.35, SD= 0.00)

Group 5: Fifth year (no response received)

Group 6: Graduate year (no response received).

The difference was statistically significant (F=4.21, p<0.05)

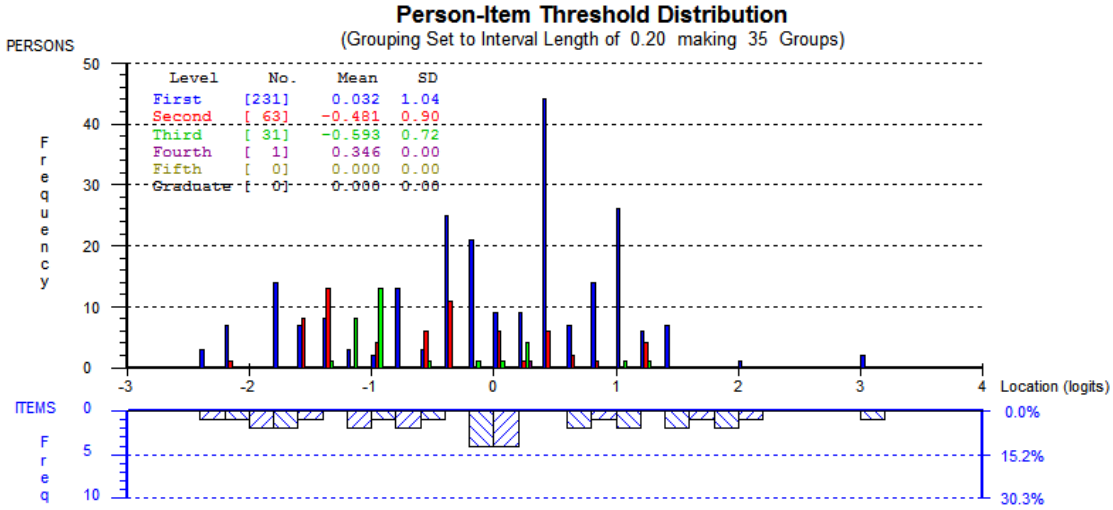

Figure 4.3.3.2.5.3. Person-item threshold distribution for Reflection in an e-learning environment scale by year

4.3.3.2.5 (d) Person frequency distribution – Ethnicity

The *Reflection* scores for Malay, Chinese, Indians, European, African, Middle Eastern and Others are plotted in Figure 4.3.3.2.5.4. The categories of respondents are:

Group 1: Malay (Mean= -0.11, SD= 1.00)

Group 2: Chinese (Mean= -0.17, SD= 1.08)

Group 3: Indian (Mean= 0.13, SD= 0.69)

Group 4: European (Mean= -0.25, SD= 0.26)

Group 5: African (no response received)

Group 6: Middle Eastern (no response received)

Group 7: Others (no response received).

The difference was not statistically significant (F=0.25, p>0.05)

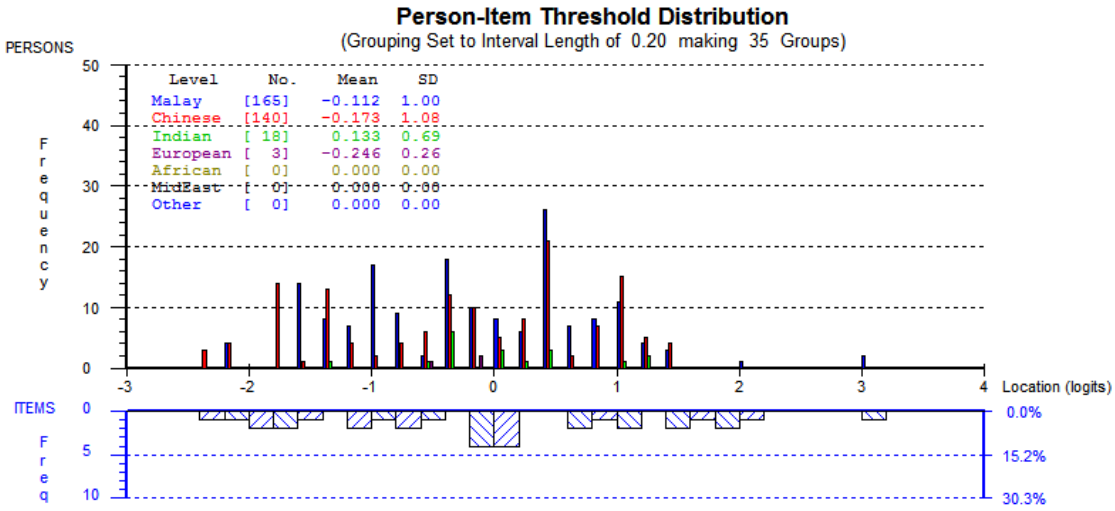

Figure 4.3.3.2.5.4. Person-item threshold distribution for Reflection in an e-learning environment scale by ethnicity

4.3.3.2.5(e) Person frequency distribution – School

The *Reflection* scores for Engineering, Computer Science, Management, Humanities, Mathematics, Industrial Technology, Education, Art and Biology are plotted in Figure 4.3.3.2.5.5. The categories respondents are:

Group 1: Engineering (Mean= -1.19, SD= 0.00)

Group 2: Computer Science (Mean= -0.12, SD= 0.87)

Group 3: Management (Mean= 0.34, SD= 0.87)

Group 4: Humanities (Mean= -0.12, SD= 0.85)

Group 5: Mathematics (Mean= -0.62, SD= 1.10)

Group 6: Industrial Technology (Mean= -0.73, SD= 0.79)

Group 7: Education (Mean= -0.28, SD= 1.12)

Group 8: Art (Mean= -0.34, SD= 1.30)

Group 9: Biology (Mean= 0.48, SD= 0.73).

The difference was statistically significant ($F=6.30$, $p<0.05$).

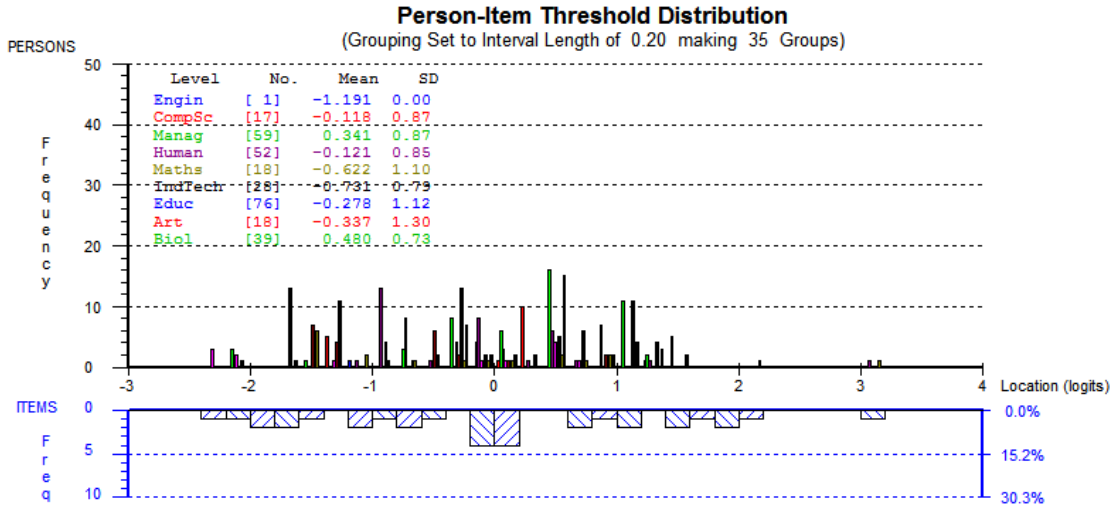

Figure 4.3.3.2.5.5. Person-item threshold distribution for Reflection in an e-learning environment scale by school

4.3.3.3 Factor 6 – Introjected Regulation

4.3.3.3.1 Summary Test-of-Fit Statistics

The item-student test-of-fit indicates that there is good consistency of *Introjected Regulation* and item response patterns (see Table 4.3.3.3.1.1). This can be shown in the mean standardised item fit residual which is 0.40 and with SD 1.26, which are close to the ideal of zero and one. The mean standardised student-item fit residual is -0.48 and its SD is 1.42 which is good. A negative fit statistic (-0.48) indicates a response pattern that fits the model closely (see Andrich, 1985).

Table 4.3.3.3.1.1
Global fit statistics for Introjected Regulation in an e-learning environment

	Items		**Persons**	
	Location	Fit Residual	Location	Fit Residual
Mean	0.00	0.40	-0.38	-0.48
SD	0.33	1.26	1.23	1.42

The result of Chi-square (0.00) (see Table 4.3.3.3.1.2) indicates that there is not a good collective agreement between *Introjected Regulation* in an e-learning environment for all item difficulties. This suggests that the data does not focus on "one attribute or dimension at a time" (Bond & Fox, 2007, p. 32) and is thus multidimensional.

Table 4.3.3.3.1.2
Item-trait Interaction

Total Item Chi Square	76.61
Separation Index	0.79
Total Deg. of Freedom	20.00
Total Chi-Square Probability	0.00

The Person Separation Index in Table 4.3.3.3.1.3 is 0.79 and this indicates a relatively well-spread distribution along the linear scale. Based on the index in Table 4.3.3.3.1.3, the power of the test-of-fit is considered to be good.

Table 4.3.3.3.1.3
Person Separation Index

Separation Index	0.79
Power of Test-of-Fit	Power is GOOD

4.3.3.3.2 Threshold Map

The Threshold map in Figure 4.3.3.3.2.3 provides a summary of the thresholds displayed from the four Category Probability Curves. The thresholds for Item 93 were not plotted because this was disordered (Item 93: *I sign up for e-learning class because would feel ashamed if I do not).*

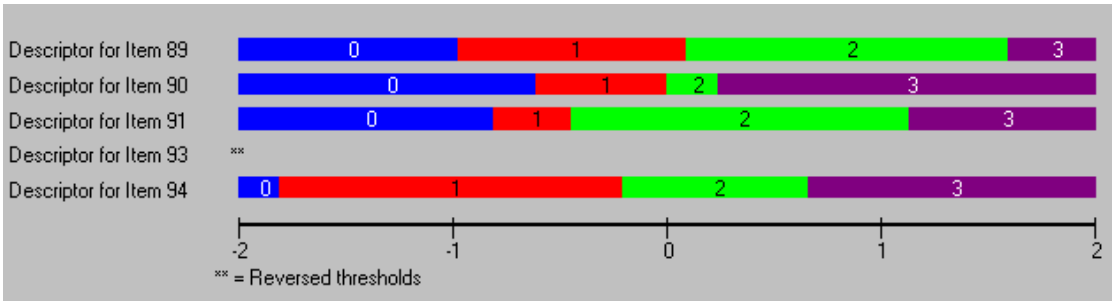

Figure 4.3.3.3.2.3. Threshold map for Introjected Regulation in an e-learning environment

4.3.3.3.3 Individual Item Fit

Table 4.3.3.3.3.1 summarises fit statistics for all five items including the residuals. All items have acceptable residuals and Table 4.3.3.3.3.1 shows that the items have a good fit to the measurement model. Also, the difficulties of the items ranged from -0.46 logits (easy) to 0.39 logits (difficult).

Table 4.3.3.3.3.1
Individual item fit statistics (I=89, 90, 91, 93 & 94, N=297)

Item	Location	SE	Residual	Degree of Freedom	Chi-Square	Probability
89	0.23	0.08	-0.15	234.72	15.44	0.00
90	-0.13	0.07	-0.07	234.72	7.36	0.12
91	-0.05	0.07	1.37	233.93	2.39	0.65
93	0.39	0.07	-1.14	233.93	9.03	0.60
94	-0.46	0.08	1.98	234.72	40.40	0.00

4.3.3.3.4 Person-Item Threshold Distributions

The mean of person location from Figure 4.3.3.3.4.1 is -0.38 logits. The respective threshold for five items is distributed from "easy" on the left to "difficult" on the right.

In Figure 4.3.3.3.4.1, the logarithmic odds scale, shows both item difficulty values from -1.95 logits (easy to affirm) to +1.95 logits (more difficult to affirm) with most questions ranged between -1.00 logits to +0.50 logits. The *Introjected Regulation* in an e-learning environment (distribution of person) measures from -3.10 logits (lower ability) to +3.33 logits (higher ability). The results of *Introjected Regulation* indicate neither a floor nor ceiling effect with the clustering of participants in the middle of the scale (indicating well distributed). However, there is one group scoring below the easy to affirm logits (-3.10) and two groups scoring above the more difficult to affirm logits (+2.20 and +3.20). Furthermore, the distribution of item thresholds indicates a shortfall in their distribution across the higher/"difficult" and lower/"easy" ends of the construct (Figure 4.3.3.3.4.1) suggesting the potential for adding items which reflect levels of *Introjected Regulation* at the higher/"difficult" and lower/"easy" ends of the scale.

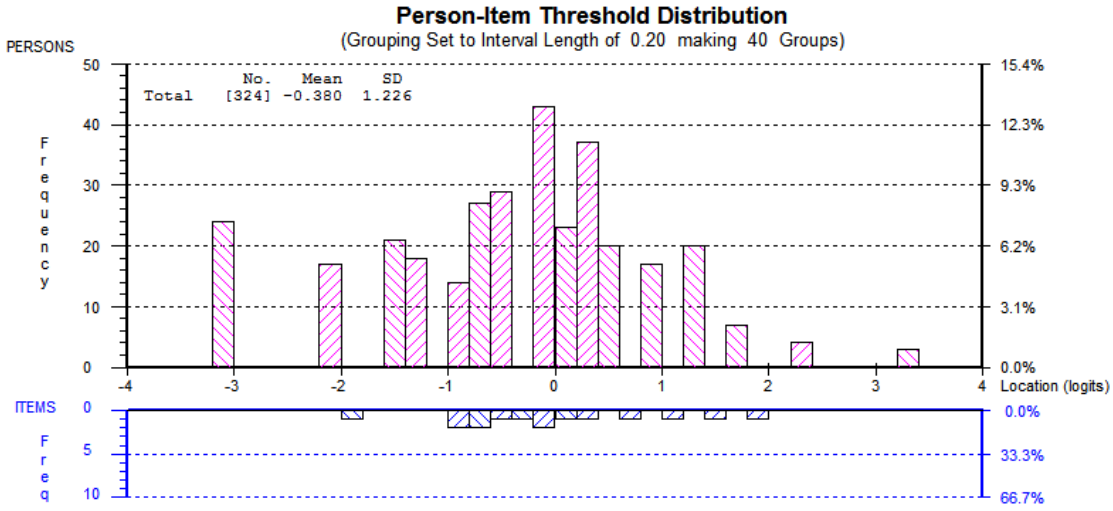

Figure 4.3.3.3.4.1. Person-item threshold distribution for Introjected Regulation in an e-learning environment scale

4.3.3.3.5 (a) Person frequency distribution – Gender

The *Introjected Regulation* scores for females and males are plotted in Figure 4.3.3.3.5.1. The female mean score was -0.44 (SD= 1.25) and the male mean score was -0.27 (SD= 1.16). The difference was not statistically significant (F=1.35, p>0.05)

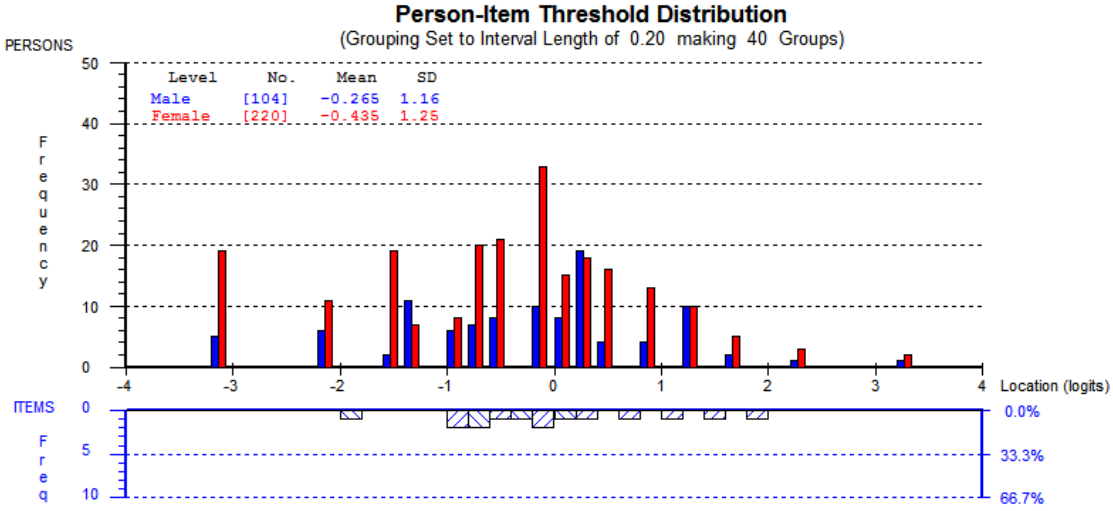

Figure 4.3.3.3.5.1. Person-item threshold distribution for *Introjected Regulation* in an e-learning environment scale by gender

4.3.3.3.5 (b) Person frequency distribution – Age

The *Introjected Regulation* scores for age between 17–20, between 21–24, between 25–28, between 29–32, between 33–36, between 37–40, between 41–44 and over 45 are plotted in Figure 4.3.3.3.5.2. The categories of respondents are:

Group 1: Age between 17-20 (Mean= -0.09, SD= 1.13)

Group 2: Age between 21-24 (Mean= -0.62, SD= 1.28)

Group 3: Age between 25-28 (Mean= -0.61, SD= 0.65)

Group 4: Age between 29-32 (no response received)

Group 5: Age between 33-36 (no response received)

Group 6: Age between 37-40 (no response received)

Group 7: Age between 41-44 (no response received)

Group 8: Age over 45 (Mean= -0.19, SD= 0.00).

The difference was statistically significant (F=2.18, p<0.05)

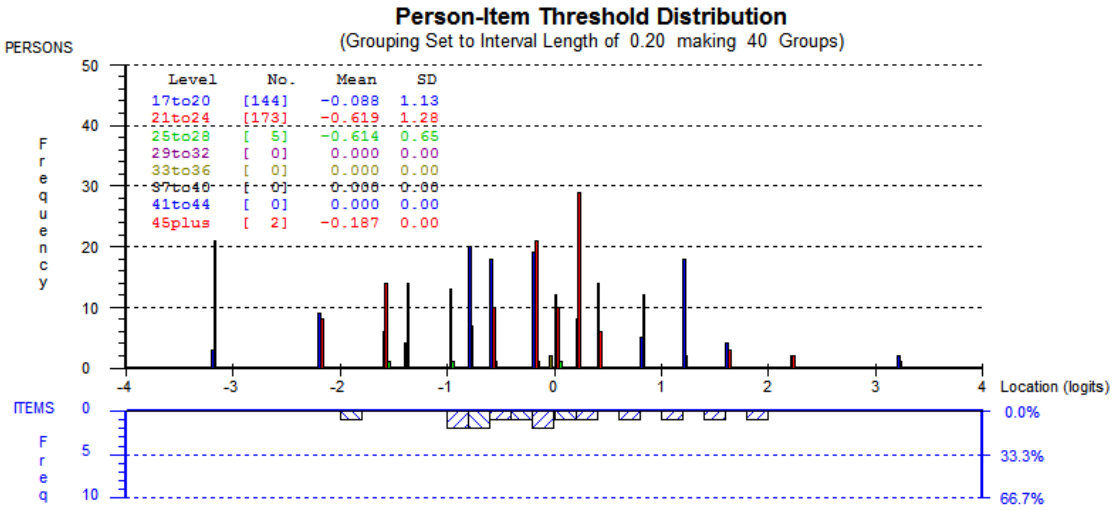

Figure 4.3.3.3.5.2. Person-item threshold distribution for *Introjected Regulation* in an e-learning environment scale by age

4.3.3.3.5 (c) Person frequency distribution – Year

The *Introjected Regulation* scores for first year, second year, third year, fourth year, fifth year and graduate year of study are plotted in Figure 4.3.3.3.5.3. The categories of respondents are:

Group 1: First year (Mean= -0.27, SD= 1.30)

Group 2: Second year (Mean= -0.51, SD= 1.02)

Group 3: Third year (Mean= -0.98, SD= 0.78)

Group 4: Fourth year (Mean= 0.54, SD= 0.00)

Group 5: Fifth year (no response received)

Group 6: Graduate year (no response received).

The difference was not statistically significant (F=2.09, p>0.05)

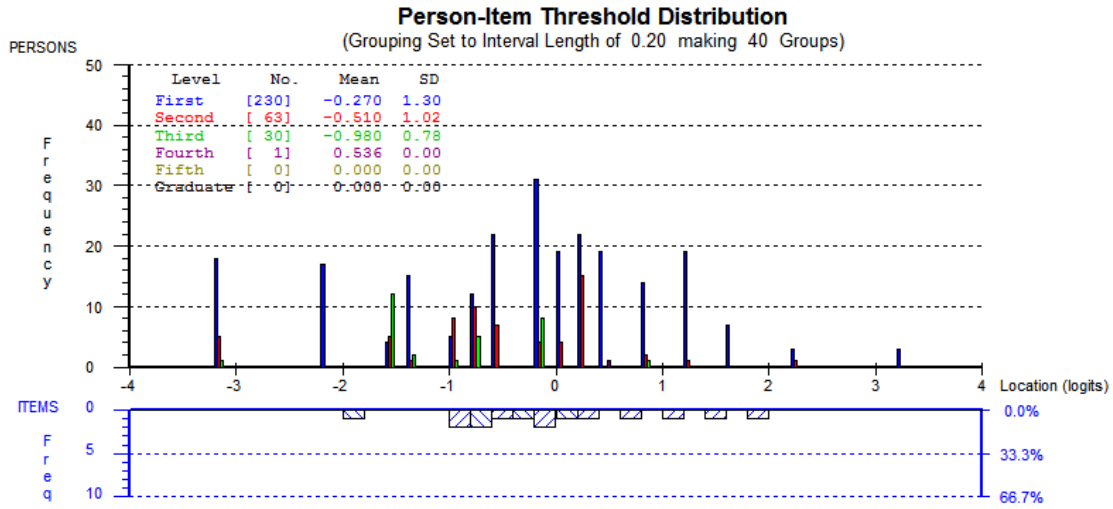

Figure 4.3.3.3.5.3. Person-item threshold distribution for *Introjected Regulation* in an e-learning environment scale by year

4.3.3.3.4 (d) Person frequency distribution – Ethnicity

The *Introjected Regulation* scores for Malay, Chinese, Indians, European, African, Middle Eastern and Others are plotted in Figure 4.3.3.3.5.4. The categories of respondents are:

Group 1: Malay (Mean= -0.24, SD= 1.11)

Group 2: Chinese (Mean= -0.57, SD= 1.29)

Group 3: Indian (Mean= 0.163, SD= 1.67)

Group 4: European (Mean= -0.34, SD= 0.13)

Group 5: African (no response received)

Group 6: Middle Eastern (no response received)

Group 7: Others (no response received).

The difference was not statistically significant (F=1.03, p>0.05)

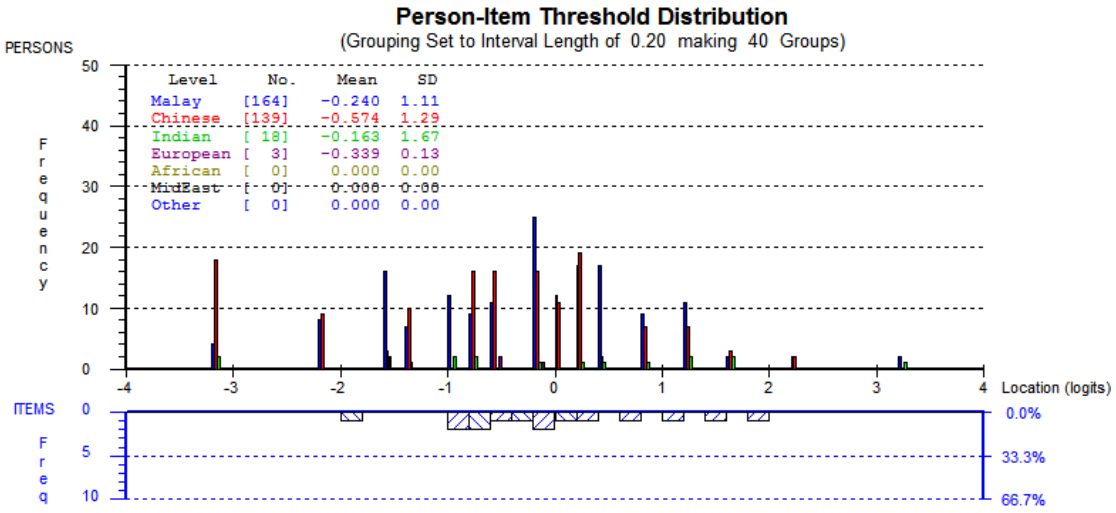

Figure 4.3.3.3.5.4. Person-item threshold distribution for *Introjected Regulation* in an e-learning environment scale by ethnicity

4.3.3.3.5(e) Person frequency distribution – School

The *Introjected Regulation* scores for Engineering, Computer Science, Management, Humanities, Mathematics, Industrial Technology, Education, Art and Biology are plotted in Figure 4.3.3.3.5.5. The categories of respondents are:

Group 1: Engineering (Mean= -0.19, SD= 0.00)

Group 2: Computer Science (Mean= -0.35, SD= 0.86)

Group 3: Management (Mean= -0.48, SD= 1.08)

Group 4: Humanities (Mean= -0.47, SD= 1.07)

Group 5: Mathematics (Mean= -0.26, SD= 1.02)

Group 6: Industrial Technology (Mean= 0.34, SD= 0.78)

Group 7: Education (Mean= -0.41, SD= 1.61)

Group 8: Art (Mean= -0.78, SD= 1.60)

Group 9: Biology (Mean= -0.13, SD= 1.14).

The difference was not statistically significant (F=0.56, p>0.05).

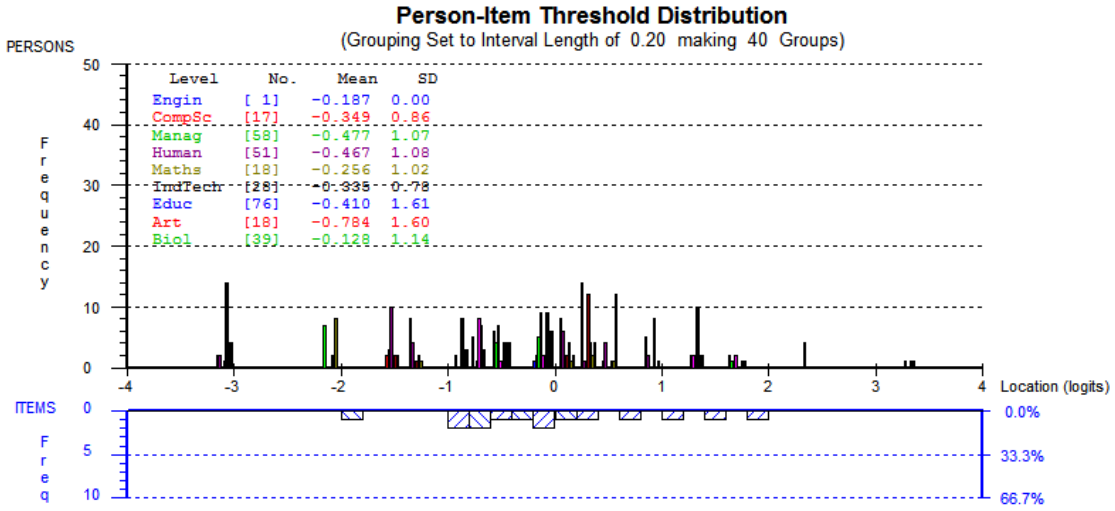

Figure 4.3.3.3.5.5. Person-item threshold distribution for *Introjected Regulation* in an e-learning environment scale by school

4.3.3.4 Factor 8 – Task Character

4.3.3.4.1 Summary of Test-of-Fit Statistics

The item-student test-of-fit indicates that there is good consistency of *Task Character* and item response patterns (see Table 4.3.3.4.1.1). This can be shown in the mean standardised item fit residual which is 0.09 and with SD 0.34, which are close to the ideal of zero and one. The mean standardised student-item fit residual is -0.36 and its SD is 0.09 which is very good. A negative fit statistic (-0.36) indicates a response pattern that fits the model closely (see Andrich, 1985).

Table 4.3.3.4.1.1
Global fit statistics for Task Character in an e-learning environment

	Items		**Persons**	
	Location	Fit Residual	Location	Fit Residual
Mean	0.00	0.09	2.26	-0.36
SD	0.53	0.34	2.15	0.90

The result of Chi-square (0.00) (see Table 4.3.3.4.1.2) indicates that there is not a good collective agreement between *Task Character* in an e-learning environment for all item difficulties. This suggests that the data does not focus on "one attribute or dimension at a time" (Bond & Fox, 2007, p. 32) and is thus multidimensional.

Table 4.3.3.4.1.2
Item-trait Interaction

Total Item Chi Square	44.48
Separation Index	0.92
Total Deg. of Freedom	16.00
Total Chi-Square Probability	0.00

The Person Separation Index in Table 4.3.3.4.1.3 is 0.92 and this indicates a well-spread distribution along the linear scale. Based on the index in Table 4.3.3.4.1.3, the power of the test-of-fit is considered to be excellent.

Table 4.3.3.4.1.3
Person Separation Index

Separation Index	0.92
Power of Test-of-Fit	Power is EXCELLENT

4.3.3.4.2 Threshold Map

The Threshold map in Figure 4.3.3.4.2.3 provides a summary of the thresholds displayed from the four Category Probability Curves. The thresholds for Item 115 were not plotted because this was disordered Item 115: *I will not sign up for e-learning class because I find that studying is not exciting).*

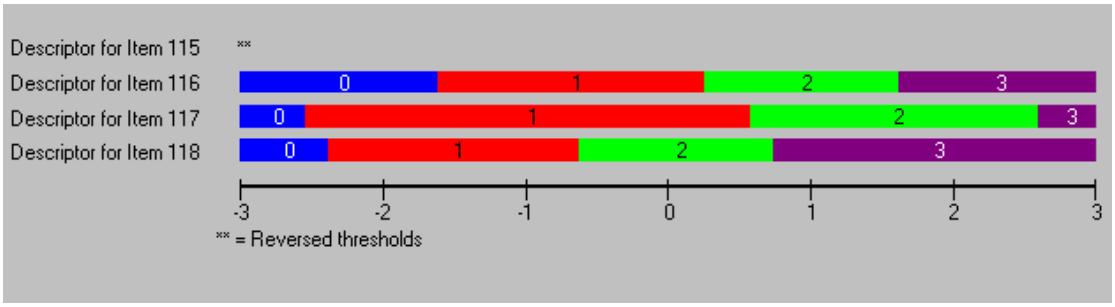

Figure 4.3.3.4.2.3. Threshold map for Task Character belief

4.3.3.4.3 Individual Item Fit

Table 4.3.3.4.3.1 summarises fit statistics for all four items including the residuals. All items have acceptable residuals and Table 4.3.3.4.3.1 shows that the items have a good fit to the measurement model. Also, the difficulties of the items ranged from -0.76 logits (easy) to 0.46 logits (difficult).

Table 4.3.3.4.3.1

Individual item fit statistics (I=115,116,117 & 118, N=165)

Item	Location	SE	Residual	Degree of Freedom	Chi-Square	Probability
115	0.46	0.12	0.10	121.00	5.01	0.29
116	0.09	0.12	-0.34	121.00	21.64	0.00
117	0.21	0.13	0.49	121.00	11.25	0.02
118	-0.76	0.13	0.11	121.00	6.59	0.16

4.3.3.4.4 Person-Item Threshold Distributions

The mean of person location from Figure 4.3.3.4.4.1 is -2.26 logits. The respective threshold for four items is distributed from "easy" on the left to "difficult" on the right.

In Figure 4.3.3.4.4.1, the logarithmic odds scale, shows both item difficulty values from -2.70 logits (easy to affirm) to +3.00 logits (more difficult to affirm) with most questions ranged between -1.00 logits to +4.20 logits. The *Task Character* in an e-learning environment (distribution of person) measures range from -4.00 logits (lower ability) to +4.20 logits (higher ability). The results *Task Character* indicate a ceiling effect with the clustering of participants at the high end of the scale (indicating high levels of *Task Character*). Furthermore, the distribution of item thresholds indicates a surplus in their distribution across the higher/"difficult" end of the construct (Figure 4.3.3.4.4.1) suggesting the potential for adding items which reflect levels of *Task Character* at the higher/"difficult" end of the scale.

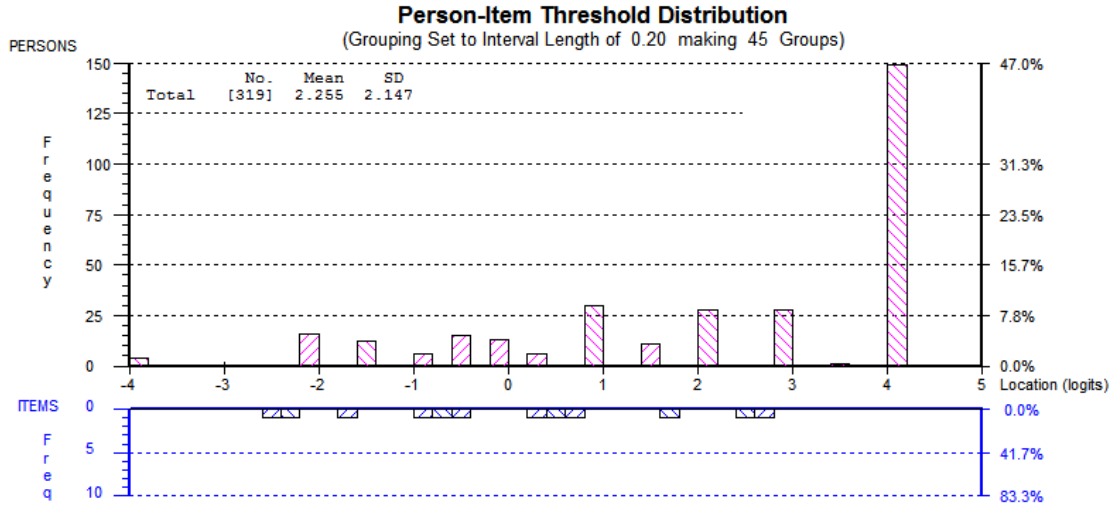

Figure 4.3.3.4.4.1. Person-item threshold distribution for Task Character in an e-learning environment scale

4.3.3.4.5 (a) Person frequency distribution – Gender

The *Task Character* scores for females and males are plotted in Figure 4.3.3.4.5.1. The female mean score was 2.34 (SD= 2.13) and the male mean score was 2.09 (SD= 2.19). The difference was not statistically significant (F=0.90, p>0.05)

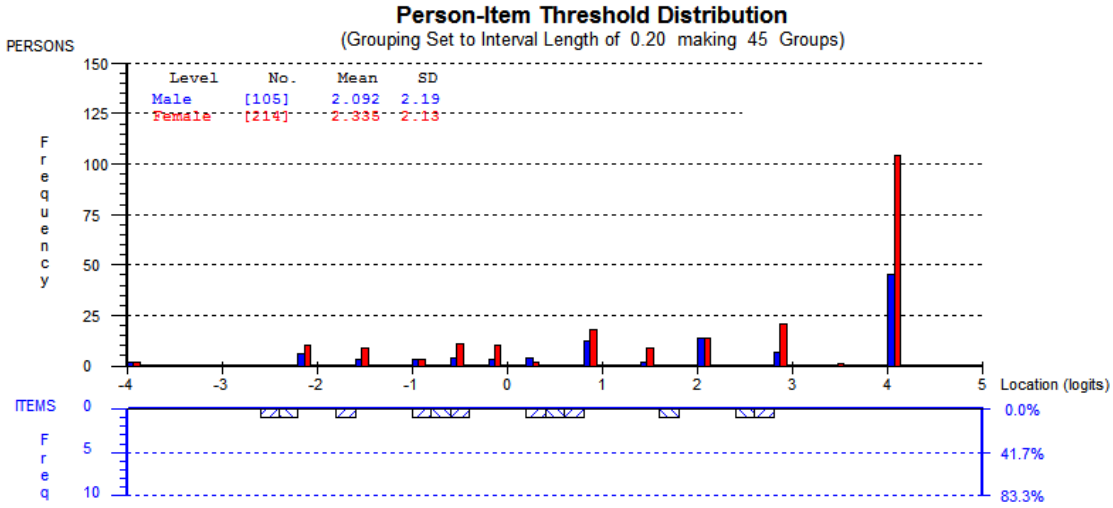

Figure 4.3.3.4.5.1. Person-item threshold distribution for Task Character in an e-learning environment scale by gender

4.3.3.4.5 (b) Person frequency distribution – Age

The *Task Character* scores for age between 17–20, between 21–24, between 25–28, between 29–32, between 33–36, between 37–40, between 41–44 and over 45 are plotted in Figure 4.3.3.4.5.2. The categories of respondents are:

Group 1: Age between 17-20 (Mean= 2.42, SD= 2.11)

Group 2: Age between 21-24 (Mean= 2.18, SD= 2.16)

Group 3: Age between 25-28 (Mean= 1.73, SD= 1.74)

Group 4: Age between 29-32 (no response received)

Group 5: Age between 33-36 (no response received)

Group 6: Age between 37-40 (no response received)

Group 7: Age between 41-44 (no response received)

Group 8: Age over 45 (Mean= -1.72, SD= 0.42).

The difference was not statistically significant (F=1.18, p>0.05)

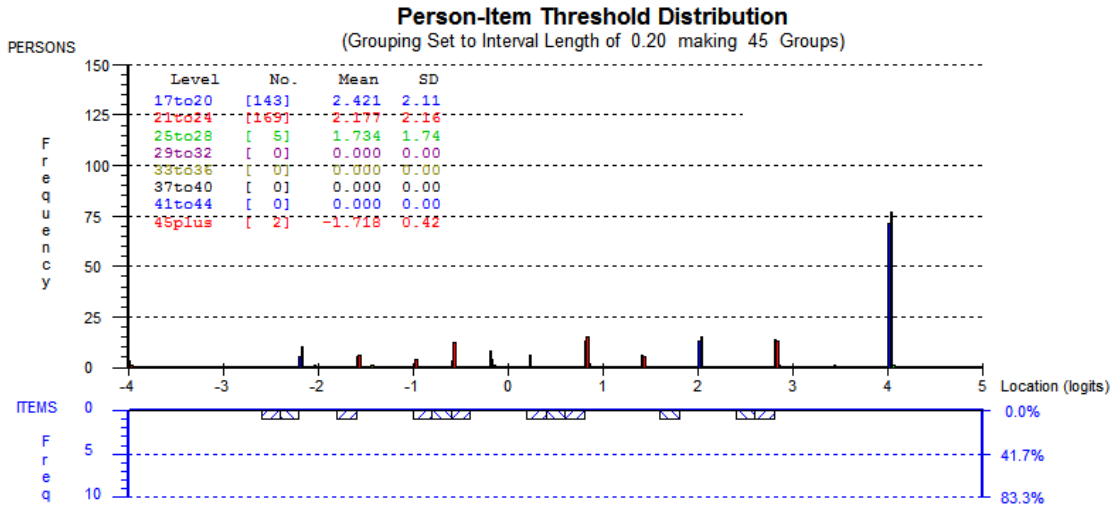

Figure 4.3.3.4.5.2. Person-item threshold distribution for Task Character in an e-learning environment scale by age

4.3.3.4.5 (c) Person frequency distribution – Year

The *Task Character* scores for first year, second year, third year, fourth year, fifth year and graduate year of study are plotted in Figure 4.3.3.4.5.3. The categories of respondents are:

Group 1: First year (Mean= 2.34, SD= 2.07)

Group 2: Second year (Mean= 2.43, SD= 2.07)

Group 3: Third year (Mean= 1.18, SD= 2.62)

Group 4: Fourth year (Mean= 4.09, SD= 0.00)

Group 5: Fifth year (no response received)

Group 6: Graduate year (no response received).

The difference was not statistically significant (F=1.83, p>0.05)

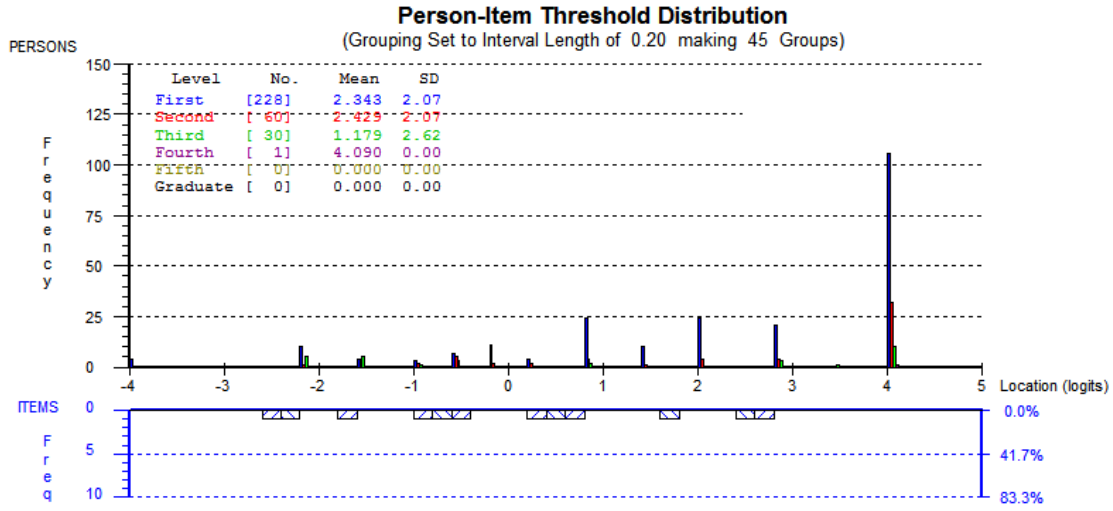

Figure 4.3.3.4.5.3. Person-item threshold distribution for Task Character in an e-learning environment scale by year

4.3.3.4.5 (d) Person frequency distribution – Ethnicity

The *Task Character* scores for Malay, Chinese, Indians, European, African, Middle Eastern and Others are plotted in Figure 4.3.3.4.5.4. The categories of respondents are:

Group 1: Malay (Mean= 2.20, SD= 2.19)

Group 2: Chinese (Mean= 2.40, SD= 2.07)

Group 3: Indian (Mean= 2.01, SD= 2.41)

Group 4: European (Mean= 0.20, SD= 0.56)

Group 5: African (no response received)

Group 6: Middle Eastern (no response received)

Group 7: Others (no response received).

The difference was not statistically significant (F=0.61, p>0.05)

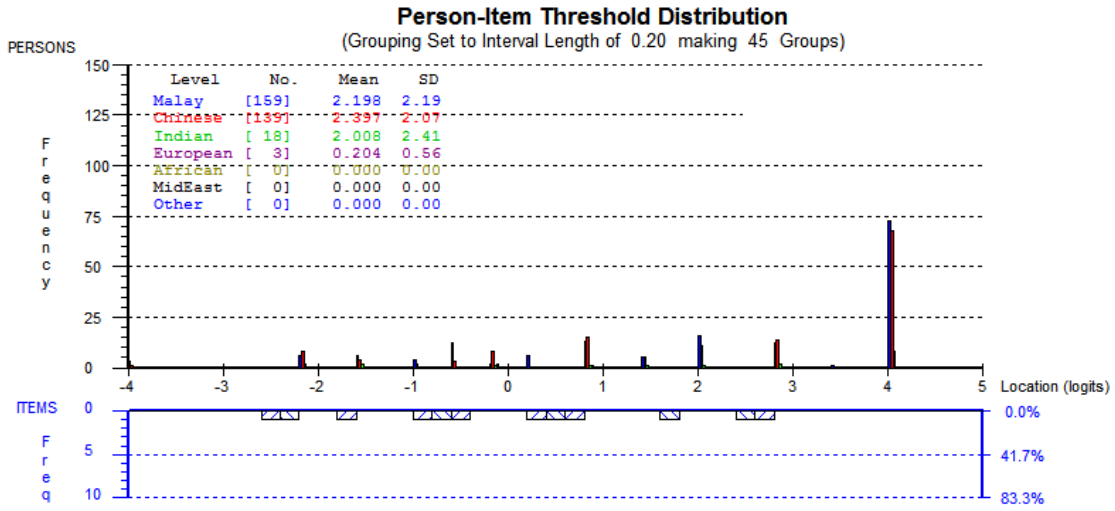

Figure 4.3.3.4.5.4. Person-item threshold distribution for Task Character in an e-learning environment scale by ethnicity

4.3.3.4.5(e) Person frequency distribution – School

The *Task Character* scores for Engineering, Computer Science, Management, Humanities, Mathematics, Industrial Technology, Education, Art and Biology are plotted in Figure 4.3.3.4.5.5. The categories of respondents are:

Group 1: Engineering (Mean= 2.13, SD= 0.00)

Group 2: Computer Science (Mean= 2.01, SD= 2.78)

Group 3: Management (Mean= 2.63, SD= 1.92)

Group 4: Humanities (Mean= 2.07, SD= 2.19)

Group 5: Mathematics (Mean= 1.08, SD= 2.34)

Group 6: Industrial Technology (Mean= 2.41, SD= 1.94)

Group 7: Education (Mean= 2.38, SD= 2.03)

Group 8: Art (Mean= 2.53, SD= 1.76)

Group 9: Biology (Mean= 2.02, SD= 2.38).

The difference was not statistically significant ($F=1.12$, $p>0.05$).

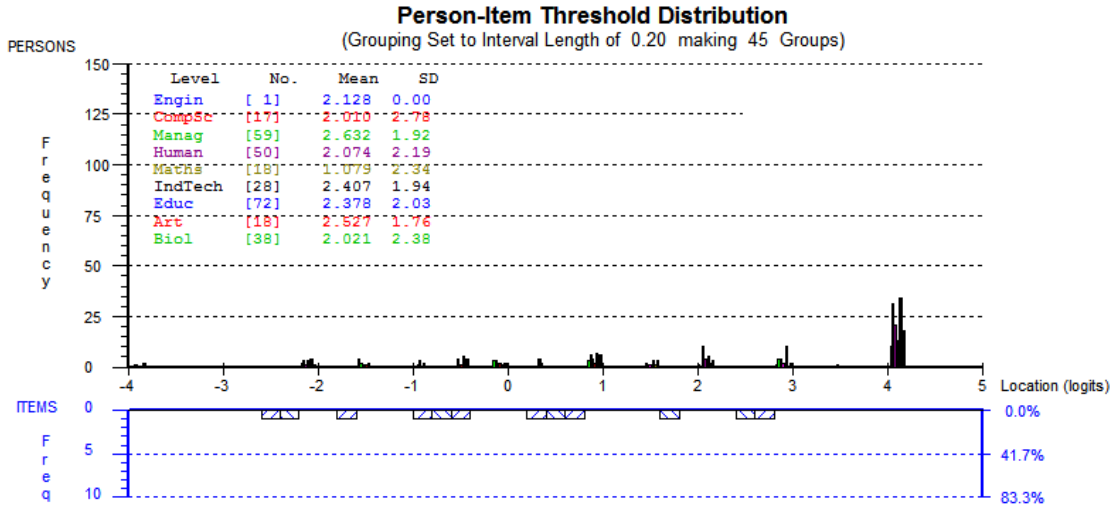

Figure 4.3.3.4.5. Person-item threshold distribution for Task Character in an e-learning environment scale by school

4.3.3.5 Factor 17 –Strategic Use

4.3.3.5.1 Summary of Test-of-Fit Statistics

The item-student test-of-fit indicates that there is close to good consistency of *Strategic Use* and item response patterns (see Table 4.3.3.5.1.1). This can be shown in the mean standardised item fit residual which is -0.08 and with SD 2.57, which are close to the ideal of zero and one. The mean standardised student-item fit residual is -0.33 and its SD is 1.17 which is good. Negative fit statistics (-0.08 and -0.33) indicate a response pattern that fits the model closely (see Andrich, 1985).

Table 4.3.3.5.1.1
Global fit statistics for Strategic Use in an e-learning environment

	Items		**Persons**	
	Location	Fit Residual	Location	Fit Residual
Mean	0.00	-0.08	-0.29	-0.33
SD	0.58	2.57	1.35	1.17

The result of Chi-square (0.00) (see Table 4.3.3.5.1.2) indicates that there is not a good collective agreement between *Strategic Use* in an e-learning environment for all item difficulties. This suggests that the data does not focus on "one attribute or dimension at a time" (Bond & Fox, 2007, p. 32) and is thus multidimensional.

Table 4.3.3.5.1.2
Item-trait Interaction

Total Item Chi Square	196.107
Total Deg. of Freedom	32.00
Total Chi-Square Probability	0.00

The Person Separation Index in Table 4.3.3.5.1.3 is 0.83 and this indicates a well-spread distribution along the linear scale. Based on the index in Table 4.3.3.5.1.3, the power of the test-of-fit is considered to be good.

Table 4.3.3.5.1.3
Person Separation Index

Separation Index	0.83
Power of Test-of-Fit	Power is GOOD

4.3.3.5.2 Threshold Map

The Threshold map in Figure 4.3.3.5.2.3 provides a summary of the thresholds displayed from the eight Category Probability Curves. There were no disordered thresholds.

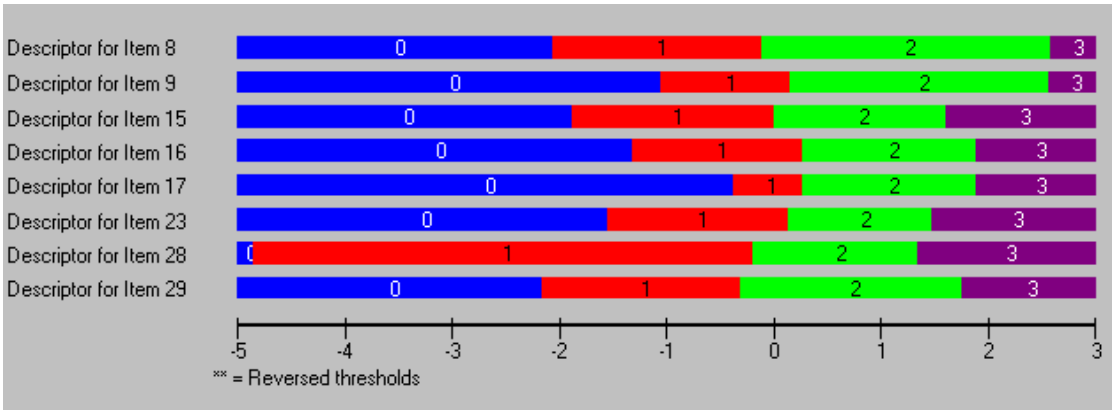

Figure 4.3.3.5.2.3. Threshold map for Strategic Use belief

4.3.3.5.3 Individual Item Fit

Table 4.3.3.5.3.1 summarises fit statistics for all eight items including the residuals. All items have acceptable residuals except for Item 9 (+2.58), Item 16 (-4.06) and Item 28 (4.15) which are out of the ±2.5 range. The Chi square values are low. In general, the Table 4.3.3.5.3.1 shows that most items did not have a good fit to the measurement model. Also, the difficulties of the items ranged from -1.24 logits (easy) to 0.59 logits (difficult).

Table 4.3.3.5.3.1
Individual item fit statistics (I=8,9,15,16,17,23 & 28, N=326)

Item	Location	SE	Residual	Degree of Freedom	Chi-Square	Probability
8	0.13	0.09	-1.28	281.17	14.25	0.00
9	0.55	0.08	2.58	280.31	19.98	0.00
15	-0.10	0.08	-0.76	275.98	30.32	0.00
16	0.28	0.08	-4.06	280.31	30.53	0.00
17	0.59	0.08	-1.47	279.44	14.34	0.00
23	0.02	0.08	-0.75	281.17	15.57	0.00
28	-1.24	0.09	4.15	280.31	56.77	0.00
29	-0.24	0.08	0.97	280.31	14.35	0.00

4.3.3.5.4 Person-Item Threshold Distributions

The mean of person location from Figure 4.3.3.5.4.1 is -0.29 logits. The respective threshold for eight items is distributed from "easy" on the left to "difficult" on the right.

In Figure 4.3.3.5.4.1, the logarithmic odds scale, shows both item difficulty values from -5.00 logits (easy to affirm) to +2.50 logits (more difficult to affirm) with most questions ranged between -2.50 logits to +1.00 logits. The *Strategic Use* in an e-learning environment (distribution of person) measures from -3.20 logits (lower ability) to +3.60 logits (higher ability). The results of *Strategic Use* indicate neither a floor nor ceiling effect with the clustering of participants in the middle of the scale (indicating well distributed). Furthermore, the distribution of item thresholds indicates a shortfall in their distribution across the higher/"difficult" end of the construct (Figure 4.3.3.5.4.1) suggesting the potential for adding items which reflect levels of *Strategic Use* at the higher/"difficult" end of the scale.

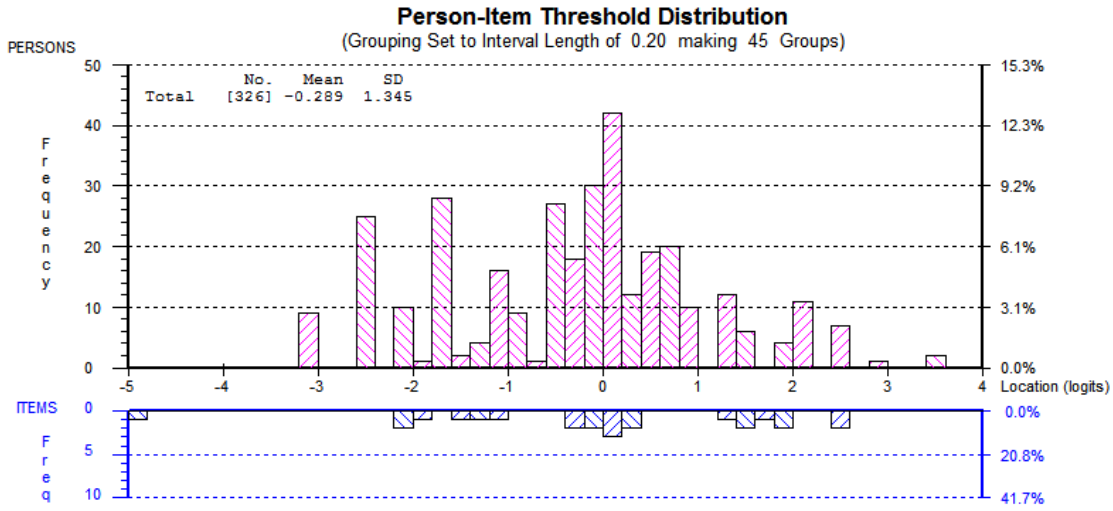

Figure 4.3.3.5.4.1. Person-item threshold distribution for Strategic Use in an e-learning environment scale

4.3.3.5.5 (a) Person frequency distribution – Gender

The *Strategic Use* scores for females and males are plotted in Figure 4.3.3.5.5.1. The female mean score was -0.27 (SD= 1.31) and the male mean score was -0.33 (SD= 1.43). The difference was not statistically significant (F=0.16, p>0.05)

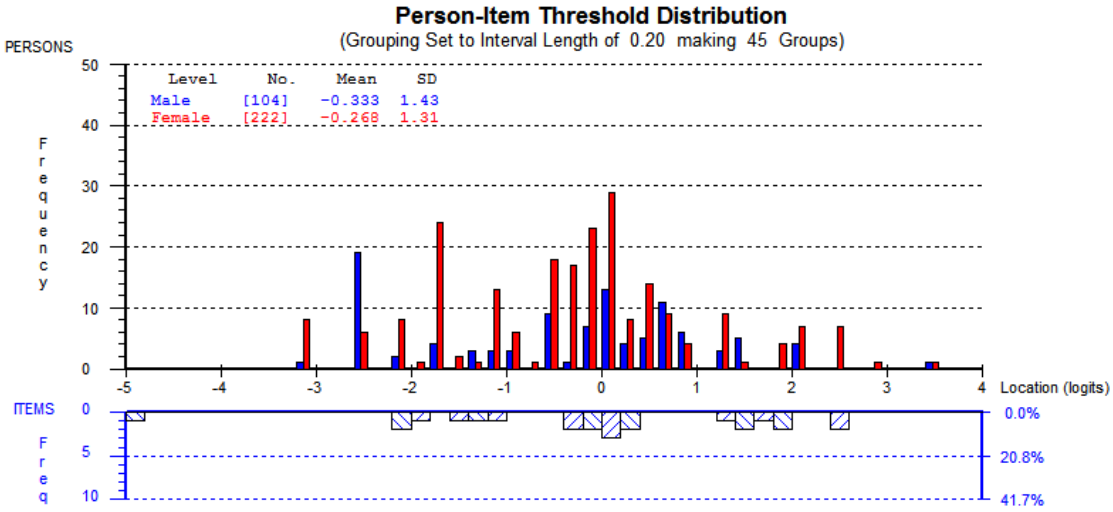

Figure 4.3.3.5.5.1. Person-item threshold distribution for Strategic Use in an e-learning environment scale by gender

4.3.3.5.5 (b) Person frequency distribution – Age

The *Strategic Use* scores for age between 17–20, between 21–24, between 25–28, between 29–32, between 33–36, between 37–40, between 41–44 and over 45 are plotted in Figure 4.3.3.5.5.2. The categories of respondents are:

Group 1: Age between 17-20 (Mean= -0.09, SD= 1.32)

Group 2: Age between 21-24 (Mean= 0.48, SD= 1.36)

Group 3: Age between 25-28 (Mean= 0.23, SD= 0.59)

Group 4: Age between 29-32 (no response received)

Group 5: Age between 33-36 (no response received)

Group 6: Age between 37-40 (no response received)

Group 7: Age between 41-44 (no response received)

Group 8: Age over 45 (Mean= -1.00, SD= 0.00).

The difference was not statistically significant (F=1.35, p>0.05)

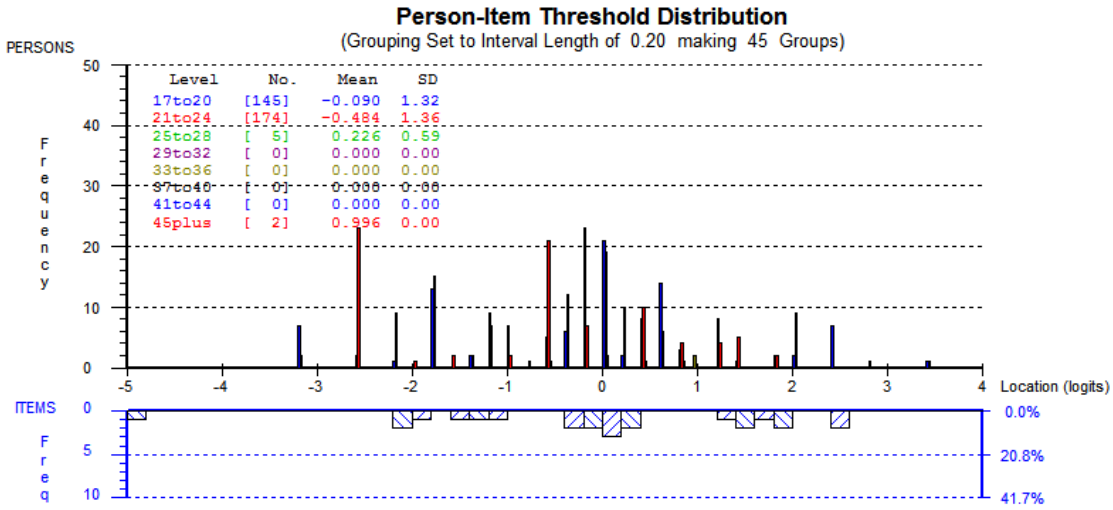

Figure 4.3.3.5.5.2. Person-item threshold distribution for Strategic Use in an e-learning environment scale by age

4.3.3.5.5 (c) Person frequency distribution – Year

The *Strategic Use* scores for first year, second year, third year, fourth year, fifth year and graduate year of study are plotted in Figure 4.3.3.5.5.3. The categories of respondents are:

Group 1: First year (Mean= -0.11, SD= 1.24)

Group 2: Second year (Mean= -0.86, SD= 1.60)

Group 3: Third year (Mean= -0.53, SD= 1.26)

Group 4: Fourth year (Mean= 0.76, SD= 0.00)

Group 5: Fifth year (no response received)

Group 6: Graduate year (no response received).

The difference was statistically significant (F=3.56, p<0.05)

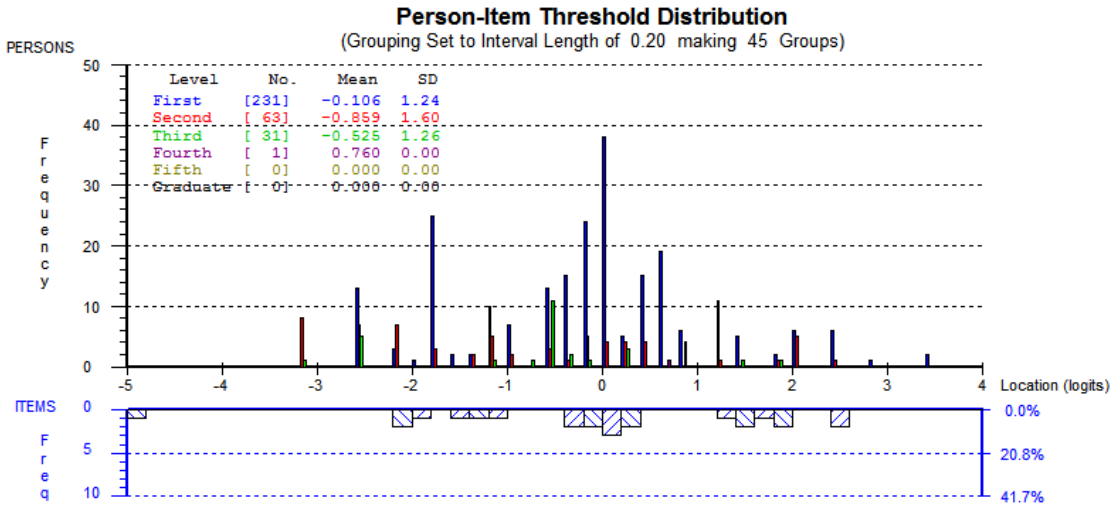

Figure 4.3.3.5.5.3. Person-item threshold distribution for Strategic Use in an e-learning environment scale by year

4.3.3.5.5 (d) Person frequency distribution – Ethnicity

The *Strategic Use* scores for Malay, Chinese, Indians, European, African, Middle Eastern and Others are plotted in Figure 4.3.3.5.5.4. The categories of respondents are:

Group 1: Malay (Mean= -0.22, SD= 1.18)

Group 2: Chinese (Mean= -0.42, SD= 1.49)

Group 3: Indian (Mean= 0.14, SD= 1.54)

Group 4: European (Mean= -0.62, SD= 1.23)

Group 5: African (no response received)

Group 6: Middle Eastern (no response received)

Group 7: Others (no response received).

The difference was not statistically significant (F=0.61, p>0.05)

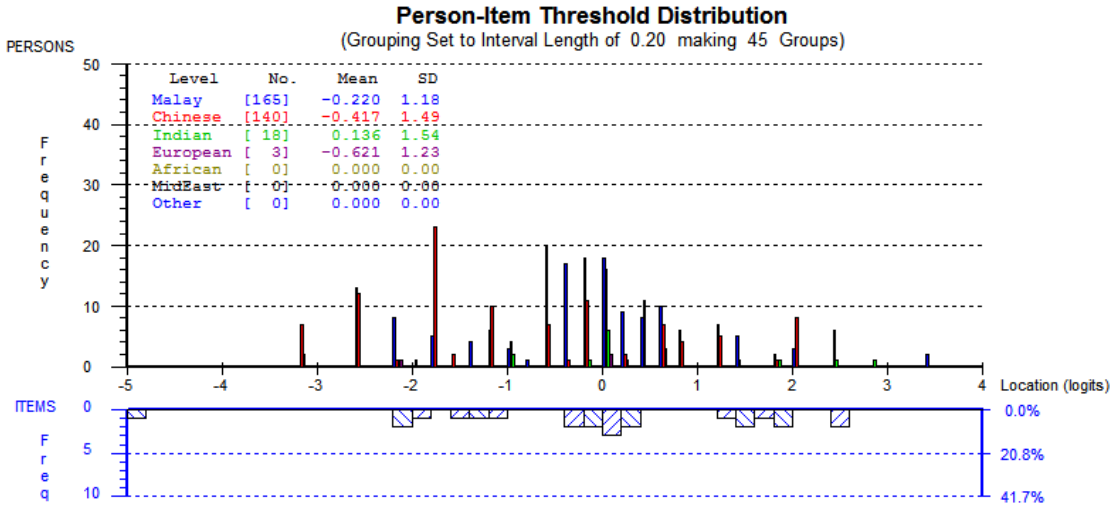

Figure 4.3.3.5.5.4. Person-item threshold distribution for Strategic Use in an e-learning environment scale by ethnicity

4.3.3.5.5(e) Person frequency distribution – School

The *Strategic Use* scores for Engineering, Computer Science, Management, Humanities, Mathematics, Industrial Technology, Education, Art and Biology are plotted in Figure 4.3.3.5.5.5. The categories of respondents are:

Group 1: Engineering (Mean= -2.05, SD= 0.00)

Group 2: Computer Science (Mean= 0.88, SD= 1.51)

Group 3: Management (Mean= -0.27, SD= 1.32)

Group 4: Humanities (Mean= 0.00, SD= 0.89)

Group 5: Mathematics (Mean= -0.93, SD= 0.99)

Group 6: Industrial Technology (Mean= -1.55, SD= 1.41)

Group 7: Education (Mean= -0.30, SD= 1.29)

Group 8: Art (Mean= -0.61, SD= 1.74)

Group 9: Biology (Mean= 0.27, SD= 0.87).

The difference was statistically significant ($F=7.86$, $p<0.05$).

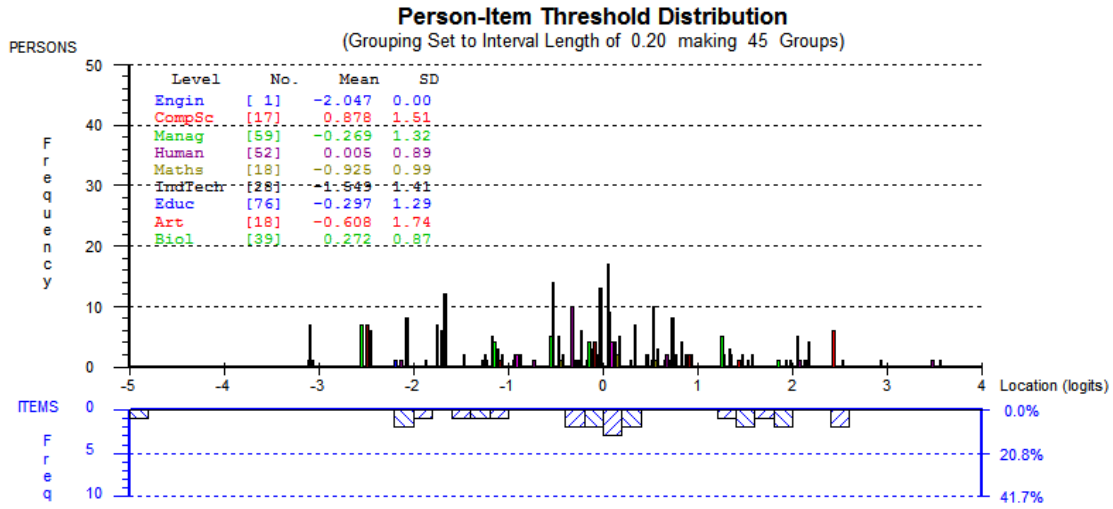

Figure 4.3.3.5.5.5. Person-item threshold distribution for Strategic Use in an e-learning environment scale by school

4.3.3.6 Factor 18 –Value of Task

4.3.3.6.1 Summary of Test-of-Fit Statistics

The item-student test-of-fit indicates that there is not good consistency of *Value of Task* and item response patterns (see Table 4.3.3.6.1.1). This can be shown in the mean standardised item fit residual which is 0.45 and with SD 6.49. The mean standardised student-item fit residual is -0.23 and its SD is 1.20. However, A negative fit statistic (-0.23) indicates a response pattern that fits the model closely (see Andrich, 1985).

Table 4.3.3.6.1.1
Global fit statistics for Value of Task in an e-learning environment

	Items		**Persons**	
	Location	Fit Residual	Location	Fit Residual
Mean	0.00	0.45	0.62	-0.23
SD	0.45	6.49	0.69	1.20

The result of Chi-square (0.00) (see Table 4.3.3.6.1.2) indicates that there is not a good collective agreement between *Value of Task* in an e-learning environment for all item difficulties. This suggests that the data does not focus on "one attribute or dimension at a time" (Bond & Fox, 2007, p. 32) and is thus multidimensional.

Table 4.3.3.6.1.2
Item-trait Interaction

Total Item Chi Square	708.82
Total Deg. of Freedom	20.00
Total Chi-Square Probability	0.00

The Person Separation Index in Table 4.3.3.6.1.3 is 0.38 and this indicates not a well-spread distribution along the linear scale. Based on the index in Table 4.3.3.6.1.3, the power of the test-of-fit is considered to be low.

Table 4.3.3.6.1.3
Person Separation Index

Separation Index	0.38
Power of Test-of-Fit	Power is LOW

4.3.3.6.2 Threshold Map

The Threshold map in Figure 4.3.3.6.2.3 provides a summary of the thresholds displayed from the five Category Probability Curves. Figure 4.3.3.6.2.3 indicated three disordered thresholds. The thresholds for Items 97, 112 and 113 were not plotted because these were disordered items (Item 97: *I will not sign up for e-learning class because I follow my friends*, Item 112: *I will not sign up for e-learning class because studying is not valuable to me* and Item 113: *I will not sign up for e-learning class because I have no good reason to study*).

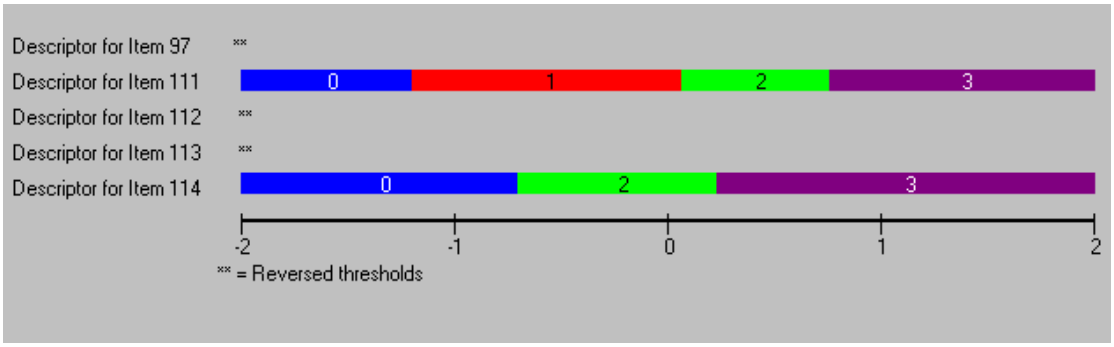

Figure 4.3.3.6.2.3. Threshold map for Value of Task

4.3.3.6.3 Individual Item Fit

Table 4.3.3.6.3.1 summarises fit statistics for all five items including the residuals. All items have unacceptable residuals except Item 111 (-1.60) and 112 (-2.04) which are within the±2.5 range. Table 4.3.3.6.3.1 shows that the two items fit the measurement model. Also, the difficulties of the items ranged from -0.30

logits (easy) to 0.73 logits (difficult).

Table 4.3.3.6.3.1.
Individual item fit statistics (I=97,111,112,113 & 114, N=318)

Item	Location	SE	Residual	Degree of Freedom	Chi-Square	Probability
97	0.73	0.05	12.00	250.93	422.30	0.00
111	-0.13	0.07	-1.60	250.14	67.07	0.00
112	-0.30	0.08	-2.04	248.56	84.52	0.00
113	0.09	0.06	-3.31	246.19	78.26	0.00
114	0.39	0.07	-2.82	246.19	56.68	0.00

4.3.3.6.4 Person-Item Threshold Distributions

The mean of person location from Figure 4.3.3.6.4.1 is -0.62 logits. The respective threshold for five items is distributed from "easy" on the left to "difficult" on the right.

In Figure 4.3.3.6.4.1, the logarithmic odds scale, shows both item difficulty values from -1.30 logits (easy to affirm) to +1.10 logits (more difficult to affirm) with questions quite evenly distributed. The *Value of Task* in an e-learning environment (distribution of person) measures from -1.30. logits (lower ability) to +2.55 logits (higher ability). The results from *Value of Task* indicate a good spread of normal distribution (Figure 4.3.3.6.4.1). However, there are two groups above the more difficult to affirm logits (+1.65 and +2.55). Furthermore, the distribution of item thresholds indicates a shortfall in the distribution across the higher/"difficult" end of the construct (Figure 4.3.3.6.4.1) suggesting the potential for adding items which reflect levels of *Value of Task* at the higher/"difficult" end of the scale.

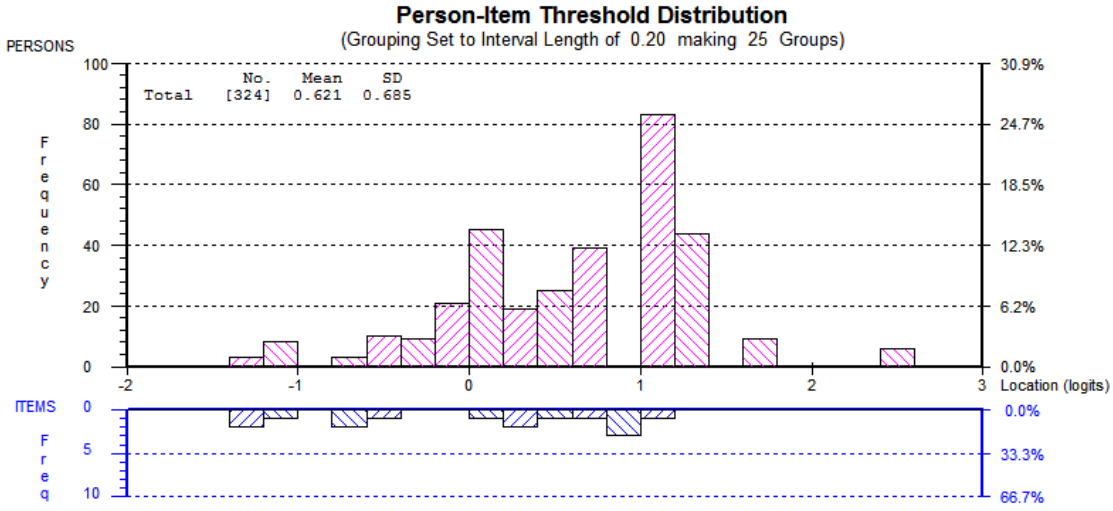

Figure 4.3.3.6.4.1. Person-item threshold distribution for Value of Task in an e-learning environment scale

4.3.3.6.5 (a) Person frequency distribution – Gender

The *Value of Task* scores for females and males are plotted in Figure 4.3.3.6.5.1. The female mean score was 0.63 (SD= 0.66) and the male mean score was 0.60 (SD= 0.73). The difference was not statistically significant (F=0.15, p>0.05)

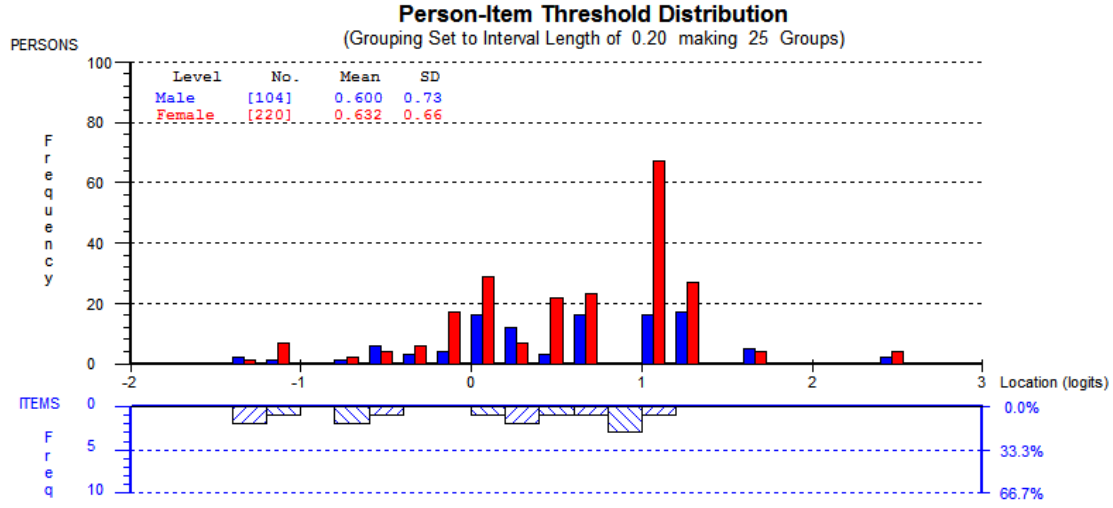

Figure 4.3.3.6.5.1. Person-item threshold distribution for Value of Task in an e-learning environment scale by gender

4.3.3.6.5 (b) Person frequency distribution – Age

The *Value of Task* scores for age between 17–20, between 21–24, between 25–28, between 29–32, between 33–36, between 37–40, between 41–44 and over 45 are plotted in Figure 4.3.3.6.5.2. The categories of respondents are:

Group 1: Age between 17-20 (Mean= 0.56, SD= 0.55)

Group 2: Age between 21-24 (Mean= 0.68, SD= 0.77)

Group 3: Age between 25-28 (Mean= 0.46, SD= 0.50)

Group 4: Age between 29-32 (no response received)

Group 5: Age between 33-36 (no response received)

Group 6: Age between 37-40 (no response received)

Group 7: Age between 41-44 (no response received)

Group 8: Age over 45 (Mean=-0.54, SD= 0.00).

The difference was not statistically significant (F=1.24, p>0.05)

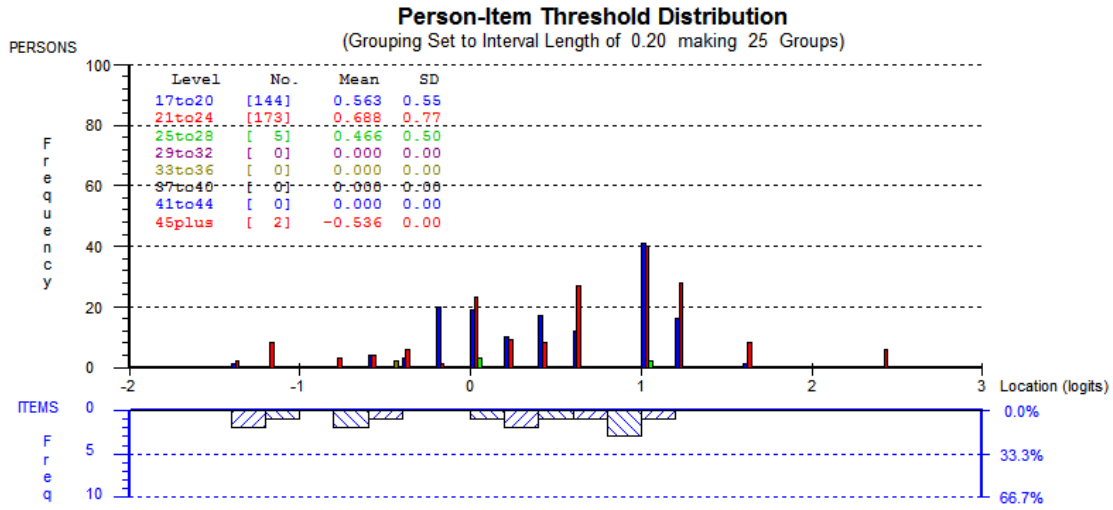

Figure 4.3.3.6.5.2. Person-item threshold distribution for Value of Task in an e-learning environment scale by age

4.3.3.6.5 (c) Person frequency distribution – Year

The *Value of Task* scores for first year, second year, third year, fourth year, fifth year and graduate year of study are plotted in Figure 4.3.3.6.5.3. The categories of respondents are:

Group 1: First year (Mean= 0.65, SD= 0.59)

Group 2: Second year (Mean= 0.62, SD= 0.93)

Group 3: Third year (Mean= 0.34, SD= 0.68)

Group 4: Fourth year (Mean= 1.77, SD= 0.00)

Group 5: Fifth year (no response received)

Group 6: Graduate year (no response received).

The difference was not statistically significant (F=1.66, p>0.05)

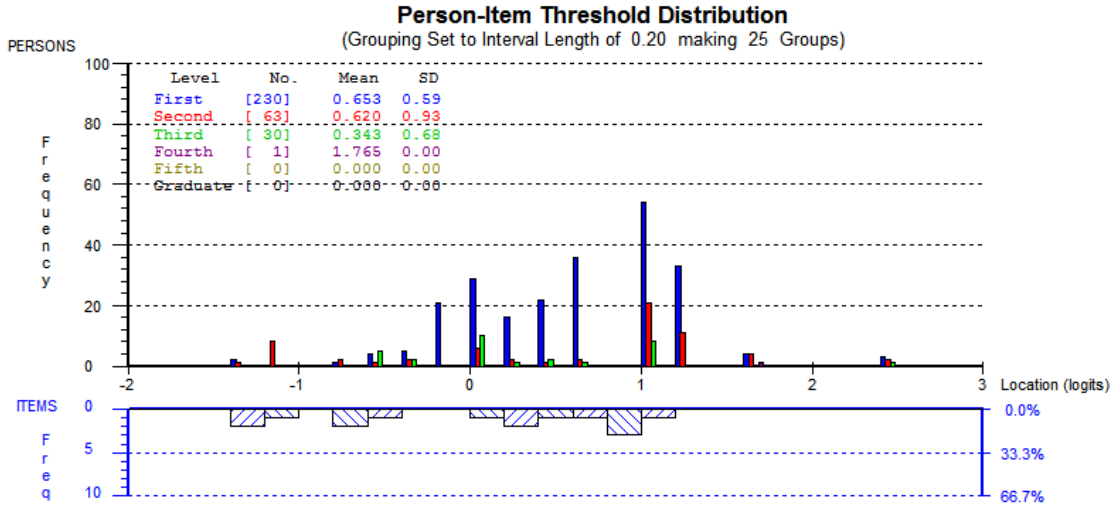

Figure 4.3.3.6.5.3. Person-item threshold distribution for Value of Task in an e-learning environment scale by year

4.3.3.6.5 (d) Person frequency distribution – Ethnicity

The *Value of Task* scores for Malay, Chinese, Indians, European, African, Middle Eastern and Others are plotted in Figure 4.3.3.6.5.4. The categories of respondents are:

Group 1: Malay (Mean= 0.47, SD= 0.73)

Group 2: Chinese (Mean= 0.77, SD= 0.59)

Group 3: Indian (Mean= 0.95, SD= 0.63)

Group 4: European (Mean= -0.11, SD= 0.37)

Group 5: African (no response received)

Group 6: Middle Eastern (no response received)

Group 7: Others (no response received).

The difference was not statistically significant (F=3.91, p>0.05)

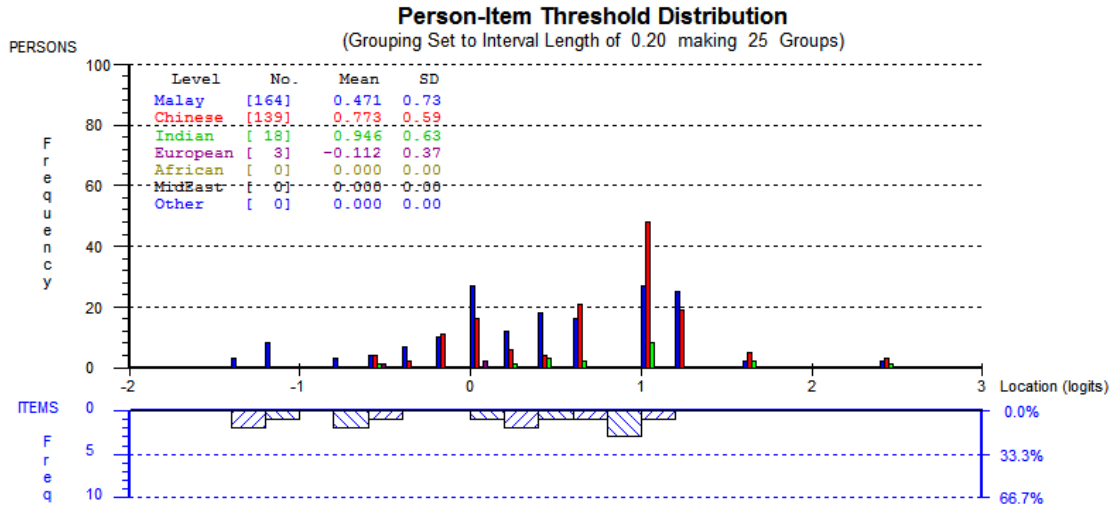

Figure 4.3.3.6.5.4. Person-item threshold distribution for Value of Task in an e-learning environment scale by ethnicity

4.3.3.6.5(e) Person frequency distribution – School

The *Value of Task* scores for Engineering, Computer Science, Management, Humanities, Mathematics, Industrial Technology, Education, Art and Biology are plotted in Figure 4.3.3.6.5.5. The categories of respondents are:

Group 1: Engineering (Mean= 0.10, SD= 0.00)

Group 2: Computer Science (Mean= 0.38, SD= 0.61)

Group 3: Management (Mean= 0.82, SD= 0.48)

Group 4: Humanities (Mean= 0.48, SD= 0.68)

Group 5: Mathematics (Mean= 0.66, SD= 0.46)

Group 6: Industrial Technology (Mean= 0.99, SD= 0.41)

Group 7: Education (Mean= 0.40, SD= 0.90)

Group 8: Art (Mean= 0.77, SD= 0.59)

Group 9: Biology (Mean= 0.76, SD= 0.55).

The difference was not statistically significant ($F=3.88$, $p>0.05$).

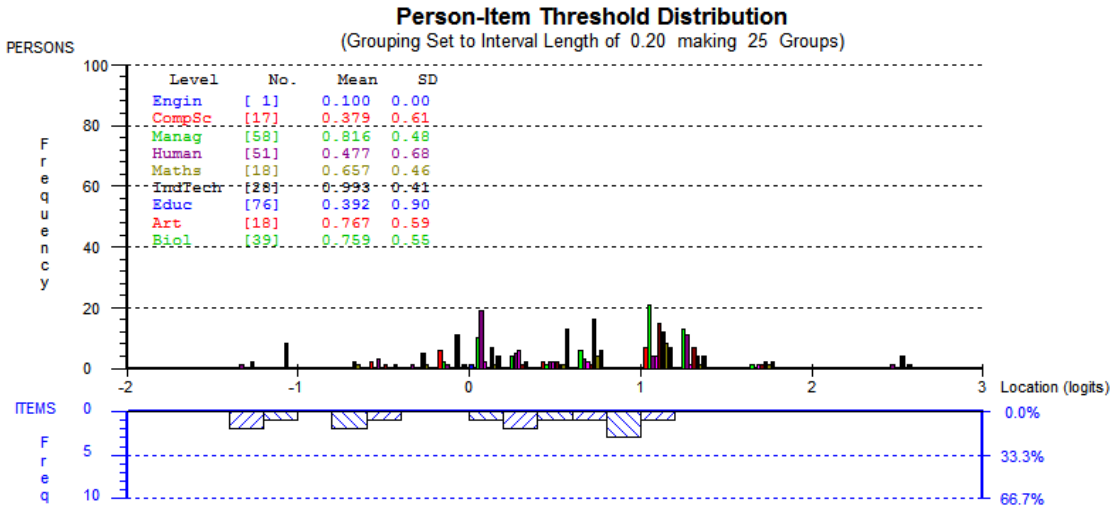

Figure 4.3.3.6.5.5. Person-item threshold distribution for Value of Task in an e-learning environment scale by school

4.3.3.7 Factor 19 –Stimulus Response

4.3.3.7.1 Summary of Test-of-Fit Statistics

The item-student test-of-fit indicates that there is good consistency of *Stimulus Response* and item response patterns (see Table 4.3.3.7.1.1). This can be shown in the mean standardised item fit residual which is 0.44 and with SD 1.18. The mean standardised student-item fit residual is -0.44 and its SD is 1.14 which is good. A negative fit statistic (-0.44) indicates a response pattern that fits the model closely (see Andrich, 1985).

Table 4.3.3.7.1.1
Global fit statistics for Stimulus Response in an e-learning environment

	Items		**Persons**	
	Location	Fit Residual	Location	Fit Residual
Mean	0.00	0.44	0.11	-0.44
SD	0.45	1.18	1.32	1.14

The result of Chi-square (0.00) (see Table 4.3.3.7.1.2) indicates that there is not a good collective agreement between *Stimulus Response* in an e-learning environment for all item difficulties. This suggests that the data does not focus on "one attribute or dimension at a time" (Bond & Fox, 2007, p. 32) and is thus multidimensional.

Table 4.3.3.7.1.2
Item-trait Interaction

Total Item Chi Square	39.04
Total Deg. of Freedom	16.00
Total Chi-Square Probability	0.00

The Person Separation Index in Table 4.3.3.7.1.3 is 0.72 and this indicates a well-spread distribution along the linear scale. Based on the index in Table 4.3.3.7.1.3, the power of the test-of-fit is considered to be good.

Table 4.3.3.7.1.3
Person Separation Index

Separation Index	0.72
Power of Test-of-Fit	Power is GOOD

4.3.3.7.2 Threshold Map

The Threshold map in Figure 4.3.3.7.2.3 provides a summary of the thresholds displayed from the four Category Probability Curves. There were no disordered thresholds.

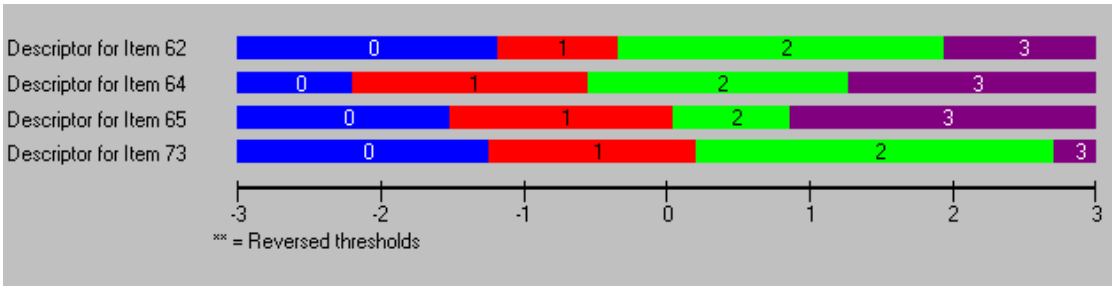

Figure 4.3.3.7.2.3. Threshold map for Stimulus Response

4.3.3.7.3 Individual Item Fit

Table 4.3.3.7.3.1 summarises fit statistics for all four items including the residuals. All items have acceptable residuals and Table 4.3.3.7.3.1 shows that the items have a good fit to the measurement model. Also, the difficulties of the items ranged from -0.49 logits (easy) to 0.56 logits (difficult).

Table 4.3.3.7.3.1
Individual item fit statistics (I=62, 64, 65, & 73, N=310)

Item	Location	SE	Residual	Degree of Freedom	Chi-Square	Probability
62	0.14	0.08	0.22	228.14	7.85	0.10
64	-0.49	0.08	1.55	229.62	6.64	0.16
65	-0.20	0.08	1.10	229.62	4.16	0.38
73	0.56	0.08	-1.12	229.62	20.10	0.00

4.3.3.7.4 Person-Item Threshold Distributions

The mean of person location from Figure 4.3.3.7.4.1 is -0.11 logits. The respective threshold for four items is distributed from "easy" on the left to "difficult" on the right.

In Figure 4.3.3.7.4.1, the logarithmic odds scale, shows both item difficulty values from -2.30 logits (easy to affirm) to +2.70 logits (more difficult to affirm) with most questions ranged between -1.50 logits to +2.00 logits. The *Stimulus Response* in an e-learning environment (distribution of person) measures from -3.60 logits (lower ability) to +3.90 logits (higher ability). The results from *Stimulus Response* indicate a good spread of normal distribution (Figure 4.3.3.7.4.1). However, there is one group above the more difficult to affirm logits (+4.00) and one group below the easy to affirm logits (-3.50). Furthermore, the distribution of item thresholds indicates shortfall in the distribution across the higher/"difficult" and lower/"easy" ends of the construct (Figure 4.3.37.4.1) suggesting the potential for adding items which reflect levels of *Stimulus Response* at the higher/"difficult" and lower/"easy" ends of the scale.

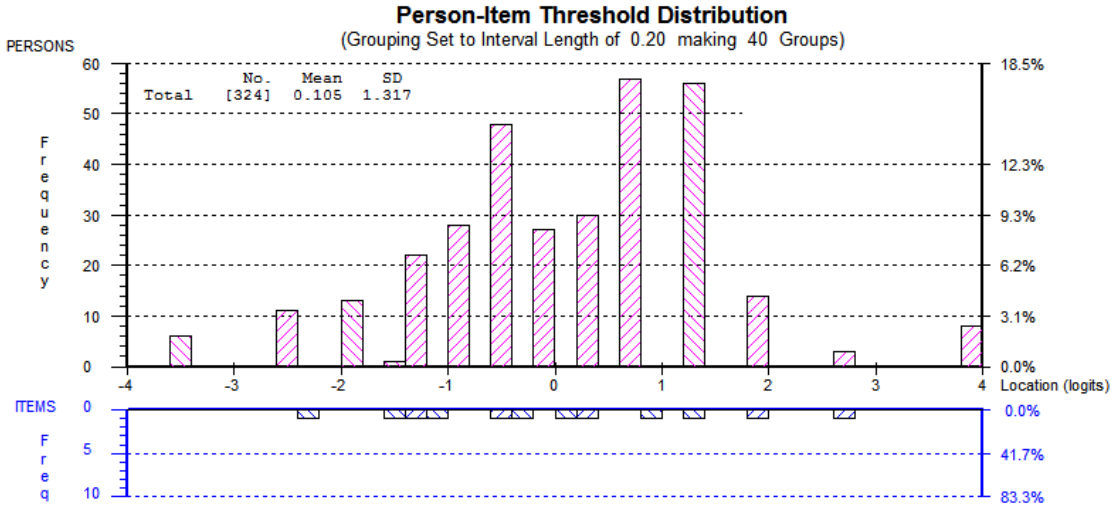

Figure 4.3.3.7.4.1. Person-item threshold distribution for Stimulus Response in an e-learning environment scale

4.3.3.7.5 (a) Person frequency distribution – Gender

The *Stimulus Response* scores for females and males are plotted in Figure 4.3.3.7.5.1. The female mean score was 0.06 (SD=1.26) and the male mean score was 0.21 (SD= 1.43). The difference was not statistically significant (F=0.98, p>0.05)

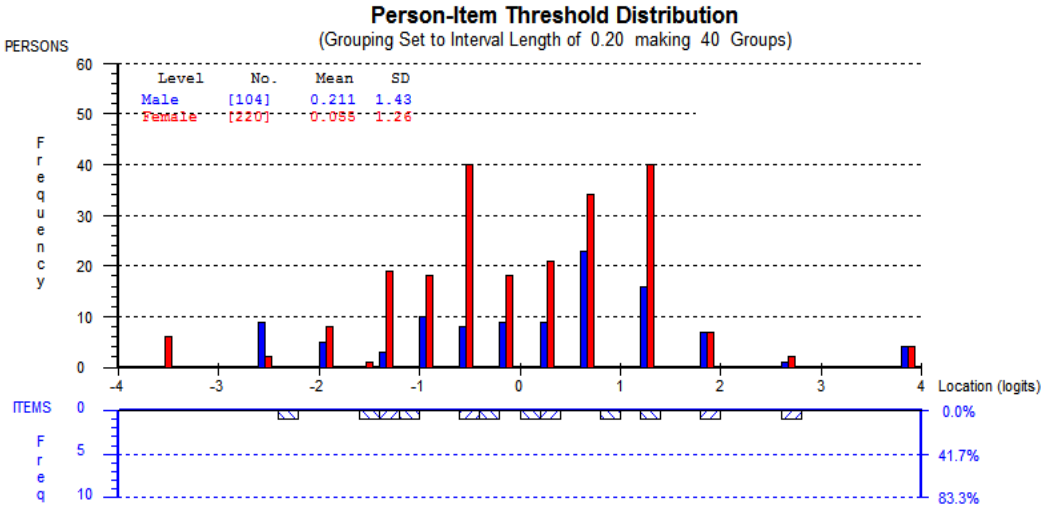

Figure 4.3.3.7.5.1. Person-item threshold distribution for Stimulus Response in an e-learning environment scale by gender

4.3.3.7.5 (b) Person frequency distribution – Age

The *Stimulus Response* scores for age between 17–20, between 21–24, between 25–28, between 29–32, between 33–36, between 37–40, between 41–44 and over 45 are plotted in Figure 4.3.3.7.5.2. The categories of respondents are:

Group 1: Age between 17-20 (Mean= 0.14, SD= 1.38)

Group 2: Age between 21-24 (Mean= 0.07, SD= 1.29)

Group 3: Age between 25-28 (Mean= 0.26, SD= 0.64)

Group 4: Age between 29-32 (no response received)

Group 5: Age between 33-36 (no response received)

Group 6: Age between 37-40 (no response received)

Group 7: Age between 41-44 (no response received)

Group 8: Age over 45 (Mean= -0.09, SD= 0.00).

The difference was not statistically significant (F=0.04, p>0.05).

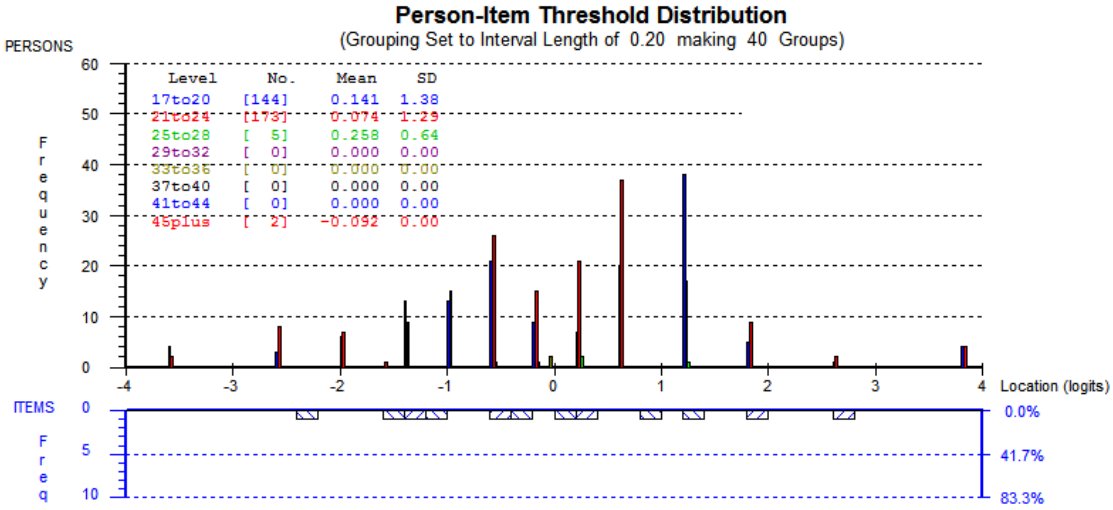

Figure 4.3.3.7.5.2. Person-item threshold distribution for Stimulus Response in an e-learning environment scale by age

4.3.3.7.5 (c) Person frequency distribution – Year

The *Stimulus Response* scores for first year, second year, third year, fourth year, fifth year and graduate year of study are plotted in Figure 4.3.3.7.5.3. The categories of respondents are:

Group 1: First year (Mean= 0.24, SD= 1.33)

Group 2: Second year (Mean= -0.13, SD= 1.33)

Group 3: Third year (Mean= -0.45, SD= 1.02)

Group 4: Fourth year (Mean= 0.74, SD= 0.00)

Group 5: Fifth year (no response received)

Group 6: Graduate year (no response received).

The difference was not statistically significant (F=2.01, p>0.05).

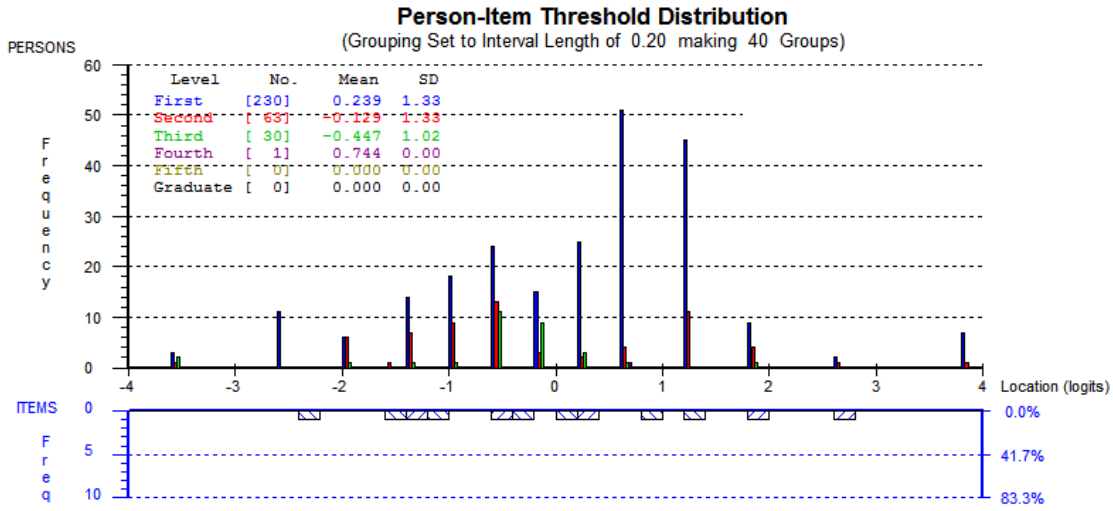

Figure 4.3.3.7.5.3. Person-item threshold distribution for Stimulus Response in an e-learning environment scale by year

4.3.3.7.4 (d) Person frequency distribution – Ethnicity

The *Stimulus Response* scores for Malay, Chinese, Indians, European, African, Middle Eastern and Others are plotted in Figure 4.3.3.7.5.4. The categories of respondents are:

Group 1: Malay (Mean= 0.16, SD= 1.27)

Group 2: Chinese (Mean=- 0.01, SD= 1.35)

Group 3: Indian (Mean= 0.66, SD= 1.48)

Group 4: European (Mean= -0.76, SD= 0.48)

Group 5: African (no response received)

Group 6: Middle Eastern (no response received)

Group 7: Others (no response received).

The difference was not statistically significant (F=0.97, p>0.05).

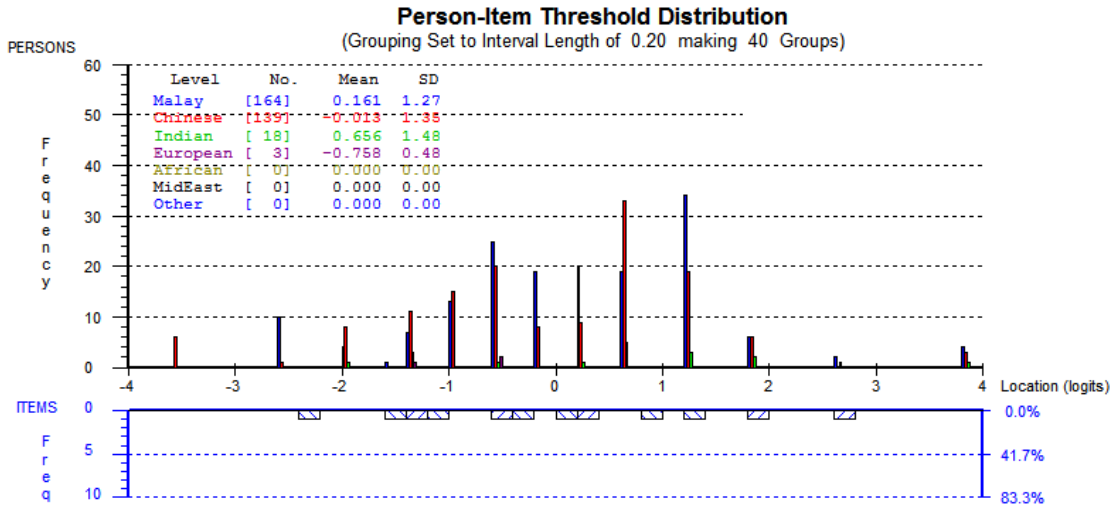

Figure 4.3.3.7.5.4. Person-item threshold distribution for Stimulus Response in an e-learning environment scale by ethnicity

4.3.3.7.5(e) Person frequency distribution – School

The *Stimulus Response* scores for Engineering, Computer Science, Management, Humanities, Mathematics, Industrial Technology, Education, Art and Biology are plotted in Figure 4.3.3.7.5.5. The categories of respondents are:

Group 1: Engineering (Mean= -0.88, SD= 0.00)

Group 2: Computer Science (Mean= -1.10, SD= 1.48)

Group 3: Management (Mean= 0.00, SD= 1.05)

Group 4: Humanities (Mean= 0.14, SD= 1.29)

Group 5: Mathematics (Mean= -0.36, SD= 1.17)

Group 6: Industrial Technology (Mean= 0.13, SD= 1.60)

Group 7: Education (Mean= 0.40, SD= 1.15)

Group 8: Art (Mean= -0.45, SD= 1.86)

Group 9: Biology (Mean= 0.78, SD= 0.97).

The difference was statistically significant ($F=4.72$, $p<0.05$).

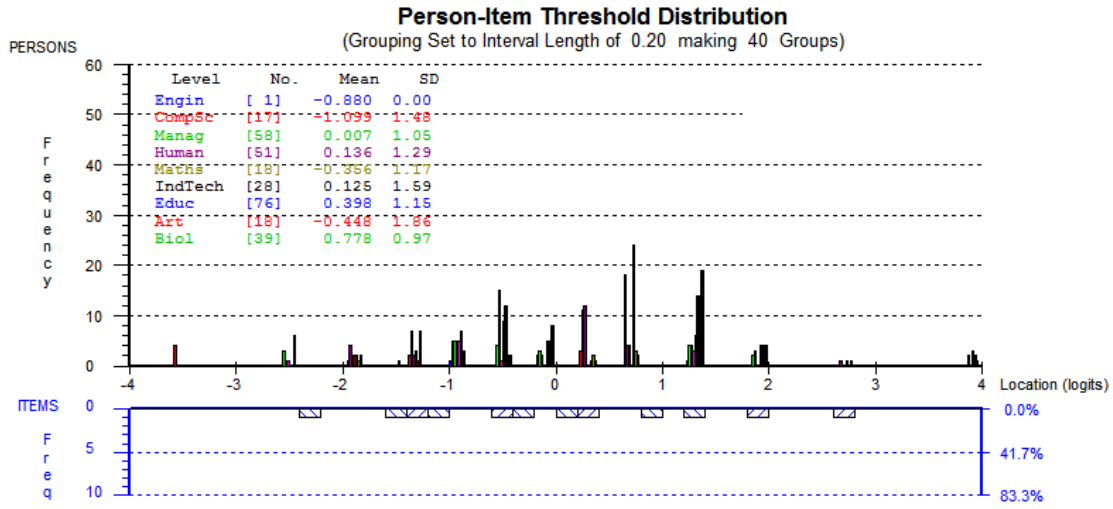

Figure 4.3.3.7.5.5. Person-item threshold distribution for Stimulus Response in an e-learning environment scale by school

4.3.3.8 Factor 23 –Recognition

4.3.3.8.1 Summary of Test-of-Fit Statistics

The item-student test-of-fit indicates that there is consistency of *Recognition* and item response patterns (see Table 4.3.3.8.1.1). This can be shown in the mean standardised item fit residual which is -0.17 and with SD 2.69. The mean standardised student-item fit residual is -0.54 and its SD is 1.32 which is good. Negative fit statistics (-0.36 and -0.17) indicate a response pattern that fits the model closely (see Andrich, 1985)

Table 4.3.3.8.1.1
Global fit statistics for Recognition in an e-learning environment

	Items		**Persons**	
	Location	Fit Residual	Location	Fit Residual
Mean	0.00	-0.17	0.55	-0.54
SD	0.41	2.69	1.33	1.32

The result of Chi-square (0.00) (see Table 4.3.3.8.1.2) indicates that there is not a good collective agreement between *Recognition* in an e-learning environment for all item difficulties. This suggests that the data does not focus on "one attribute or dimension at a time" (Bond & Fox, 2007, p. 32) and is thus multidimensional.

Table 4.3.3.8.1.2
Item-trait Interaction

Total Item Chi Square	139.19
Total Deg. of Freedom	16.00
Total Chi-Square Probability	0.00

The Person Separation Index in Table 4.3.3.8.1.3 is 0.73 and this indicates a well-spread distribution along the linear scale. Based on the index in Table 4.3.3.8.1.3, the power of the test-of-fit is considered to be good.

Table 4.3.3.8.1.3
Person Separation Index

Separation Index	0.73
Power of Test-of-Fit	Power is GOOD

4.3.3.8.2 Threshold Map

The Threshold map in Figure 4.3.3.8.2.3 provides a summary of the thresholds displayed from the four Category Probability Curves. There were no disordered thresholds.

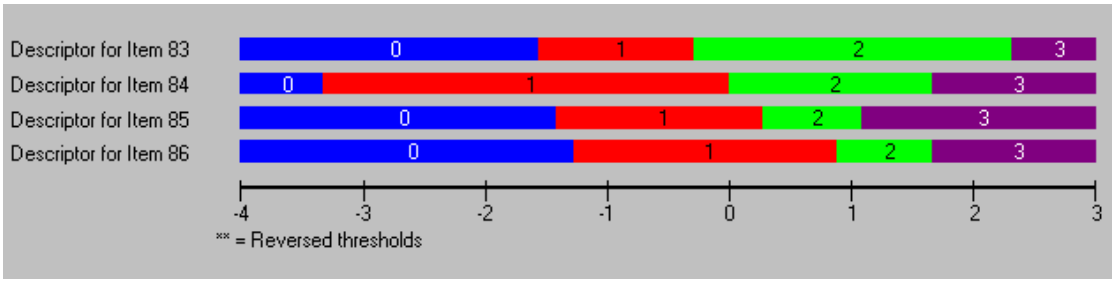

Figure 4.3.3.8.2.3. Threshold map for Recognition

4.3.3.8.3 Individual Item Fit

Table 4.3.3.8.3.1 summarises fit statistics for all four items including the residuals. All items have acceptable residuals except item except Items 83 (+3.48) and 84 (-3.00) which are slightly out of ±2.5 range. Table 4.3.3.8.3.1 shows that all other items have a fit to the measurement model. Also, the difficulties of the items ranged from -0.56 logits (easy) to 0.42 logits (difficult).

Table 4.3.3.8.3.1
Individual item fit statistics (I=83, 84, 85 & 86, N=300)

Item	Location	SE	Residual	Degree of Freedom	Chi-Square	Probability
83	0.15	0.09	3.48	222.12	69.00	0.00
84	-0.56	0.09	-2.99	222.12	31.437	0.00
85	-0.02	0.08	-0.80	221.38	16.99	0.00
86	0.42	0.08	-0.37	221.38	21.77	0.00

4.3.3.8.4 Person-Item Threshold Distributions

The mean of person location from Figure 4.3.3.8.4.1 is +0.55 logits. The respective threshold for eight items is distributed from "easy" on the left to "difficult" on the right.

In Figure 4.3.3.8.4.1, the logarithmic odds scale, shows both item difficulty values from -3.20 logits (easy to affirm) to +2.25 logits (more difficult to affirm) with most questions ranged between -0.80 logits to +3.50 logits. The *Recognition* in an e-learning environment (distribution of person) measures from -4.30 logits (lower ability) to +2.30 logits (higher ability). The results of *Recognition* indicate a ceiling effect with the clustering of participants at the high end of the scale (indicating high levels of *Recognition*). Furthermore, the distribution of item thresholds indicates a shortfall in their distribution across the higher/"difficult" end of the construct (Figure 4.3.3.8.4.1) suggesting the potential for adding items which reflect levels of *Recognition* at the higher/"difficult" end of the scale.

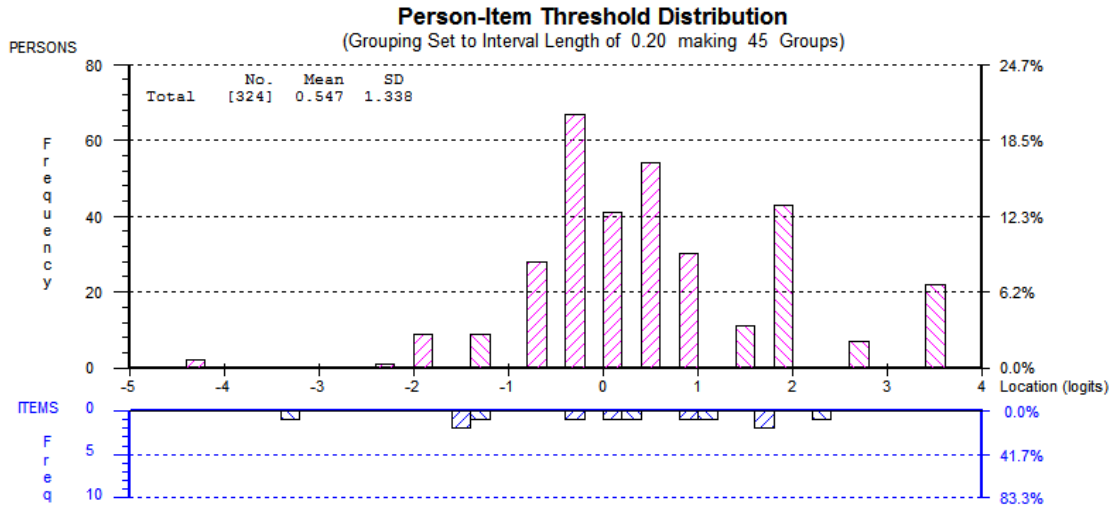

Figure 4.3.3.8.4.1. Person-item threshold distribution for Recognition in an e-learning environment scale

4.3.3.8.5 (a) Person frequency distribution – Gender

The *Recognition* scores for females and males are plotted in Figure 4.3.3.8.5.1. The female mean score was 1.53 (SD= 1.85) and the male mean score was 1.25 (SD= 1.69). The difference was statistically significant (F=4.99, p<0.05)

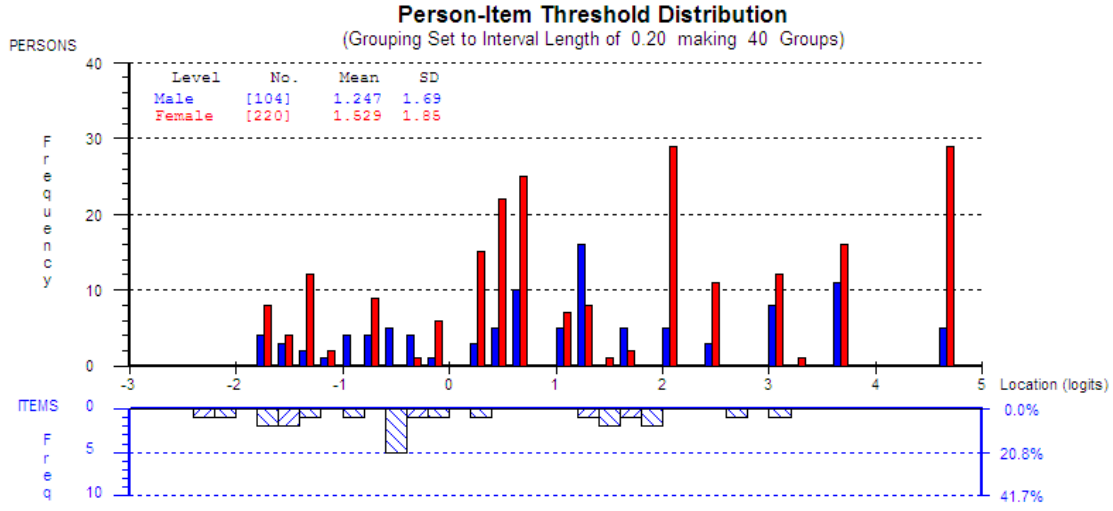

Figure 4.3.3.8.5.1. Person-item threshold distribution for Recognition in an e-learning environment scale by gender

4.3.3.8.5 (b) Person frequency distribution – Age

The *Recognition* scores for age between 17–20, between 21–24, between 25–28, between 29–32, between 33–36, between 37–40, between 41–44 and over 45 are plotted in Figure 4.3.3.8.5.2. The categories of respondents are:

Group 1: Age between 17-20 (Mean= 1.17, SD= 1.88)

Group 2: Age between 21-24 (Mean= 1.66, SD= 1.70)

Group 3: Age between 25-28 (Mean= 2.13, SD= 1.89)

Group 4: Age between 29-32 (no response received)

Group 5: Age between 33-36 (no response received)

Group 6: Age between 37-40 (no response received)

Group 7: Age between 41-44 (no response received)

Group 8: Age over 45 (Mean= -0.64, SD= 0.00).

The difference was not statistically significant (F=0.41, p>0.05)

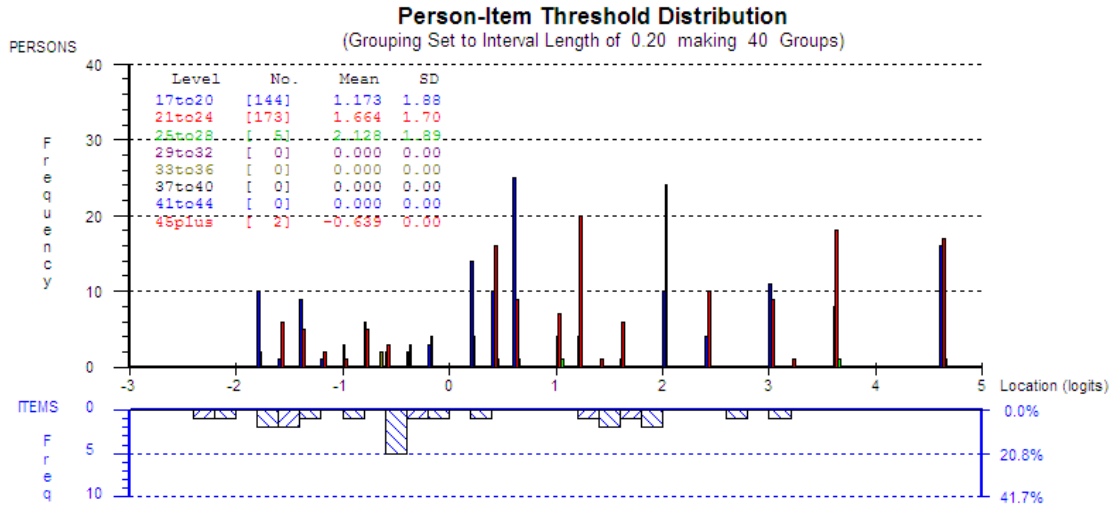

Figure 4.3.3.8.5.2. Person-item threshold distribution for Recognition in an e-learning environment scale by age

4.3.3.8.5 (c) Person frequency distribution – Year

The *Recognition* scores for first year, second year, third year, fourth year, fifth year and graduate year of study are plotted in Figure 4.3.3.8.5.3. The categories of respondents are:

Group 1: First year (Mean= 0.66, SD= 1.36)

Group 2: Second year (Mean= 0.15, SD= 1.32)

Group 3: Third year (Mean= 0.50, SD= 1.02)

Group 4: Fourth year (Mean= 0.98, SD= 0.00)

Group 5: Fifth year (no response received)

Group 6: Graduate year (no response received).

The difference was not statistically significant (F=1.50, p>0.05)

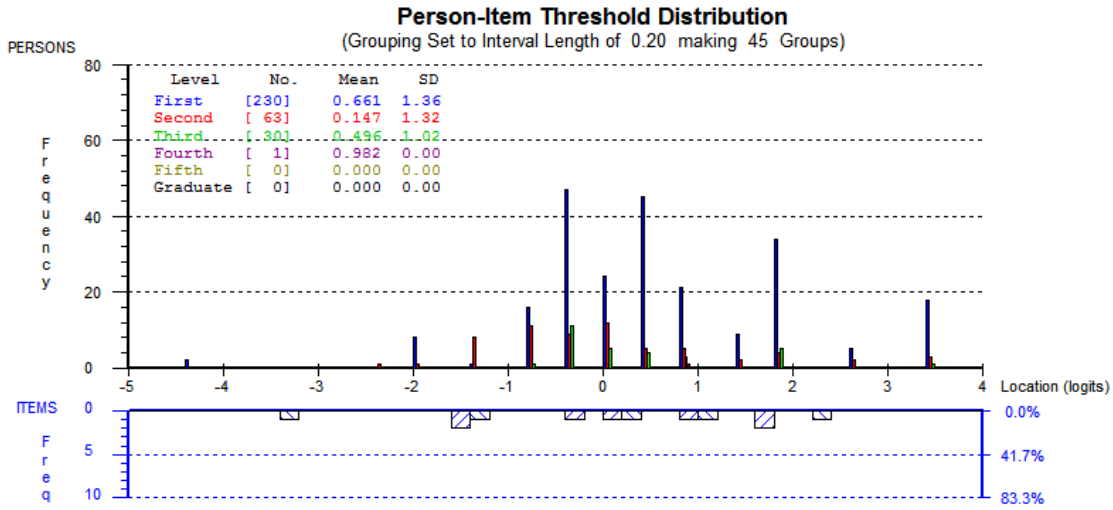

Figure 4.3.3.8.5.3. Person-item threshold distribution for Recognition in an e-learning environment scale by year

4.3.3.8.5 (d) Person frequency distribution – Ethnicity

The *Recognition* scores for Malay, Chinese, Indians, European, African, Middle Eastern and Others are plotted in Figure 4.3.3.4.5.4. The categories of respondents are:

Group 1: Malay (Mean=0.37, SD=1.21)

Group 2: Chinese (Mean=0.72, SD=144)

Group 3: Indian (Mean=0.90, SD=1.56)

Group 4: European (Mean= -0.02, SD=0.50)

Group 5: African (no response received)

Group 6: Middle Eastern (no response received)

Group 7: Others (no response received).

The difference was not statistically significant (F=1.20, p>0.05)

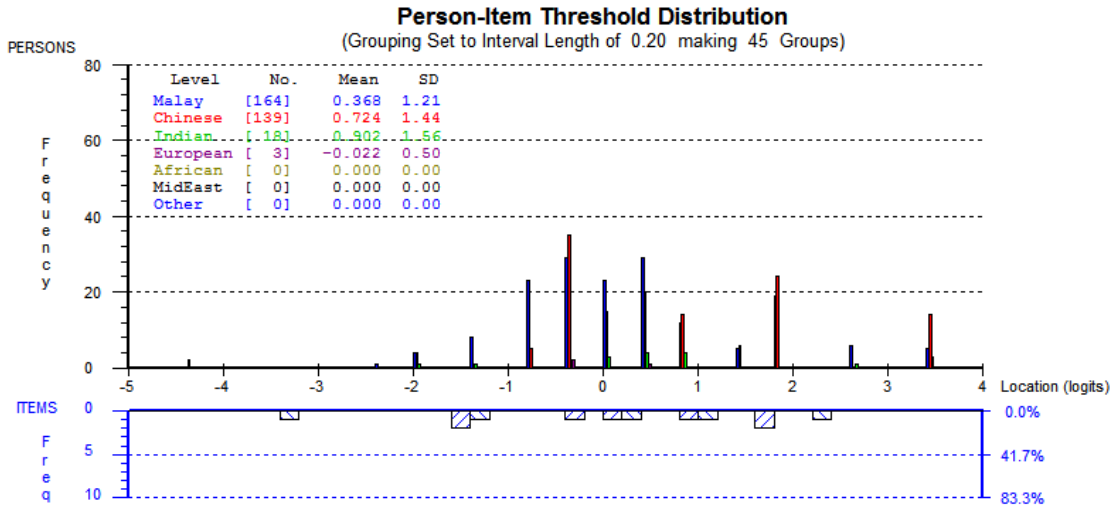

Figure 4.3.3.8.5.4. Person-item threshold distribution for Recognition in an e-learning environment scale by ethnicity

4.3.3.8.5(e) Person frequency distribution – School

The *Recognition* scores for Engineering, Computer Science, Management, Humanities, Mathematics, Industrial Technology, Education, Art and Biology are plotted in Figure 4.3.3.8.5.5. The categories of respondents are:

Group 1: Engineering (Mean= 0.13, SD= 0.00)

Group 2: Computer Science (Mean= 0.44 SD= 0.72)

Group 3: Management (Mean= 0.52, SD= 1.37)

Group 4: Humanities (Mean= 0.07, SD= 1.34)

Group 5: Mathematics (Mean= 0.96, SD= 1.40)

Group 6: Industrial Technology (Mean= 0.33, SD= 0.38)

Group 7: Education (Mean= 0.76, SD= 1.28)

Group 8: Art (Mean= 0.80, SD= 0.80)

Group 9: Biology (Mean= 0.87, SD= 1.24).

The difference was not statistically significant (F=3.38, p>0.05).

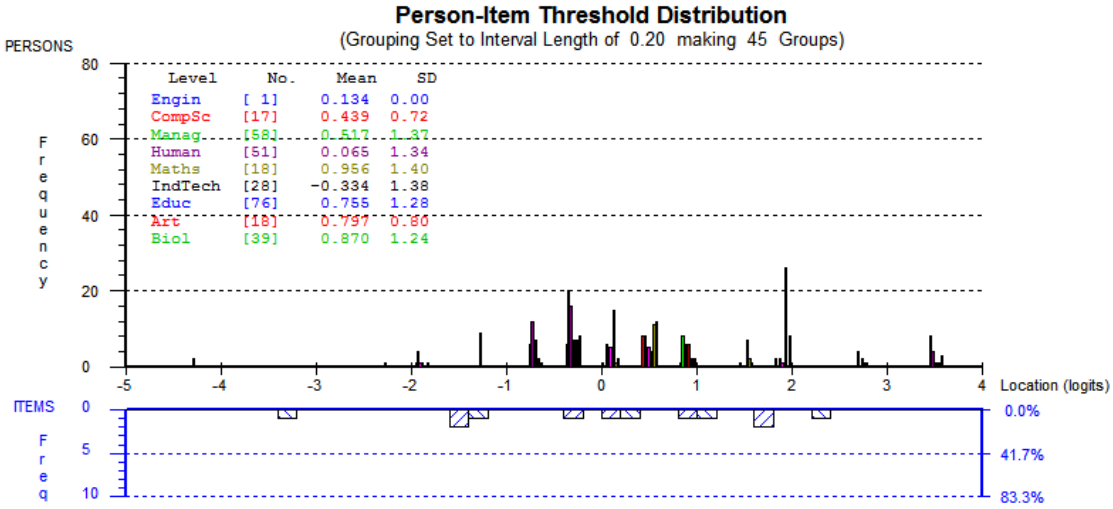

Figure 4.3.3.8.5.5. Person-item threshold distribution for Recognition in an e-learning environment scale by school

4.4 Summary

The respondents comprised 223 (67.9%) females and 104 (31.8%) males. The data came from 118 items scored 1, 2, 3 or 4 and was provided by a total of 327 respondents. Due to the multivariate nature of the data, Exploratory Factor Analysis was initially used, and a 28-factor solution was generated with items loading strongly on eight factors. The nature of the constructs underlying responses in self-regulated learning in an e-learning environment in a Malaysian university were:

1. *Ability and Effort Beliefs* (Factor 2)
2. *Reflection*, (Factor 4)
3. *Introjected Regulation* (Factor 6)
4. *Task Character* (Factor 8)
5. *Strategic Use* (Factor 17)
6. *Value of Task* (Factor 18)
7. *Stimulus Response* (Factor 19)
8. *Recognition* (Factor 23).

Items in the original instrument were then extracted as factors that were analysed by separate Rasch model analyses.

Test-of-Fit statistics were then run for all eight factors to estimate the item (item-person) and person (person-item) response patterns. In general, data from the respective factors fitted the model reasonably well. The item difficulty locations were also estimated to show which aspects of self-regulated e-learning were affirmed by the students. The following chapter discusses the results in relation to the research questions and the literature.

CHAPTER FIVE

DISCUSSION AND CONCLUSION

5.1 Overview

This chapter begins by showing how the findings of the study address the research questions. This is followed by a discussion of the findings and ends with the limitations of the study and a number of recommendations for further research.

5.2 Research questions

The key research questions which guided the study were:

1. Can self-regulated learning in an e-learning environment in a Malaysian university be measured?
2. What are student perceptions of their e-learning and their e-learning environment?
3. What aspects of e-learning were easy for the students to affirm and which were difficult to affirm? and
4. Does membership of particular groups (e.g. gender) account for variance in student e-learning perceptions?

5.3 Research Question 1

Can self-regulated learning in an e-learning environment in a Malaysian university be measured?

The data for the eight factors generally fitted the Rasch model. The fit was demonstrated by the various fit statistics and displays generated by RUMM2030. The following sections summarise the RUMM2030 analyses.

In specific response to the research question, student scores (perspective measures) were plotted on a linear scale. These interval scores are measures.

5.3.1 Ordering of Thresholds

Detailed explanations of the ordering of thresholds have been presented in Chapter Four sections 4.3.3.1.2, 4.3.3.2.2, 4.3.3.3.2, 4.3.3.4.2, 4.3.3.5.2, 4.3.3.6.2, 4.3.3.7.2 and 4.3.3.8.2. Of the 118 items, only seven elicited data that did not conform to the threshold requirements of the Rasch rating scale model:

1. In Factor 2 (*Ability and Effort Beliefs),* only two disordered thresholds were detected (see Figure 4.3.3.1.2.3),
2. In Factor 6 (*Introjected Regulation),* only one disordered threshold was detected (see Figure 4.3.3.3.2.3),
3. In Factor 8 (*Task Character),* only one disordered threshold was detected (see Figure 4.3.3.4.2.3), and
4. In Factor 18 (*Value of Task*), three disordered thresholds were detected (see Figure 4.3.3.6.2.3).

Therefore, it can be concluded that based on the examination of the ordering of thresholds for all eight factors, the pattern of thresholds was a very good fit to the conceptual model of self-regulated learning in an e-learning environment.

5.3.2 Summary of Test-of-Fit Statistics

Detailed explanations of person (student)-item and item-person (student) threshold distributions have been presented in Chapter Four sections 4.3.3.1.1, 4.3.3.2.1, 4.3.3.3.1, 4.3.3.4.1, 4.3.3.5.1, 4.3.3.6.1, 4.3.3.7.1 and 4.3.3.8.1. The item-student and student-item test-of-fit indices indicated an overall reasonable fit of data to the measurement model for the majority of the eight factors (see Table 5.3.2.1). The Chi square test results suggest that there is some internal dimensionality within most of the factors. This is common in learning environment investigations (see Cavanagh & Waugh, 2011)

Table 5.3.2.1
Summary test-of-fit for Self-regulated learning in an e-learning environment in a Malaysian university

	Items		**Persons**	
	Location	Fit Residual	Location	Fit Residual
Factor: 2				
Mean	0.00	-0.65	1.44	-0.63
SD	0.29	1.44	1.80	1.62
Factor: 4				
Mean	0.00	0.23	-0.13	-0.33
SD	0.28	1.45	1.02	1.34
Factor: 6				
Mean	0.00	0.40	-0.38	-0.48
SD	0.33	1.26	1.23	1.42
Factor: 8				
Mean	0.00	0.09	2.26	-0.36
SD	0.53	0.34	2.15	0.90
Factor: 17				
Mean	0.00	-0.08	-0.29	-0.33
SD	0.58	2.57	1.35	1.17
Factor: 18				
Mean	0.00	0.45	0.62	-0.23
SD	0.45	6.49	0.69	1.20
Factor: 19				
Mean	0.00	0.44	0.11	-0.44
SD	0.45	1.18	1.32	1.14
Factor: 23				
Mean	0.00	-0.17	0.55	-0.54
SD	0.41	2.69	1.33	1.32

5.3.3 Individual Item Fit

Detailed explanations of individual item fit (conceptual validity of the scale) have been presented in chapter four sections 4.3.3.1.3, 4.3.3.2.3, 4.4.3.3.3, 4.3.3.4.3, 4.3.3.5.3, 4.3.3.6.3, 4.3.3.7.3 and 4.3.3.8.3. The individual item fit indicated how well items fitted the underlying construct of self-regulated learning in an e-learning environment. The goodness-of-fit for each item is good. Of 118 questions, only ten did not fit:

1. In Factor 2 (*Ability and Effort Beliefs)*, all residuals were acceptable except one (Item 108) (see Table 4.3.3.1.3.1)
2. In Factor 4 (*Reflection)*, all residuals were acceptable except one (Item 19) (see Table 4.3.3.2.3.1)
3. In Factor 6 (*Introjected Regulation)*, all residuals were acceptable (see Table 4.3.3.3.3.1)
4. In Factor 8 (*Task Character)*, all residuals were acceptable (see Table 4.3.3.4.3.1)
5. In Factor 17 (*Strategic Use)*, all residuals were acceptable except three (Items 9, 16 and 28) (see Table 4.3.3.5.3.1)

6. In Factor 18 (*Value of Task),* all residuals were acceptable except three (Items 97, 113 and 114) (see Table 4.3.3.6.3.1)
7. In Factor 19 (*Stimulus Response),* all residuals were acceptable (see Table 4.3.3.7.3.1)
8. In Factor 23 (*Recognition),* all residuals were acceptable except two (Item 83 and 84) (see Table 4.3.3.8.3.1).

Therefore, it can be concluded that based on the examination of individual item fit for all eight factors, data fitted well with the underlying construct of self-regulated learning in an e-learning environment.

In summary, self-regulated learning in an e-learning environment in a Malaysian university was measured by the construction of eight scales and the fit of their data to the Rasch model is a result of measures being created.

5.4 Research Question 2

What are student perceptions of their e-learning and their e-learning environment?

The perceptions of students' e-learning and e-learning environment can be defined by the sub-constructs that were measured and their constituent items.

5.4.1 Ability and Effort Beliefs

The theoretical framework (see Appendix 3.1) and constituent items (see Table 4.3.2.2.1) of *Ability and Effort Beliefs* together define the perceptions of students' e-learning and the e-learning environment.

According to students' responses regarding the *Ability and Effort Beliefs* factor of e-learning and the e-learning environment, students indicated they would not sign up for an e-learning class because they felt they did not have what it takes to do well in this class or the knowledge required to succeed. Also, students perceived themselves as not performing well at university and considered the demands of e-learning tasks to be beyond their ability. They were too lazy to engage in

e-learning and also did not feel like participating in e-learning. In addition, students also perceived themselves to be too busy with their homework and did not have the energy to study. In summary, students perceived e-learning and the e-learning environment in terms of poor academic performance, low academic self-esteem, a higher intent to withdraw from school and retraction of effort. All these perceptions might affect academic achievement and most likely lead to undesirable academic behaviours (e.g., spending little or no time on homework, skipping class, being tardy).

5.4.2 Reflection

The perceptions of students' e-learning and the e-learning environment for *Reflection* were derived from the theoretical framework (see Appendix 3.1) and constituent items (see Table 4.3.2.2.2).

Based on the response from students, the *Reflection* factor of e-learning and e-learning environments were defined as, during the process of e-learning, students perceived their way of learning as continuously changing, and these changes continue in their future learning. Also, students perceived that their past and present experiences would influence how they tackle their future learning activities. They used reference materials or other literature to help strengthen their performance in e-learning activities. In addition, looking back at their learning enabled them to know how successful they had been and stepping back from the task helped them to understand their progress in e-learning. Further, students perceived that by being their own critic and examining their work, they were able to summarise their learning in the course and to examine their understanding of what they had learned. Also, students recognised that they should set specific goals before they begin a task in e-learning and organise their time to best achieve their goals. In summary, students perceived e-learning and the e-learning environment as being a process during which learning engagement leads to adjustments in action. Reflection happens after an act is completed, and coupled with self-evaluation, can be used in the transfer of learning strategies to new situations which will increase responsibility for planning and regulating a student's own learning.

5.4.3 Introjected Regulation

The perceptions of students' e-learning and e-learning environment for *Task Character* were defined by the theoretical framework (see Appendix 3.1) and constituent items (see Table 4.3.2.2.3).

Students perceived the *Introjected Regulation* factor of e-learning and the e-learning environment as a course requirement and a way to avoid punishment from teachers. In addition, students perceived that by signing up for an e-learning class, first, their instructor would think they were good students, and secondly, they would feel ashamed if they did not and finally, it would bother them if they did not. In summary, students perceived that participation in e-learning and the e-learning environment was a behaviour that prevents guilt and enhances the ego.

5.4.4 Task Character

Both the theoretical framework (see Appendix 3.1) and constituent items (see Table 4.3.2.2.4) of *Task Character* formed the perception of students' e-learning and e-learning environment.

Students stated that they would not sign up for an e-learning class because they found that studying was not exciting, they did not like studying, and they had the impression that it was always the same thing every day with learning tasks which were not stimulating. In summary, students perceived their e-learning and the e-learning environment to be a poor experience with unappealing academic tasks, thereby resulting in student disengagement.

5.4.5 Strategic Use

The theoretical framework (see Appendix 3.1) and constituent items (see Table 4.3.2.2.5) of *Strategic Use* together form the perception of students' e-learning and e-learning environment.

Students claimed that during and after e-learning, it was easier to understand their performance. They found it easy to assess their progress while they were still completing their e-learning tasks. Their e-learning discussion activities allowed

them to express how they arrived at their conclusions. These activities also helped them to know which strategies could be applied in other learning situations. They made notes on the different learning strategies used in the classroom environment and the e-learning environment. They were also able to use their previous knowledge to solve problems during reasoning, and finally, they were able to assess the challenges encountered during reasoning. These all led to the e-learning students' belief that a reflective journal (where students make notes on the discussion process) can assist them to develop the awareness of strategies. Awareness of strategies can then be applied to other learning situations after class by examining how skilled persons perform and construct meaning from this act.

5.4.6 Value of Task

The perceptions of students' e-learning and e-learning environment for *Value of Task* were derived from the theoretical framework (see Appendix 3.1) and constituent items (see Table 4.3.2.2.6).

Students said that they would not sign up for an e-learning class just to follow their friends, because, for them, university had no interest, study was of no value, and they had no good reason to study. These reasons led to the e-learning students' belief which resulted in identifying their priorities and further giving meaning to difficult or demanding activities.

5.4.7 Stimulus Response

Both the theoretical framework (see Appendix 3.1) and constituent items (see Table 4.3.2.2.7) of *Stimulus Response* together form the perception of students' e-learning and e-learning environment.

Students stated that both during and after e-learning courses, they were given feedback on their performance. Another positive aspect of e-learning is that different sounds and images stimulate their learning and e-learning has attractive features that motivate them. Finally, the instructor helps them to imagine real-life applications for what they have learned. This led to the e-learning students' belief that if their interest is stimulated, they are able to more readily see how their

knowledge can be applied in real-life settings. Similarly, this can be achieved by making the attainment of personal meaningful goals probable but uncertain with en route performance feedback.

5.4.8 Recognition

The theoretical framework (see Appendix 3.1) and constituent items (see Table 4.3.2.2.8) of *Recognition* together form the perception of students' e-learning and the e-learning environment.

Students claimed that during or after e-learning, they were more motivated if recognition of their performance was visible to others; they were happy when the instructor recognised their work, or people admired them; they also wanted classmates to think they are knowledgeable. This indicates that students are more likely to be motivated if they receive recognition from their instructors as well as their peers for their performance. Being publically recognised as being knowledgeable is clearly important to students in the e-learning environment. This requires that the individual's performance regarding the learning activity be visible. Recognition differs from competition in that it does not involve a comparison with the performance of someone else.

In summary, students stated that e-learning and the e-learning environment in Malaysia enabled them to reflect during and after class. In addition, students also claimed that the opportunity to use strategies such as note taking while participating in e-learning tasks enhances their learning. This will then help them to construct meaning to their learning and later develop awareness of their learning which they can later apply to other learning situations. In other words, Malaysian students favour an e-learning environment which helps them to develop skills which enable them to know how to learn (metacognition). Malaysian students also identified that experience tasks stimulate their interest which will then help them to identify their priorities and further give meaning to difficult or demanding activities. In addition, from the data collected, students perceived that participation in e-learning and the e-learning environment is a behaviour that prevents guilt and enhances their ego. Last but not least, students claimed that they need recognition and appealing academic tasks. Based on the response from students, failing to include one or

more of these factors in an e-learning environment may trigger feelings of not doing well in university, low academic self-esteem, retraction of effort and intent to withdraw from university.

5.5 Research Question 3

What aspects of e-learning were easy for the students to affirm and which were difficult to affirm?

"Location" is the item difficulty in logits (the log odds of answering the response categories positively). "Location" is a measure of the difficulty the students had in affirming the item. The item difficulties for the eight aspects of e-learning are presented below. These are the same values as presented in the previous chapter, but have been rearranged to show comparisons more clearly.

5.5.1 Ability and Effort Beliefs

The most difficult item to affirm in the *Ability and Effort Beliefs* aspect of e-learning was Item 103 (0.52 logits) and the easiest to affirm was Item 110 (-0.36 logits). Table 5.5.1.1 below lists all the easy and difficult to affirm items in ascending order. Low difficulty measures were obtained for *Ability and Effort Beliefs* Items 110, 104, 106, 107 and 108; they all have negative logits and these are easy to affirm items. On the other hand, the high measures for *Ability and Effort Beliefs* are for items 103, 105 and 109.

Table 5.5.1.1
Ability and Effort Beliefs items and difficulties

Factor 2: Ability and Effort Beliefs			
Item No.	Stem Statement	Wording	Location (Difficulty)
		Aspect: Self-determination	
		Ability and Effort Beliefs	
110.	I will not sign up for an e-learning class:	Because I don't have the energy to study.	-0.36
106.		Because the tasks demanded of me went beyond my abilities.	-0.29
104.		Because I don't have the knowledge required to succeed in this class.	-0.14
107.		Because I'm a bit lazy.	-0.04
108.		Because I do not feel like doing it.	-0.04
105.		Because I'm not good at university.	0.07
109.		Because I am too busy with my homework.	0.28
103.		Because I don't have what it takes to do well in this class.	0.52

5.5.2 Reflection

The most difficult item to affirm in the *Reflection* aspect of e-learning was Item 2 (0.40 logits) and the easiest to affirm was Item 4 (-0.47 logits). Table 5.5.2.1 below lists all the easy and difficult to affirm items in ascending order. Low measures for *Reflection* Items are 3, 4, 10, 11 and 19; they all have negative logits and these are easy to affirm items. On the other hand, the high measures for *Reflection* are for items 1, 2, 5, 6, 7 and 21.

Table 5.5.2.1
Reflection items and difficulties

Factor 4: Reflection			
Item No.	Stem Statement	Wording	Location (Difficulty)
		Aspect: Metacognition	
		Reflection	
4.	During or after e-learning:	My past and present experiences will take control of how I complete future activities	-0.47
3.		The experience I gained changed my learning habits	-0.46
10.		I try to be my own critic and look at my work from a significant viewpoint	-0.18
19.		I set specific goals before I begin a task in e-learning	-0.04
11.		I summarize my learning in the course to examine my understanding of what I have learned	-0.02
21.		I organize my time to best achieve my goals in e-learning	0.03
5.		I use references or other literature to strengthen my point of view in e-learning activities	0.10
7.		I step back from what I am doing in order to understand my progress in e-learning	0.18
6.		Looking back at my learning enables me to know how successful I am	0.20
1.		The way I learn is continuously changing	0.25
2.		As I am learning, I may change the way I learn	0.40

5.5.3 Introjected Regulation

The most difficult item to affirm in the *Introjected Regulation* aspect of e-learning was Item 93 (0.39 logits) and the easiest to affirm was Item 94 (-0.46 logits). Table 5.5.3.1 below lists all the easy and difficult to affirm items in ascending order. Low measures for *Introjected Regulation* items are 90, 91 and 94; they all have negative logits and these are easy to affirm items. On the other hand, the high measures for *Introjected Regulation* are for items 89 and 93.

Table 5.5.3.1
Introjected Regulation items and their difficulties

Factor 6: Introjected Regulation			
Item No.	Stem Statement	Wording	Location (Difficulty)
		Aspect: Self-determination	
		Introjected Regulation	
94.	I sign up for an e-learning class:	Because it bothers me when I don't	-0.46
90.		Because that's the rule	-0.13
91.		Because I want the instructor to think I am a good student	-0.05
89.		So that the teacher won't punish me	0.23
93.		Because I would feel ashamed if I do not	0.39

5.5.4 Task Character

The most difficult item to affirm in the *Task Character* aspect of e-learning was Item 115 (0.46 logits) and the easiest to affirm was Item 118 (-0.76 logits). Table 5.5.4.1 below lists all the easy and difficult to affirm items in ascending order. Low measure for *Task Character* item is 118; it is in negative logits. On the other hand, the high measures for *Task Character* are for items 115, 116 and 117.

Table 5.5.4.1
Task Character items and their difficulties

Factor 8: Task Character			
Item No.	Stem Statement	Wording	Location (Difficulty)
		Aspect: Self-determination	
		Task Character	
118	I will not sign up for an e-learning class:	Because my assignment is not stimulating	-0.76
116		I don't like studying	0.09
117		Because I have the impression that it's always the same thing everyday	0.21
115		Because I find that studying is not excited	0.46

5.5.5 Strategic Use

The most difficult item to affirm in the *Strategic Use* aspect of e-learning was Item 17 (0.59 logits) and the easiest to affirm was Item 28 (-1.24 logits). Table 5.5.5.1 below lists all the easy and difficult to affirm items in ascending order. Low measures for *Strategic Use* item are 15, 28 and 29; they are all in negative logits and these are easy to affirm items. On the other hand, the high measures for *Strategic Use* are for items 8, 9, 16, 17 and 23

Table 5.5.5.1
Strategic Use items and their difficulties

Factor 17: Strategic Use			
Item No.	Stem Statement	Wording	Location (Difficulty)
		Aspect: Metacognition	
		Strategic Use	
28.	During or after e-learning:	I am able to use my previous knowledge to solve problem during reasoning	-1.24
29.		I am able to assess the challenges encountered during reasoning	-0.24
15.		My e-learning discussion activities allow me to express how I arrived to my conclusions	-0.10
23.		I write down notes of the different learning strategies between class room environment learning and e-learning	0.02
8.		It's easier to understand my performance after I have finished the work on e-learning	0.13
16.		My e-learning activities help me to recognize how I plan to achieve my future learning	0.28
9.		I find it easy to assess my progress while I'm still completing the work in e-learning	0.55
17.		My e-learning activities help me to know which strategies can be applied to other learning situation	0.59

5.5.6 Value of Task

The most difficult item to affirm in the *Value of Task* aspect of e-learning was Item 97 (0.73 logits) and the easiest to affirm was Item 112 (-0.30 logits). Table 5.5.6.1 below lists all the easy and difficult to affirm items in ascending order. Low measures for *Value of Task* item are 111 and 112; they are all in negative logits and these are easy to affirm items. On the other hand, the high measures for *Value of Task* are for items 97, 113 and 114.

Table 5.5.6.1
Value of Task items and their difficulties

Factor 18: Value of Task			
Item No.	Stem Statement	Wording	Location (Difficulty)
		Aspect: Self-determination	
		Value of Task	
112.	I will not sign up for an e-learning class:	Because studying is not valuable to me	-0.30
111.		Because, for me, school holds no interest	-0.13
113.		Because I have no good reason to study	0.09
114.		Because studying is not important to me	0.39
97.		Because I follow my friends	0.73

5.5.7 Stimulus Response

The most difficult item to affirm in the *Stimulus Response* aspect of e-learning was Item 73 (0.56 logits) and the easiest to affirm was Item 112 (-0.30 logits). Table 5.5.7.1 below lists all the easy and difficult to affirm items in ascending order. Low measures for *Stimulus Response* item are 64 and 65; they are all in negative logits and these are easy to affirm items. On the other hand, the high measures for *Stimulus Response* are for items 62 and 73.

Table 5.5.7.1
Stimulus Response items and their difficulties

Factor 19: Stimulus Response			
Item No.	Stem Statement	Wording	Location (Difficulty)
		Aspect: Self-determination	
		Stimulus Response	
64.	During or after e-learning:	Providing different sounds and images stimulates my learning	-0.49
65.		E-learning should have attractive features that motivated me	-0.20
62.		I was given feedback on my performance as the e-learning course proceeded	0.14
73.		The instructor helps me to imagine real-life application of learned material	0.56

5.5.8 Recognition

The most difficult item to affirm in the *Recognition* aspect of e-learning was Item 86 (0.42 logits) and the easiest to affirm was Item 84 (-0.56 logits). Table 5.5.8.1 below lists all the easy and difficult to affirm items in ascending order. Low measures for *Recognition* item are 84 and 85; they are all in negative logits and these are easy to affirm items. On the other hand, the high measures for *Recognition* are for items 83 and 86.

Table 5.5.8.1
Recognition items and their difficulties

Factor 23 Recognition			
Item No.	Stem Statement	Wording	Location (Difficulty)
		Aspect: Self-determination	
		Recognition	
84.	During or after e-learning:	I am happier when the instructor recognises my work	-0.56
85.		I like people to admire me	-0.02
83.		I am more motivated if Recognition is visible to others	0.15
86.		I want classmates to think I am knowledgeable	0.42

In summary, items that were easy for students to affirm were 3, 4, 10, 11, 15, 19, 28, 29, 64, 65, 84, 85, 90, 91, 94, 104, 106, 107, 108, 110, 111, 112 and 118. On the other hand, items that were difficult for students to affirm were: 1, 2, 5, 6, 7, 8, 9, 16, 17, 21, 23, 83, 86, 89, 93, 97, 103,105,109, 113,114, 115, 116 and 117.

5.6 Research Question 4

Does membership of particular groups (e.g. gender) account for variance in student e-learning perceptions?

The membership of particular groups which account for variance in student e-learning perceptions included gender, age group, year of study at university, ethnicity and school factor. These groups were defined in Chapter Four as age, year, ethnicity and school (within the University). The effect of membership of these groups is presented group by group and includes the effect for each factor.

5.6.1 Gender

Analysis of the data from Figures 4.3.3.1.5.1, 4.3.3.2.5.1, 4.3.3.3.5.1, 4.3.3.4.5.1, 4.3.3.5.5.1, 4.3.3.6.5.1 and 4.3.3.7.5.1 revealed that the average scores for the two *gender* groups in *Ability and Effort Beliefs, Reflection, Introjected Regulation, Task Character, Strategic Use, Value of Task* and *Stimulus Response* were not significantly different. The female groups had a slightly higher means than the male groups except for *Strategic Use* which was the reverse. Furthermore, analysis using the one-way ANOVA technique revealed no significant result with F-statistic of 1.74 which was not significant at the 0.05 level (p=0.18) for *Ability and Effort Beliefs*, F-statistic of 0.06 which was not significant at the 0.05 level (p=0.81) for *Reflection*, F-statistic of 1.40 which was not significant at the 0.05 level (p=0.25) for *Introjected Regulation*, F-statistic of 0.90 which was not significant at the 0.05 level (p=0.34) for *Task Character*, F-statistic of 0.16 which was not significant at the 0.05 level (p=0.69) for *Strategic Use*, F-statistic of 0.15 which was not significant at the 0.05 level (p=0.70) for *Value of Task* and F-statistic of 0.98 which was not significant at the 0.05 level (p=0.32) for *Stimulus Response* (see Table 5.5.1.1). Therefore, it can be concluded that university students of both genders showed no marked difference in respect of their *Ability and Effort Beliefs, Reflection, Introjected Regulation, Task Character, Strategic Use, Value of Task,* and *Stimulus Response.* Thus, *gender* in *Ability and Effort Beliefs, Reflection, Introjected Regulation, Task Character, Strategic Use, Value of Task,* and *Stimulus Response* did not account for variance in students' e-learning perceptions.

On the other hand, the analysis of the data from Figure 4.3.3.8.5.1 revealed that the female group scored slightly higher in *Recognition* than did the male group. Analysis using the one-way ANOVA technique yielded a significant result with F-statistic of 4.99 which was significant at the 0.05 level (p=0.03) for *gender* (see Table 5.5.1.1). Therefore, it can be concluded that the university students from the two *gender* groups were different in terms of their *Recognition*. Thus, *gender* in *Recognition* accounts for variance in students' e-learning perceptions.

Table 5.6.1.1
ANOVA results for gender with different factors

Factor	F-statistic	P Value
Ability and Effort Beliefs	1.74	0.18
Reflection	0.06	0.81
Introjected Regulation	1.40	0.25
Task Character	0.90	0.34
Strategic Use	0.16	0.69
Value of Task	0.15	0.70
Stimulus Response	0.98	0.32
Recognition	**4.99**	**0.03**

5.6.2 Age Group

Analysis of the data from Figures 4.3.3.1.5.2, 4.3.3.2.5.2, 4.3.3.4.5.2, 4.3.3.5.5.2, 4.3.3.6.5.2, 4.3.3.7.5.2, 4.3.3.8.5.2 revealed that the average scores for the age groups showed no significant impact on *Ability and Effort Beliefs, Reflection, Task Character, Strategic Use, Value of Task, Stimulus Response* and *Recognition* (see Table 5.6.2.1). The highest mean score for *Ability and Effort Beliefs* was seen in age between 25-28 (group 3) and lowest in age over 45 (group 8), followed by the highest mean score for *Reflection* was seen in age over 45 (group 8) and lowest was in age between 25-28 (group 3), the highest mean score for *Task Character* was seen in age between 17-20 (group 1) and lowest was in age over 45 (group 8), the highest mean score for *Strategic Use* was seen in age between 21-24 (group 2) and lowest was in age over 45 (group 8), the highest mean score for *Value of Task* was seen in age between 21-24 (group 2) and lowest was in age over 45 (group 8), the highest mean score for *Stimulus Response* was seen in age between 25-28 (group 3) and lowest was in age over 45 (group 8) and the highest mean score for *Recognition* was seen in age between 25-28 (group 3) and lowest was in age over 45 (group 8).

Furthermore, analysis using the one-way ANOVA technique revealed no significant result with F-statistic of 0.40 which was not significant at the 0.05 level (p=0.90) for *Recognition,* F-statistic of 2.00 which was not significant at the 0.05 level (p=0.54) for *Reflection,* F-statistic of 1.18 which was not significant at the 0.05 level (p=0.31) for *Task Character,* F-statistic of 1.35 which was not significant at the 0.05 level (p=0.22) for *Strategic Use,* F-statistic of 1.24 which was not significant at the 0.05 level (p=0.28) for *Value of Task,* F-statistic of 0.04 which was not significant at the 0.05 level (p=1.00) for *Stimulus Response* and F-statistic of 0.40 which was not significant at the 0.05 level (p=0.90) for *Recognition* (see Table

5.6.2.1). Therefore, it can be concluded that the university students of different age groups showed no marked difference in respect of their *Ability and Effort Beliefs, Reflection, Task Character, Strategic Use, Value of Task, Stimulus Response* and *Recognition*. Thus, *age* in *Ability and Effort Beliefs, Reflection, Task Character, Strategic Use, Value of Task, Stimulus Response* and *Recognition* did not account for variance in students' e-learning perceptions.

On the other hand, the analysis of the data from Figure 4.3.3.3.5.2 revealed that the average scores for the age groups in *Introjected Regulation* were different. Age between 17-20 (Group 1) showed the highest ability and age between 25-28 (group 3) the lowest. Furthermore, analysis using the one-way ANOVA technique revealed a significant result with F-statistic of 2.19 which was significant at the 0.05 level (p=0.04) (see Table 5.6.2.1). Therefore, it can be concluded that the university students from different age groups were different in respect of their *Introjected Regulation*. Thus, age in terms of *Introjected Regulation* accounts for variance in students' e-learning perceptions.

Table 5.6.2.1
ANOVA results for age group with different factors

Factor	F-statistic	P Value
Ability and Effort Beliefs	1.33	0.23
Reflection	2.00	0.54
Introjected Regulation	**2.19**	**0.04**
Task Character	1.18	0.31
Strategic Use	1.35	0.22
Value of Task	1.24	0.28
Stimulus Response	0.04	1.00
Recognition	0.40	0.90

5.6.3 Year of study at university

Analysis of the data from Figures 4.3.3.1.5.3, 4.3.3.3.5.3, 4.3.3.4.5.3, 4.3.3.6.5.3, 4.3.3.7.5.3, 4.3.3.8.5.3 revealed that the average scores for the year of study at university showed no significant impact on *Ability and Effort Beliefs, Introjected Regulation, Task Character, Value of Task, Stimulus Response* and *Recognition* (see Table 5.6.3.1). The highest mean score for *Ability and Effort Beliefs* was seen in fourth year students (group 4) and lowest was in first year students (group 1), followed by the highest mean score for *Introjected Regulation* was seen in fourth year students (group 4) and lowest was in third year students

(group 3), the highest mean score for *Task Character* was seen in group 1and lowest was in third year students (group 3), the highest mean score for *Value of Task* was seen in fourth year students (group 4) and lowest was in third year students (group 3), the highest mean score for *Stimulus Response* was seen in fourth year students (group 4) and lowest was in third year students (group 3) and the highest mean score for *Recognition* was seen in group 4 and lowest was in second year students (group 2).

Furthermore, analysis using the one-way ANOVA technique revealed no significant result with F-statistic of 1.89 and p-value of 0.09 for *Ability and Effort Beliefs*, followed by F-statistic of 2.09 and p-value of 0.07 for *Introjected Regulation,* F-statistic of 1.83 and p-value of 0.11 for *Task Character,* F-statistic of 1.66 and p-value of 0.14 for *Value of Task,* .F-statistic of 2.01 and p-value of 0.08 for *Stimulus Response* and F-statistic of 1.50 and p-value of 0.19 for *Recognition*. Therefore, it can be concluded that the university students from different year of study at university did not show much difference in *Ability and Effort Beliefs*. Thus, year of study at university did not account for variance in students' e-learning perceptions for *Ability and Effort Beliefs*.

On the other hand, the analysis of the data from Figure 4.3.3.2.5.3 revealed that the average scores for the graduate students (group 6) in *Reflection* responses were different. Third year students (group 3) showed the highest ability and second year students (group 2) the lowest. Furthermore, analysis using the one-way ANOVA technique revealed that the analysis yielded a significant result with F-statistic of 4.21 which was significant at the 0.05 level (p=0.00) (see Table 5.6.3.1). Therefore, it can be concluded that the university students from different years of study at university showed a difference in terms of their *Reflection* responses. Thus, year of study at university accounts for variance in students' e-learning perceptions in regards to *Reflection*. Also, the analysis of the data from Figure 4.3.3.5.5.3 revealed that the average scores for the graduate students (group 6) (see Table 5.6.3.1) in *Strategic Use* were different. Fourth year students (group 4) showed the highest ability and second year students (group 2) the lowest. Furthermore, analysis using the one-way ANOVA technique revealed that the analysis yielded a significant result with F-statistic of 3.56 which was significant at the 0.05 level (p=0.00).

Also, it can be concluded that the university students from different years of study are different in respect of their *Strategic Use*. Thus, year of study at university in *Strategic Use* accounts for variance in students' e-learning perceptions.

Table 5.6.3.1
ANOVA results for year of study at university with different factors

Factor	F-statistic	P Value
Ability and Effort Beliefs	1.89	0.09
Reflection	**4.21**	**0.00**
Introjected Regulation	2.09	0.07
Task Character	1.83	0.11
Strategic Use	**3.56**	**0.00**
Value of Task	1.66	0.14
Stimulus Response	2.01	0.08
Recognition	1.50	0.19

5.6.4 Ethnicity

Analysis of the data from Figures 4.3.3.1.5.4, 4.3.3.3.5.4, 4.3.3.4.5.4, 4.3.3.6.5.4, 4.3.3.7.5.4, 4.3.3.8.5.4 revealed that the average scores for the *ethnicity* group showed no significant impact on *Reflection*, *Introjected Regulation*, *Task Character*, *Strategic Use*, *Stimulus Response* and *Recognition* (see Table 5.6.4.1).

The highest mean score for *Reflection* was seen in Indian (group 3) and lowest was in European (group 4), followed by the highest mean score for *Introjected Regulation* was seen in Indian (group 3) and lowest was in Chinese (group 2), the highest mean score for *Task Character* was seen in Chinese (group 2), and lowest was in European (group 4), the highest mean score for *Strategic Use* was seen in Indian (group 3), and lowest was in European (group 4), the highest mean score for *Stimulus Response* was seen in Indian (group 3), and lowest was in European (group 4) and the highest mean score for *Recognition* was seen in Indian (group 3), and lowest was in European (group 4).

Furthermore, analysis using the one-way ANOVA technique revealed no significant result with F-statistic of 0.25 and p-value of 0.96 for *Reflection*, followed by F-statistic of 1.03 and p-value of 0.41 for *Introjected Regulation*, F-statistic of 0.62 and p-value of 0.72 for *Task Character*, F-statistic of 0.61 and p-value of 0.72 for *Strategic Use*, F-statistic of 0.97 and p-value of 0.44 for *Stimulus Response* and F-statistic of 1.20 and p-value of 0.31 for *Recognition*. Therefore, it can be

concluded that the university students from different *year* categories also did not show much difference in *Reflection, Introjected Regulation, Task Character, Strategic Use, Stimulus Response,* and *Recognition.* Thus, *ethnicity* in *Reflection, Introjected Regulation, Task Character, Strategic Use, Stimulus Response,* and *Recognition* did not account for variance in students' e-learning perceptions.

On the other hand, the analysis of the data from Figures 4.3.3.2.5.4 and 4.3.3.5.5.4 revealed that the average scores for the seven *ethnicity* groups in *Ability and Effort Beliefs* were different. Indian (group 3) scored the highest on ability and European (group 4) the lowest. Furthermore, analysis using the one-way ANOVA technique revealed that the analysis yielded a significant result with F-statistic of 4.37 which was significant at the 0.05 level (p=0.00) (see Table 5.6.4.1). Therefore, it can be concluded that the university students from different *ethnicity* groups were different in respect of their *Ability and Effort Beliefs.* Thus, *ethnicity* accounts for variance in students' e-learning perceptions. In addition, the analysis of the data from Figure 4.3.3.6.5.4 revealed that the average scores for the seven *ethnicity* groups in *Value of Task* were different. Indian (group 3) had the highest score on ability and European (group 4) the lowest. Furthermore, analysis using the one-way ANOVA technique revealed that the analysis yielded a significant result with F-statistic of 3.91 which was significant at the 0.05 level (p=0.00) (see Table 5.6.4.1). Therefore, it can be concluded that the university students of different *ethnicity* differed in respect of their *Value of Task.* Thus, *ethnicity* in *Value of Task* accounts for variance in students' e-learning perceptions.

Table 5.6.4.1
ANOVA results for ethnicities with different factors

Factor	F-statistic	P Value
Ability and Effort Beliefs	4.37	0.00
Reflection	0.25	0.96
Introjected Regulation	1.03	0.41
Task Character	0.62	0.72
Strategic Use	0.61	0.72
Value of Task	**3.91**	**0.00**
Stimulus Response	0.97	0.44
Recognition	1.20	0.31

5.6.5 School

Analysis of the data from Figures 4.3.3.1.5.5, 4.3.3.3.5.5 and 4.3.3.4.5.5 revealed that the average scores for the *school* showed no significant impact on *Ability and Effort Beliefs*, *Introjected Regulation* and *Task Character* (see Table 5.6.5.1).

The highest mean score for *Ability and Effort Beliefs* was seen in the School of Art (group 8) and lowest was in the School of Engineering (group 1), followed by the highest mean score for *Introjected Regulation* was seen in group 6 and lowest was in the School of Art (group 8) and the highest mean score for *Task Character* was seen in group 3 and lowest was in the School of Mathematics (group 5).

On the other hand, the analysis of the data from Figures 4.3.3.2.5.5, 4.3.3.5.5.5, 4.3.3.6.5.5, 4.3.3.7.5.5 and 4.3.3.8.5.5 revealed that the average scores for the nine Schools in *Reflection*, *Strategic Use*, *Value of Task*, *Stimulus Response*, and *Recognition* were different (see Table 5.6.5.1). The highest mean score for *Reflection* was seen in the School of Art (group 8) and lowest was in the School of Engineering (group 1), followed by the highest mean score for *Strategic Use* was seen in the School of Computer Science (group 2) and lowest was in the School of Engineering (group 1), highest mean score for *Value of Task* was seen in the School of Industrial Technology (group 6) and lowest was in the School of Engineering (group 1) and highest mean score for *Recognition* was seen in the School of Mathematics (group 5) and lowest was in the School of Engineering (group 1).

Furthermore, analysis using the one-way ANOVA technique revealed a significant result with F-statistic of 6.30 and p-value of 0.00 for *Reflection*, followed by F-statistic of 7.86 and p-value of 0.00 for *Strategic Use*, F-statistic of 3.88 and p-value of 0.00 for *Value of Task*, F-statistic of 4.72 and p-value of 0.00 for *Stimulus Response* and F-statistic of 3.38 and p-value of 0.00 for *Recognition*. Therefore, it can be concluded that the university students of different schools differed in respect of their *Reflection*, *Strategic Use*, *Value of Task*, *Stimulus Response*, and *Recognition*. Thus, *ethnicity* in *Reflection*, *Strategic Use*, *Value of Task*, *Stimulus Response*, and *Recognition* account for variance in students' e-learning perceptions.

Table 5.6.5.1
ANOVA results for schools with different factors

Factor	F-statistic	P Value
Ability and Effort Beliefs	1.87	0.06
Reflection	**6.30**	**0.00**
Introjected Regulation	0.06	0.81
Task Character	1.11	0.35
Strategic Use	**7.86**	**0.00**
Value of Task	**3.88**	**0.00**
Stimulus Response	**4.72**	**0.00**
Recognition	**3.38**	**0.00**

In summary, the membership of particular groups which account for variance in student e-learning perceptions are:

1. *Recognition* in *gender*
2. *Introjected Regulation* in *age*
3. *Reflection* and *Strategic Use* in *year*
4. *Ability and efforts beliefs* and *Value of Task* in *ethnicity*
5. *Reflection, Strategic Use, Value of Task, Stimulus Response* and *Recognition* in *school*.

5.7 Discussion of Findings

Based on the results of this study, the current e-learning environment in Malaysia has the capability of allowing students to reflect on what they already know. Kramnick (2007) thought that it was highly desirable that students be encouraged to understand the learning materials with learning significance drawing from their past experience with enough "space" given in order to add further knowledge. Also, in order for students to shift to a constructivist domain which is the base of self-regulated learning, *Reflection* must take place. Sandars (2009) and Dewey (1963) both agreed that greater understanding of both the self and the situation (*Reflection*) allowed students to make sense of learning derived from their experiences. In addition, Zimmerman (1986) stated that reflection is necessary to understand and control the learning process. *Reflection* is classified at the highest level of metacognition (Zimmerman, 1986) and according to Schön (1983) *Reflection* could be either a "reflection-in" or "reflection-on" action.

In order to develop a better self-regulated e-learning environment, there is a need to consider "reflection-in" and "reflection-on" learning in action. From this study, Malaysian students applied Problem-Based Learning (reflection in learning) and the use of a reflection journal (reflection on learning). From the literature, many authors believe that PBL is an important approach for e-learning. Schön (1983) also agrees that reflection in learning helps the thinking and inferring process. Furthermore, PBL recognises how students continue to change when they reflect in learning. Similarly, reflection journals or learning journals (Langley & Brown; Lew & Schmidt, 2007) were tools to help e-learning students to review their own learning and help reveal what, "students think about what they have learned and facilitates the integration of new materials" (Langley & Brown, 2010, p. 13). In other words, reflection journals help e-learners to reflect on their learning.

Both PBL and reflective journals are essential for the development of a self-regulated e-learning environment based on the literature review and the results from the Malaysian students in this study. Also, since Malaysia is moving away from rote learning, the strategy of taking notes on any discussion is another highly desired factor.

The e-learning environment can be improved if facilitators and (or) instructional technologists include the metacognitive tools to help e-learning students to use strategies not just to take notes, but to know how to learn. In other words, a metacognitive tool or an e-learning environment is needed to encourage "… awareness that learners are thinking about the learning strategies they are using during learning activities" (Stacey, 2001, p. 5). Apart from the importance of metacognitive tools, stimulus tasks emerged as another important factor according to the results of this study. As mentioned, stimulus tasks helped students to identify their priorities and further gave meaning to difficult or demanding activities. To achieve this, students must see the value placed on the task. It is very important that the *Value of Task* be an integral part of students' lives because according to Legault, Green-Demers and Pelletier (2006), "when the task is not an integral component of a student's life, or if, in effect, is not important to the student, amotivation may result" (p. 569). Apart from a task being an integral part of the student's learning, it should also not exceed the capability of students. Barkoukis et

al., (2008) believe that the Value of Task will not be appreciated if students believe "that the activity is too demanding for the individual" (Barkoukis, et al., 2008, p. 40). Because of this, *Reflection* and *Strategic Use* should be introduced to students gradually at the beginning of their study and there should not be a sudden increase of expectations in the final year. This might lead to what Legault et al. (2006), mentioned: "if the qualitative experience of the activity does not engage the knowledge or ability or stimulation of students, then it is unlikely students will favour it" (p. 569).

This study also indicated that the Malaysian self-regulated e-learning environment may need to have a mechanism which allows e-learning students to avoid guilt or to enhance their ego. As mentioned in the literature, e-learning students are trying their best to obtain rewards (gaining extra marks) and to avoid punishment (losing marks). This type of student behaviour is quite common in Malaysia. Also, studying online often creates amotivation that could be redressed in the design of e-learning by breaking studying down into smaller steps. In the process of providing rewards, facilitators and (or) instructional technologists should include things that are rewarding which require the performance of many small tasks, with multiple decisions to be made along the way (Allen, 2003). This behaviour according to Ballmann and Mueller (2008) is known as "*introjected regulation*".

Another important component of the self-regulated e-learning environment was *Recognition*. It was interesting to note that students need recognition, and Malaysian students are no exception. According to the literature, a good e-learning environment should recognise what students have done, and Malone and Lepper (1987) believed learners felt satisfied when others recognized and appreciated their accomplishments. Apart from identifying *Recognition* as a component of the self-regulated e-learning environment in Malaysia, it is also important to know what facilitators and (or) instructional technologists can do to improve recognition in the self-regulated e-learning environment in Malaysia. According to literature, Vockell (2010) mentioned that there are three ways by which facilitators and (or) instructional technologists can ensure recognition of student achievement: (1) the process of performing an activity which is visible, (2) the product of the activity should be visible, or (3) some other result of the activity should be visible (for

example, an article may appear in the newspaper listing the names of people who participated in a science fair).

To improve the e-learning environment, facilitators and (or) instructional technologist need to pay attention to developing appealing academic tasks to avoid poor qualitative experience of activities or unappealing academic tasks that lead to student disengagement. To achieve this, Allen (2003) emphasised that tasks must be set one at the time. In addition, "Breaking complex tasks apart and teaching component separately can be an effective instructional practice" (p. 198). In this way, students will not lose interest and they will be more engaged in their learning. Also, working on a specific task as compared to an objective stimulates students to engage and work harder towards achieving tangible results. There is also a need to help e-learners to transfer their newly learned knowledge and skills to real-world tasks. This will further engage students in their e-earning because they understand that their newly acquired knowledge and skills can be transferred to real-world tasks.

From this study, the feeling of not doing well in university, low academic self-esteem, retraction of effort and intent to withdraw from university could feasibly occur if one or more of the abovementioned factors were missing. According to the literature, Skinner et al. (as cited in Legault et al., 2006) believed that ability and effort must be considered together, and they are both predecessors of good performance in school. Furthermore, Legault et al. (2006) believed that "poor belief is a driving component of academic disengagement" (p. 568). The design of an e-learning environment should take into account the results of the study mentioned above to prevent poor ability beliefs. According to the literature, it is more often poor academic alibility belief and difficulties which lead e-learners to low perceived competence (Barkoukis, et al., 2008; Chua, 2009). Similarly, effort belief was important to keep e-learners motivated; the design of the e-learning environment must continually promote different strategies to help e-learners to cope with the ever-changing environment. This is important because e-learning students may still lack motivation even if they are aware of requirements and have positively appraised their ability efforts.

Apart from the importance of the abovementioned factors, there was also a need to look in detail at the groups which had significant impact on the self-regulated e-learning environment in a Malaysian university. For example, *gender* had a significant impact on *Recognition*; *age* had a significant impact on *Introjected Regulation*; *year* had a significant impact on *Reflection* and *Strategic Use*; *ethnicity* had a significant impact on *Ability and Effort Beliefs* and *Value of Task* and *school* had a significant impact on *Reflection*, *Strategic Use*, *Value of Task, Stimulus Response* and *Recognition*. Also, there was no one group (e.g. gender, age, year, ethnicity and school) that had significant impact on *Task Character*.

Results in Factor 2 (*Ability and Effort Beliefs*) and Factor18 (*Value of Task*) indicated that ethnicity or cultural background had a significant impact on *Ability and Effort Beliefs* and *Value of Task* (see Table 5.6.4.1). This was significantly high in group 3 (Indian) (see Tables 4.3.3.1.5.4 and 4.3.3.6.5.4). Although the findings of Moreno, Shell and Pirritano (2009) found that "comparisons between cultural groups may not provide the best answers" (p. 5), nonetheless the three major goups of diverse cultural background in Malaysia do indicate a difference, and this may be attributed to the fact that "different cultural groups may have developed unique abilities [and efforts] from their preferred ways of processing information" (Moreno & Saldaña, 2005, p. 1).

Ethnicity has been discussed in a lot of research (Moreno & Saldaña, 2005; Moreno et al., 2009). Furthermore, "race is the most powerful variable shaping stratification beliefs" (Hunt, 2004, p. 841). In this study, e*thnicity* had a significant impact on *Ability and Effort Beliefs* and *Value of Task* (see Table 5.6.4.1). According to Loren (2008), ability and effort can generally be divided into higher achievers and lower achievers. Higher achievers, regardless of ethnicity, "had similar beliefs about the causes of success and failure" (Loren, 2008, p. 1) with high effort. On the other hand, "the lower achievers believed that success was due to external factors, and that failure was due to lack of ability" (Loren, 2008, p. 1) with low effort. There is a need for facilitators and (or) instructional technologists to explore ways to acknowledge cultural backgrounds in higher/lower achievers. Similarly, how students look at the *Value of Task* is highly related to their background. *Value of Task* is related to behaviour to identify the students' priorities

and further give meaning to difficult or demanding activities (Legault et al., 2006). Lewis (2005) believes that "the patterning and complex stratification in contemporary Malaysian society encompass a number of social differences besides race" (Lewis, 2005, p. 14), and there is a need to look at, "1. gender; 2. age; 3. class; 4. occupation; 5. religion; 6. lineage and clan (especially for the Chinese); 7. rural-urban; 8. modern-traditional, and, 9. caste" (Lewis, 2005, p. 14). The problem for *Value of Task* is when students do not value an activity, do not feel an integral part of it and lack inner acceptance. These are the types of behaviours which facilitators and (or) instructional technologists want least (Legault, et al., 2006).

The number of years into university study had a significant impact on *Reflection* and *Strategic Use* (see Table 5.6.3.1). *Reflection* and *Strategic Use* are often discussed cohesively (Erskine, 2009; Flavell, 1979; Reingold, Rimor, & Kalay, 2008; Zimmerman, 1986). Also, fourth year students scored the highest in *Reflection* above all other groups (see Table 4.3.3.2.5.3). This shows that the longer students are immersed in a self-regulated knowledge acquired environment such as e-learning, the more learning strategies they acquired. As Halter stated, "knowing how to learn and which strategies work best are valuable skills that differentiate expert learners from novice" (as cited in Liggins, 2006, p. 14). Similarly, the result in Factor 17 (*Strategic Use*) indicated that fourth year students scored above all other groups and had a significant impact on *Strategic Use* (see Table 4.3.3.5.5.3). These indicated that, the closer e-learning students moved towards graduation, the more they were able to master the use of reflection and learning strategies in and on what they were learning. The design and development of an e-learning environment in Malaysia should take into consideration the impact of *year* on *Reflection* and *Strategic Use*.

Results in Factor 6 (*Introjected Regulation*) indicated that *age* had a significant impact on *Introjected Regulation* (see Table 5.6.2.1). For trying to avoid guilt or enhance ego, the youngest age group (between 17-20) scored the highest (see Table 4.3.3.3.5.2). According to Erikson (2006) and Wilder (2003) their research showed adolescents were aged between 13-19. In this study, the youngest age group was 17-20 which is slightly over the adolescent age. Malaysian students are no different from students in the United Kingdom and Spain with "adolescents [in the United

Kingdom] reporting strong *Introjected Regulation*" (Gillison, Osborn, Standage, & Skevington, 2009, p. 309). Similar to this, according to Etxebarria, Isasi and Pérez (2002), "[in Spain] more intense guilt feelings in females found support in the adolescent group, but not in the adult group" (p. 786).

Although the findings of Reed and Cox (2007) indicated that *age* had no significant impact on *Introjected Regulation*, this study indicated the reverse. In addition, the findings of Murcia, Gimeno and Camacho (2007) indicate that differences were established in the 16-24 age group which matched fairly closely the findings of this study (between 17 – 20). Also, facilitators and (or) instructional technologists should pay attention to the group aged between 25-28 when designing an e-learning environment in Malaysia. This age group normally is the graduating group which is in their final year of study. It is usual for this group of students to score the lowest for *Introjected Regulation* because they have learned to be more responsible for their learning rather than avoiding guilt or enhancing ego by doing their assignment or studying at the last minute. This group of students works the hardest, so this might be the best time to push them as much as possible. On the other hand, the group aged between 17-22 scored the highest on avoiding guilt or enhancing their ego. This age group normally is in their first year of university, and one of the explanations for this behaviour might be that they had just come from a secondary school system which was still predominantly teacher-centred and which produces low responsibility and high *Introjected Regulation* in their learning. Another possibility might be that students were still adapting to university life, and there were too many things going on during their first year, especially in the first semester (Erskine, 2009).

Results in Factor 17 (*Strategic Use*) indicated that *school* had a significant effect on *Strategic Use* (see Table 5.6.5.1) with the School of Computer Science showing the most significant effect (see Table 4.3.3.5.5.5). It would be expected that students from Computer Science which branched from Engineering would have similar metacognition and self-determination levels as those of Engineering students. In the findings of Newell, Dahm, Harvey and Newell (2004) Engineering students, indicated an increase in *Strategic Use* with students concentrating on "their own learning styles and those of their teammates" (p. 320). This indicated that students

are using their own strategies and those of their teammates to increase success in their learning. Also, according to Parham, Gugerty, and Stevenson (2010), strategies play a significant role in solving computer science problems, especially in programming.

Every university has its own schools, and different schools have their particular characteristics, values and discipline which differentiate them from others. Therefore, it is normal that *Reflection* (Schön, 1983), *Strategic Use* (Blakey & Spence, 1990, p. 2), *Value of Task* (Barkoukis, et al., 2008), *Stimulus Response* (Ryan & Deci, 2000b) and *Recognition* (Malone & Lepper, 1987) are different in each school. All these factors played important roles in developing a good e-leaning environment. Facilitators and (or) instructional technologists should design the e-learning environment carefully because different schools have different characteristics and values (Allodi & Fischbein, 2010; Tinambunan, 2011). Apart from all these factors, using an easier approach, Allodi and Fischbein (2010) suggested that schools can be classified according to:

1. Low in Reward and Low in Workload Satisfaction
2. High in Reward and Low in Workload Satisfaction
3. Low in Reward and High in Workload Satisfaction
4. High in Reward and High in Workload Satisfaction.

It is common for students of different majors to have their own characteristics and this has also been documented in various types of research. In the School of Education for example, students, "use both analytic and pragmatic strategies" (Cogmen & Saracaloglu, 2009, p. 250) in their study. Also, students majoring in Education would most likely have the characteristics of fairness, positive attitude, preparedness, personal touch, sense of humor, creativity, willingness to admit mistakes, forgiveness, respect, high expectations, compassion and sense of belonging (Thompson, Greer, & Greer, 2004). On the other hand, the idea of the stereotypical student in the School of Engineering and Computer Science as being "studious and intellectually able but also socially awkward and relatively unskilled at effective teamwork as well as oral and written communication" seems to be confirmed by the study of Boylen (2003). In addition, Newell et al. (2004) confirmed that Engineering students have a tendency to exhibit relatively low scores in precision

and confluence and relatively high scores in sequence. In this study, *school* has a significant impact on various factors (*Reflection, Strategic Use, Value of Task, Stimulus Response* and *Recognition*) which is quite common as detailed above. Different characteristics will lead to different metacognition and self-regulation. Therefore, it is highly recommended that each school develop its own e-learning environment, paying particular attention to the factors mentioned.

There have been many studies on the relationship between gender and motivation (Green-Demers, et al., 2008; Rozendaal, Minnaert, & Boekaerts, 2001; Rusillo & Arias, 2004). In this study, *gender* had a significant impact on *Recognition* (see Table 4.3.3.8.5.1) which was a sub-construct of motivation (Malone & Lepper, 1987). This was because female students as compared to male students had different principles in *Recognition*. According to Rusillo and Arias (2004), "female students tend to take more responsibility for bad academic results … [and] male students give more credit to luck" (p. 108). Although Malaysian students may not fall into this category, it is recommended that facilitators and (or) instructional technologists take this factor into consideration.

Results for Factor 23 (*Recognition*) indicated that *gender* had a significant impact on *Recognition* (see Table 5.6.1.1) of the female group. Females are an important group in Malaysian society, and the design of *Recognition* in an e-learning environment in Malaysia should focus on females. This is due to the society in Malaysia being different from the West as Crismore (2003) experienced and mentioned. Also, domestic labour like, "cooking and cleaning [are] still deemed to be female responsibilities" (Williamson, 2011, p. 3). Surprisingly, Malaysian females in the e-learning environment are not much different from those in the West – they need recognition. Therefore, the design of an e-learning environment in Malaysia should pay more attention to female students.

5.8 Limitations

This study investigated aspects of implementing self-regulated learning in an e-learning environment in a Malaysian university. Although many of the findings of this research concur with those of similar studies in other Western societies, caution

must be taken in generalising the results due to the limitation of the study. Such limitations relate to the research sample, time frame, instruments used, metacognitive levels, self-determination factors and interpretation of the results.

5.9 Further Research

Self-regulated leaning is imperative for an e-learning environment in Malaysia. When examining how groups account for variance in student e-learning perceptions, the following eight factors should be taken into consideration:

1. Factor 2 (*Ability and Effort Beliefs*)
2. Factor 4 (*Reflection*)
3. Factor 6 (*Introjected Regulation*)
4. Factor 8 (*Task Character*)
5. Factor 17 (*Strategic Use*)
6. Factor 18 (*Value of Task*)
7. Factor 19 (*Stimulus Response*)
8. Factor 23 (*Recognition*).

The e-learning environment is an important environment for students to learn and hone their metacognition skills with the help of self-determination (motivation). However, the researcher has come to the conclusion, from this study, that in order for an e-learning environment to be effective, there must be a preliminary study of the metacognitive levels of the students and their self-determination towards success in e-learning. There must be a connection between the data collected for the development of the e-learning environment and how it is later implemented in the actual university. As the researcher has learned during the course of this study, the implementation of the e-learning environment is worth researching. This is because most ICT projects fail at the implementation phase, and the e-learning environment is no exception. Research could be undertaken to discover the metacognitive levels and how self-determination (motivation) factors favour e-learning. Also, facilitators and (or) instructional technologists should do their best to design and develop an e-learning environment which is favourable for Malaysian students. However, the collaboration and cooperation of both the academic and administrative management in universities are vital for its success. Moreover, researchers should

be encouraged to evaluate the management of the e-learning environment in Malaysian universities. Thus, the researcher recommends further research in this area.

5.10 Conclusion

In summary, the proposed model in section 2.1.1 (see Figure 2.0.1.1) in Chapter Two was derived from the theoretical framework of this study. It is important to note that the results of this study indicate that *awareness use* was not an important aspect of implementing a self-regulated e-learning environment in a Malaysian university. On the other hand, the following were among the important aspects of implementing a self-regulated e-learning environment in a Malaysian university:

1. Reflective use
    a) Reflection in Learning
    b) Reflection on Learning
2. Strategic Use
    a) Self-Evaluation
    b) Debriefing the Thinking Process
    c) Planning and Self-Regulation
    d) Keeping a Thinking Journal
    e) Talking About Thinking
3. Intrinsic Motivation
    a) Challenge
    b) Curiosity
    c) Recognition
4. Extrinsic motivation
    a) External Regulation
    b) Introjected Regulation
    c) Identified Regulation
5. Amotivation
    a) Ability Beliefs
    b) Effort Beliefs
    c) Value of Task
    d) Task Character.

Implementing self-regulated learning in an e-leaning environment in Malaysia requires careful study of metacognition and self-determination in students. It is important for Malaysian universities to pay attention to these two factors, in addition to identifying student membership of particular groups and the various aspects of implementing a self-regulated e-learning environment in a Malaysian university.

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Appendix 3.1
Framework of self-regulated e-learning (2.0)

Framework of self-regulated e-learning (2.0)

Metacognition (2.3)			Self-determination (2.4)		
Reflective use 2.3.1	Strategic Use 2.3.2	Awareness use 2.3.3	Extrinsic motivation 2.4.1	Intrinsic motivation 2.4.2	Amotivation 2.4.3
A. Reflection in learning 2.3.1.1 Process during learning engagement that leads to adjustments in action like Problem-Based Learning	A. Self-evaluation 2.3.2.1 Has guided self-evaluation experiences that can be recognized and later transfers learning strategies to new situations	A. Declarative knowledge 2.3.3.1 Knowledge about one's skill, intellectual resources and ability as a learner	A. Integrated 2.4.1.1 Experiences behaviours that are most congruent with his/her values and needs	A Individual 1. Challenge 2.4.2.1 Set personally meaningful goals, Make attainment of goals probable but uncertain, Give en route performance feedback, and Relate goals to learners' self esteem	A. Ability beliefs 2.4.3.1 Result in poor academic performance, low academic self-esteem and a higher intent of withdrawing from high school
B. Reflection on learning 2.3.1.2 Reflection that happens after an act is completed	B. Debriefing the thinking process 2.3.2.2 Has closure activities which focus student discussion on thinking processes to develop awareness of strategies that can be applied to other learning situations	B. Procedural knowledge 2.3.3.2 Knowledge about how to implement learning procedures (e.g. strategies)	B. Identified 2.4.1.2 Identifies the personal importance of behaviour	2. Curiosity 2.4.2.2 Stimulate sensory curiosity by making abrupt changes that will be perceived by the senses, and Stimulate cognitive curiosity by making a person wonder about something (i.e., stimulate the learner's interest)	B. Effort beliefs 2.4.3.2 Might also affect academic achievement, and a retraction of effort is most likely to lead to undesirable academic behaviours (e.g., spending little or no time on homework, skipping class, being tardy)
	C. Planning and self-regulation 2.3.2.3 Must assume increasing responsibility for planning and regulating their learning	C. Conditional knowledge 2.3.3.3 Knowledge about when and why to use learning procedures	C. Introjected 2.4.1.3 Behaves so as to avoid guilt or to enhance one's ego	3. Control 2..4.2.3 Make clear the cause-and-effect relationships between what students are doing and things that happen in real life (contingency), Allow learners to freely choose what they want to learn, and how they will learn it (choice), and Enable the learners to believe that their work will lead to powerful effects (power)	C. Values of Task 2.4.3.3 Give meaning to difficult or demanding activities
	D. Keeping a thinking journal 2.3.2.4 Has the use of a journal or learning log	H. Evaluation of learning 2.3.3.4 Analysis of performance and strategy effectiveness after a learning episode	D. External 2.4.1.4 Performs actions are performed to satisfy external demands	4. Fantasy 2.4.2.4 Make a game out of learning, Help learners imagine themselves using the learned information in real-life settings, and Make the fantasies intrinsic rather than extrinsic	D. Task Character 2.4.3.4 May be associated with amotivation due to Task Characteristics as well, because unappealing school work presumably fosters avoidance behaviours
	E. Talking about thinking 2.3.2.5 Allowing students to see how a skilled person performs and to construct meaning from this act	G. Debugging strategies 2.3.3.5 Strategies used to correct comprehension and performance error		B. Interpersonal 1. Competition 2.4.2.5 Competition occurs naturally as well as artificially, Competition is more important for some people than for others, People who lose at competition often suffer more than the winners profit, and Competition sometimes reduces the urge to be helpful to other learners	
	F. Identifying what is known and what is not known 2.3.2.6 Making conscious decisions about their knowledge and later verify, clarify and expand, or replace with more accurate information	F. Monitoring 2.3.3.6 Assessment of one's learning or strategy use		2. Cooperation 2.4.2.6 Cooperation occurs naturally as well as artificially, Cooperation is more important for some people than for others, Cooperation is a useful real-life skill, and Cooperation requires and develops interpersonal skills	
		E. Information management strategies 2.3.3.7 Skill and strategy sequences use online materials to process information more effectively (e.g. organizing, elaborating, summarizing and selective focusing)		3. Recognition 2.4.2.7 Recognition requires that the process or product or some other result of the learning activity be visible. Recognition differs from competition in that it does not involve a comparison with the performance of someone else	

Note: Numbers refer to sub-heading within Chapter two

Appendix 3.2
USM Approval letter

UNIVERSITI SAINS MALAYSIA

PUSAT TEKNOLOGI PENGAJARAN DAN MULTIMEDIA
CENTRE FOR INSTRUCTIONAL TECHNOLOGY AND MULTIMEDIA

MEMORANDUM

DITERIMA PADA
25 APR 2008
Pejabat Timbalan Naib Canselor (Hal-Ehwal Pelajar) USM

Kepada: Profesor Ahmad Shukri Mustapa Kamal
Timbalan Naib Canselor
(Hal Ehwal Akademik & Antarabangsa)
Universiti Sains Malaysia

Prof. Madya Omar Osman
Timbalan Naib Canselor
(Hal Ehwal Pembangunan Pelajar)
Universiti Sains Malaysia

Daripada: Pengarah

Tarikh: 25 April 2008

Memohon Kebenaran untuk Mengumpul Data
Dari Pelajar dan Pensyarah Universiti Sains Malaysia

Dengan hormatnya perkara di atas dirujuk.

Untuk makluman tuan, Encik Phung Li Furn adalah seorang pelajar di bawah Rancangan Latihan Kakitangan Akademik Universiti. Beliau sekarang berada di School of Education, Language Studies and Social Work, Curtin University of Technology, Perth Western Australia.

Bagi memenuhi keperluan tesis, beliau perlu mengumpul beberapa data daripada pelajar-pelajar tahun pertama, tahun akhir dan juga pensyarah-pensyarah USM. Beliau telahpun menulis surat kepada saya memohon kebenaran untuk mengumpul data-data tersebut (surat beliau bertarikh 9 April 2008 disertakan).

Bagi tujuan pengutipan data tersebut, sebanyak enam buah Pusat Pengajian/Pusat telah dikenalpasti oleh Encik Phung:

1. Pusat Pengajian Sains Komputer
2. Pusat Pengajian Ilmu Pendidikan
3. Pusat Pengajian Pengurusan
4. Pusat Pengajian Ilmu Kemanusiaan
5. Pusat Pengajian Pendidikan Jarak Jauh
6. Pusat Teknologi Pengajaran dan Multimedia

Memandangkan data-data tersebut amat diperlukan untuk memenuhi keperluan tesis beliau, saya menyokong penuh permohonan tersebut dan ingin memanjangkan perkara ini untuk kelulusan dan sokongan tuan.

Segala perhatian dan jasabaik tuan di dalam hal ini amatlah dihargai dan diucapkan ribuan terima kasih.

"BERKHIDMAT UNTUK NEGARA"
'Cintailah Bahasa Kita'

PM Wan Fauzy — Kelulusan.

Saya tiada halangan

25/4

(Prof. Madya Dr. Wan Mohd. Fauzy Wan Ismail)

PROF. MADYA OMAR OSMAN
TNC-HEPP, USM

lwnF/saah/Phung-1

11800 USM, Pulau Pinang, Malaysia
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Appendix 3.3

INFORMATION SHEET

Date: 11/01/2011

Dear Participants,

My name is Phung, Li Funn and I am completing my doctoral studies at Curtin University. The title of my thesis is ***Self-regulated Learning in an E-learning environment in a Malaysian University***. The aim of my study is to conceptualise, design and validate an instrument for measuring self-regulated learning in the e-learning environment in a Malaysian university.

Part of my study will involve interviews. Your involvement is entirely voluntary and you may withdraw from the study at anytime. You also can be assured that all information will be treated confidentially and is highly protected. For ethical purposes, the names of the students would be kept anonymous.

If any publications are to arise from this study, only aggregate of findings will be reported. All interviews will be recorded and transcribed and all interviewee information will be kept confidential. The use of a tape recorder will be required to record verbal protocol analysis of participants. All original data will be retained at the School of Education (SoE) at Curtin University. The researcher and the School will take full responsibility to ensure appropriate safety for the data.

Dr. Lina Pelliccione is my supervisor at Curtin University. Should you have any queries about this study, please do not hesitate to contact me or my supervisor. Dr. Lina Pelliccione can be contacted at: l.pelliccione@curtin.edu.au / +(61) 08 9266 2169

Thank you in advance for your help and am anticipating your favourable co-operation.

Sincerely yours,

_____

Phung, Li Funn

Email: lifunn@hotmail.com / lifunn.phung@postgrad.curtin.edu.au

Appendix 3.4

Pilot Instrument of Self-regulated Learning in an E-Learning Environment (SRL-EL) Questionnaire

This questionnaire is part of a pilot study in a larger investigation of self-regulation and e-learning. In particular, it will examine the development of a transitional model to transform dependent learners who have studied mainly in face-to-face contexts to independent learners who study in online mode.

Your participation is voluntary so you do not have to complete the questionnaire. The researchers will assume completing the questionnaire shows your willingness to participate. Don't write your name on the questionnaire.

Please answer all the questions as carefully as possible.

Feel free to write on the questionnaire if you wish to comment on any aspects of the questionnaire. For example, identifying words or phrases you find confusing.

This questionnaire has two sections.

- The first section is general information about yourself. Please tick one answer for each of the six questions.
- The second section is about how you see your own e-learning. Please respond to each statement by writing/typing in the box which best shows your view.

You may also email me back if you wish at lifunn@hotmail.com

Your time and effort in answering this questionnaire is greatly appreciated.

Part One: General information
Please tick only one answer for each question

1. What is your gender?
   Male [ ] Female [ ]

2. How old are you?
   17-20 [ ] 21-24 [ ] 25-28 [ ] 29-32 [ ] 33-36 [ ]
   37-40 [ ] 41-44 [ ] 45-48 [ ] 49-52 [ ] over 53 [ ]

3. What year are you in your study?
   1st Year Student [ ] 2nd Year Student [ ] 3rd Year Student [ ]
   4th Year Student [ ] 5th Year Student [ ] Graduate Student [ ]

4. What is your race/ethnicity?
   Malay/Native (Bumiputra) [ ] Chinese [ ] Indian [ ] European [ ] African [ ] Middle Eastern [ ] Other _____

5. Which University/College do you attend?
   University Sains Malaysia [ ] KDU College [ ]
   Other _____

6. Which school or centre are you in?
   Engineering [ ] Computer Science [ ] Business [ ]
   Humanities [ ] Law [ ] Medicine [ ]
   Other _____

Part two: Self-regulated learning questionnaire

Directions:
Please rate (write or type) the questions below according to the one prospective:

1) I actually do this.

Place a number (1 to 4) corresponding to each perspective on the appropriate line opposite each question.

All of the time (every time) **write/type 4**
Most of the time (60% - 70%) **write/type 3**
Some of the time (30% - 59%) **write/type 2**
Little or none of the time (below 30%) **write/type 1**

Please consider time mentioned above as the time you spend doing e-learning task.

4 3 2 1

		I actually do this
	Reflecting in learning	
	during e-learning:	
1	How I learn normally changes	
2	My learning is continuously changing	
3	As I am learning, I may change the way I learn	
4	Depending on what I am experiencing, how I complete activities might be different in the future	
5	My experience during learning shapes whether or not I change how I learn	
6	My actions are influenced by my experiences during e-learning	
7	As I learn electronically, I refer to references or other literature	
8	I use references or other literature to strengthen my point of view in e-learning activities	

		I actually do this
	Reflective on learning	
	after e-learning:	
9	Looking back at my learning enables me to make judgements about how my success in e-learning	
10	I step back from what I am doing in order to understand my progress in e-learning	
11	It's easier to understand my performance after I have finished the work on e-learning	
12	I find it easy to assess my progress while I'm still completing the work in e-learning	

		I actually do this
	Self evaluation	
	during or after e-learning:	

13	I Try to be my own critic and look at my work from a critical perspective	
14	I summarize my learning in the course to examine my understanding of what I have learned	
15	I ask myself a lot of questions about the learning material when studying for my course	
16	I adjust my way of studying based on my performance in my course	
17	I communicate with my classmates to find out what I am learning that is different from what they are learning	
18	I proofread my assignments a couple of times before submitting them to my instructor	
19	I compare what I have learned with the course objectives the instructor posted online	

		I actually do this
	Debriefing the thinking process	
	during or after e-learning:	
20	My course has discussion activities	
21	My e-learning discussion activities allow me tell how I came to a certain conclusion	
22	My e-learning activities help me to recognize how I plan for achieving my learning goals.	
23	My e-learning activities enable me to know what strategies to be applied to other learning situations	

		I actually do this
	Planning and self-regulation	
	during or after e-learning:	
24	I think about what I really need to learn before I begin a task	
25	I set specific goals before I begin a task in e-learning	
26	I ask myself questions about the material before I begin	
27	I think of several ways to solve a problem and choose the best one for my e-learning	
28	I organize my time to best accomplish my goals in e-learning	

		I actually do this
	Keeping a thinking Journal	
	during or after e-learning:	
28	I write down how I learn	
29	I write down notes of the different learning strategies between class room environment learning and e-learning	
30	I make a copy of what the instructor provides for further Reflection	
31	I look at my past assignments for points to be included in doing my future assignments	
32	I refer back to my notes when I am doing my online assignments	

		I actually do this
	Talking about thinking	
	during or after e-learning:	
33	I reconsider the types of question(s) I have asked	
34	I know what to ask in online learning	
35	I am able to make connections between core/main concepts and unimportant subjects,	
36	I am able to use my prior knowledge to solve problem during reasoning	
37	I am able to assess the challenges and difficulties encountered during reasoning	
38	I am able to assess the difficulties encountered during reasoning	

		I actually do this
	Identifying what is known and what is not known	
	during or after e-learning:	
39	I make conscious decisions about my knowledge	
40	I verify my conscious decisions made before when I have more accurate information	
41	I am able to expand my knowledge as I get more accurate information	

		I actually do this
	Declarative knowledge	
	during or after e-learning:	
42	I understand my intellectual strength and weaknesses	
43	I know what kind of information is most important to learn	
44	I am good at organizing information	
45	I know what the teacher expects me to learn	
46	I am good at remembering information	
47	I have control over how well I learn	
48	I am a good judge of how well I understand something	
49	I learn more when I am interested in the topic	

		I actually do this
	Procedural knowledge	
	during or after e-learning:	
50	I try to use strategies that have worked in the past	
51	I have a specific purpose for each strategy I use	
52	I am aware of what strategies I use when I study	
53	I find myself using helpful learning strategies automatically	
54	I use the organizational structure of the text to help me learn	
55	I try to use strategies that have worked in the past	

		I actually do this
	Conditional knowledge	
	during or after e-learning:	
55	I learn best when I know something about the topic	
56	I use different learning strategies depending on the situation	
57	I can motivate myself to learn when I need to	
58	I use my intellectual strengths to compensate for my weaknesses	
59	I know when each strategy I use will be most effective	

		I actually do this
	Planning	
	during or after e-learning:	
60	I pace myself while learning in order to have enough time	
61	I think about what I really need to learn before I begin a task	
62	I set specific goals before I begin a task	
63	I ask myself questions about the material before I begin	
64	I think of several ways to solve a problem and choose the best one	
	I read instructions carefully before I begin a task	
	I organize my time to best accomplish my goals	

		I actually do this
	Information management strategies	
	During or after e-learning:	
65	I slow down when I encounter important information in e-learning	
66	I consciously focus my attention on important information in e-learning	
67	I focus on the meaning and significance of my new information in e-learning	
68	I draw pictures or diagrams to help me understand while learning in e-learning	
69	I try to translate new information into my own words in e-learning	
70	I ask myself if what I am reading is related to what I	

	already know in e-learning	
71	I try to break e-learning studying down into smaller steps	
72	I focus on overall meaning rather than specifics in e-learning	

		I actually do this
	Monitor	
	During or after e-learning:	
73	I frequently monitor my course grade	
74	I make notes of important activities and dates for my e-learning course on a calendar so I won't miss anything	
75	I only choose e-learning courses that I think I am capable of doing well	
76	If not required, I only participate in course activities (chat room, threaded discussion, etc) in my e-learning class that are helpful for my learning	
77	I establish personal contact with my classmates to satisfy my social needs	
78	I enjoy taking e-learning courses because they are challenging	
79	I keep asking myself if I understand the course content	
80	I try different learning strategies to find the one that is most effective for me.	
81	I keep watching my progress in learning to make sure that I will be ready for taking tests or completing assignments	
82	I keep a record of the amount of time I spend on the course.	
83	If the instructor is demanding, then I demand as much of myself	
84	I ask myself periodically if I am meeting my goals in e-learning	
85	I consider several alternatives to an e-learning problem before I answer	
86	I ask myself if I have considered all options when solving a problem in e-learning	
87	I find myself analysing the usefulness of strategies while I study online	
88	I find myself pausing regularly to check my comprehension in e-learning	
89	I ask myself questions about how well I am doing while I am learning something new in e-learning	

		I actually do this
	Debugging strategies	
	During or after e-learning:	
90	I ask others for help when I don't understand something	
91	I change strategies when I fail to understand	
92	I re-evaluate my assumptions when I get confused	
93	I stop and go back over new information that is not clear	
94	I stop and reread when I get confused	

		I actually do this
	Evaluation of learning	
	during or after e-learning:	
95	I know how well I did once I finish a test	
96	I ask myself if there was an easier way to do things after I finish a task	
97	I summarize what I've learned after I finish	
98	I ask myself how well I accomplished my goals once I'm finished	
99	I ask myself if I have considered all options after I solve a problem	
100	I ask myself if I learned as much as I could have once I finish a task	

		I actually do this
	Challenge	
	during or after e-learning:	
101	I set personally meaningful goals in e-learning	
102	I make goals which I can attain on e-learning	
103	I was given performance feedback as the e-learning course goes	
104	I am able to relate my goals to what I want in life	

		I actually do this
	Curiosity	
	during or after e-learning:	
105	Sudden change of computer images in e-learning stimulates my learning	
106	Sudden change of audio in e-leaning stimulates my learning	
107	E-learning should have attractive features that motivated me	
108	My e-learning materials are comprehensive	
109	My e-learning materials are consistent	
110	I find my e-learning materials easy to understand	

		I actually do this
	Control	
	during or after e-learning:	
111	I am clear about the cause-and-effect relationships between what I am doing and things that happen in real life	
112	I was allowed to freely choose what I want to learn and how I will learn	
113	I was made to believe hard work will lead to powerful effects in the future	

		I actually do this
	Fantasy	
	during or after e-learning:	
114	I make a game out of learning	
115	Instructor helps me to imagine myself using the learned information in real-life settings	
116	I can imagine what I can do in the future	

		I actually do this
	Competition	
	during or after e-learning:	
117	Competition occurs naturally in class	
118	Competition in class is helpful	
119	I lose motivation if class competition decreases	

		I actually do this
	Cooperation	
	during or after e-learning:	
120	Cooperation occurs naturally in class	
121	Cooperation is more important for some people than for others	
122	Cooperation is a useful real-life skill	
123	Cooperation requires interpersonal skills	
124	Cooperation develops interpersonal skills	

		I actually do this
	Recognition	
	during or after e-learning:	
125	I am more motivated if Recognition is visible to others	
126	I am happier when instructor give my works recognition as opposed to comparing my works with others	
127	I like people to admire me	
128	I want classmates to think I am knowledgeable	
129	I get more respect when if I answer questions in the class	

	Extrinsic motivation	I actually do this
	External regulation	
	I sign up for e-learning class:	
130	Because I will get into trouble if I don't	
131	Because that is what I am supposed to do	
132	So that the teacher won't yell at me	
133	Because that's the rule	

		I actually do this
	Introjected Regulation	
	I sign up for e-learning class:	
134	Because I want the instructor think I am a good students	
135	Because I would feel bad about myself if I did not	
136	Because I would feel guilty if I did not	
137	Because I would other students to think I am skilful	
138	Because I would feel ashamed if I do not	
139	Because I would feel bad about myself if I do not	
140	Because it bothers me when I don't	

		I actually do this
	Identify regulation	
	I sign up for e-learning class:	
141	Because I want to learn what is in this class	
142	Because it is important for me to do well in this class	
143	Because I want to improve my understanding in this class	
144	Because I can learn skills that I could use in other areas of my life	
145	Because I admire classmates doing well in it	
146	Because I value this class	

		I actually do this
	Integrated regulation	
	I sign up for e-learning class:	
147	Because I know I will do well in this class	
148	Because I want to associate with classmates	
149	Because I can tolerate and accept difference in classroom delivery methods	
150	Because I am an open-minded person	

	Amotivation	I actually do this
	Ability beliefs	
	I will not sign up for e-learning class:	
151	Because I don't have what it takes to do well in this class	
152	Because I don't have the knowledge required to succeed in this class	
153	Because I'm not good at school	
154	Because the tasks demanded of me surpass my abilities	

		I actually do this
	Effort beliefs	
	I will not sign up for e-learning class:	
155	Because I'm a bit lazy	
156	Because I'm not energetic enough	
157	Because I can't seem to invest the effort that is required	
158	Because I don't have the energy to study	

		I actually do this
	Value of Task	
	I will not sign up for e-learning class:	
159	Because, for me, school holds no interest	
160	Because studying is not valuable to me	
161	Because I have no good reason to study	
162	Because studying is not important to me	

		I actually do this
	Task Character	
163	Because I find that studying is boring	
164	I don't like studying	
165	Because I have the impression that it's always the same thing everyday	
166	Because my school work is not stimulating	

Thank you

Appendix 3.5

Self-regulated Learning in an E-Learning Environment (SRL-EL) Questionnaire

Its intended application will be in online e-learning environments in Universiti Sains Malaysian. I would like to request information from you to assist in its development.

By answering the questions below you agree to participate in this survey, confirm your participation is totally voluntary and you have not been influenced in any way to participate. Also, you do not need to identity yourself in any way.

Kindly provide only one answer to each question. All information provided will be treated in strict confidence and shall only be used for the research purposes.

The questions will be divided into 2 parts: general and self-regulated learning. Kindly answer all parts below.

I appreciate your time and effort in answering this questionnaire.

Part One: General information
Please tick only one answer for each question

1. What is your gender?
   Male [ ] Female [ ]

2. How old are you?
   17-20 [ ] 21-24 [ ] 25-28 [ ] 29-32 [ ] 33-36 [ ]
   37-40 [ ] 41-44 [ ] 45-48 [ ] 49-52 [ ] over 53 [ ]

3. What year are you in your study?
   1st Year Student [ ] 2nd Year Student [ ] 3rd Year Student [ ]
   4th Year Student [ ] 5th Year Student [ ] Graduate Student [ ]

4. What is your race/ethnicity?
   Malay/Native (Bumiputra) [ ] Chinese [ ] Indian [ ] European [ ]
   African [ ] Middle Eastern [ ] Other _____

7. Which University/College do you attend?
   University Sains Malaysia [ ] KDU College [ ]
   Other _____

8. Which school or centre are you in?
   Engineering [ ] Computer Science [ ] Management [ ]
   Humanities [ ] Mathematics [ ] Industrial Technology [ ]
   Education [ ] Art[ ] Biology [ ]
   Other _____

Part two: Self-regulated learning questionnaire

Directions:
Please rate (write or type) the questions below according to the one prospective:

1) I actually do this.

Place a number (1 to 4) corresponding to each perspective on the appropriate line opposite each question.

All of the time (every time) **write/type 4**
Most of the time (60% - 70%) **write/type 3**
Some of the time (30% - 59%) **write/type 2**
Little or none of the time (below 30%) **write/type 1**

Please consider time mentioned above as the time you spend doing e-learning task.

4 3 2 1

		I actually do this
	Reflecting in learning	
	during e-learning:	
1.	The way I learn is continuously changing	
2.	As I am learning, I may change the way I learn	
3.	The experience I gained changed my learning habits	
4.	My past and present experiences will take control of how I complete future activities	
5.	I use references or other literature to strengthen my point of view in e-learning activities	

4 3 2 1

		I actually do this
	Reflecting on learning	
	after e-learning:	
6.	Looking back at my learning enables me to know how successful I am	
7.	I step back from what I am doing in order to understand my progress in e-learning	
8.	It's easier to understand my performance after I have finished the work on e-learning	
9.	I find it easy to assess my progress while I'm still completing the work in e-learning	

4 3 2 1

		I actually do this
	Self evaluation	
	during or after e-learning:	
10.	I try to be my own critic and look at my work from a significant viewpoint	
11.	I summarize my learning in the course to examine my understanding of what I have learned	
12.	I communicate with my classmates to find out what I am learning that is different from what they are learning	
13.	I proofread my assignments a couple of times before submitting	

	them to my instructor	

4 3 2 1

		I actually do this
	Debriefing the thinking process	
	during or after e-learning:	
14.	My course has discussion activities	
15.	My e-learning discussion activities allow me to express how I arrived to my conclusions	
16.	My e-learning activities help me to recognize how I plan to achieve my future learning	
17.	My e-learning activities help me to know which strategies can be applied to other learning situation	

4 3 2 1

		I actually do this
	Planning and self-regulation	
	during or after e-learning:	
18.	I think about what I really need to learn before I begin a task	
19.	I set specific goals before I begin a task in e-learning	
20.	I think of several ways to solve a problem and choose the best one for my e-learning	
21.	I organize my time to best achieve my goals in e-learning	

4 3 2 1

		I actually do this
	Keeping a thinking Journal	
	during or after e-learning:	
22.	I write down how I learn	
23.	I write down notes of the different learning strategies between class room environment learning and e-learning	
24.	I look at my past assignments for points to be included in doing my future assignments	
25.	I refer back to my notes when I am doing my online assignments	

4 3 2 1

		I actually do this
	Talking about thinking	
	during or after e-learning:	
26.	I think about the question I have asked	
27.	I am able to make connections between main concepts and unimportant subjects,	
28.	I am able to use my previous knowledge to solve problem during reasoning	
29.	I am able to assess the challenges encountered during reasoning	

4 3 2 1

		I actually do this
	Identifying what is known and what is not known	
	during or after e-learning:	
30.	I am in control of my knowledge and learning	
31.	I am willing to review my past decisions when I get more information	
32.	I am willing to keep an open mind and expand my knowledge with I get more information	

4 3 2 1

		I actually do this
	Declarative knowledge	
	during or after e-learning:	
33.	I understand my intellectual strength and weaknesses	
34.	I know what kind of information is most important to learn	
35.	I am good at organizing information	
36.	I have control over how well I learn	

4 3 2 1

		I actually do this
	Procedural knowledge	
	during or after e-learning:	
37.	I try to use strategies that have worked in the past	
38.	I am aware of what strategies I use when I study	
39.	I am willing to ask for help when there is help available	
40.	I use the organizational structure of the text to help me learn	

4 3 2 1

		I actually do this
	Conditional knowledge	
	during or after e-learning:	
41.	I use different learning strategies depending on the situation	
42.	I can motivate myself to learn when I need to	
43.	I use my intellectual strengths to balance out my weaknesses	
44.	I know when each strategy I use will be most effective	

4 3 2 1

		I actually do this
	Evaluation of learning	
	during or after e-learning:	
45.	I summarize what I've learned after I finish	
46.	I know how well I did once I finish a test	
47.	I ask myself how well I accomplished my goals once I'm finished	
48.	I ask myself if I have considered all options after I solve a problem	

4 3 2 1

		I actually do this
	Debugging strategies	
	During or after e-learning:	
49.	I ask others for help when I don't understand something	
50.	I change strategies when I fail to understand	
51.	I re-evaluate my belief when I get confused	
52.	I stop and go back over new information that is not clear	

4 3 2 1

		I actually do this
	Monitoring	
	During or after e-learning:	
53.	I frequently monitor my course grade/result	
54.	I keep asking myself if I understand the course content	
55.	I find myself stoping regularly to check my understanding	

4 3 2 1

		I actually do this
	Information management strategies	
	During or after e-learning:	
56.	I focus on the meaning and significance of my new information	
57.	I draw pictures or diagrams to help me understand while Learning	
58.	I try to translate new information into my own words	
59.	I ask myself if what I am reading is related to what I already know	

4 3 2 1

		I actually do this
	Challenge	
	during or after e-learning:	
60.	I set personally meaningful goals	
61.	I set goals which I can attain	
62.	I was given feedback on my performance as the e-learning course proceeded	
63.	I am able to relate my goals to what I want in life	

4 3 2 1

		I actually do this
	Curiosity	
	during or after e-learning:	
64.	Providing different sounds and images stimulates my learning	
65.	E-learning should have attractive features that motivated me	
66.	My e-learning materials are in details	
67.	My e-learning materials encourage me to keep learning	
68.	I find my e-learning materials easy to understand	

		4 3 2 1
		I actually do this
	Control	
	during or after e-learning:	
69.	I am clear about the cause-and-effect relationships between what I am doing and things that happen in real life	
70.	I was allowed to freely choose what I want to learn and how I will learn	
71.	I was made to believe that my work had a powerful impact on my future	

		4 3 2 1
		I actually do this
	Fantasy	
	during or after e-learning:	
72.	I make a game out of learning	
73.	The instructor helps me to imagine real-life application of learned material	
74.	I can imagine my successful future	
75.	I fantasise about what I can become	

		4 3 2 1
		I actually do this
	Competition	
	during or after e-learning:	
76.	I would like it if competition occurs naturally in class	
77.	I think competition in class is helpful	
78.	I am very motivated when there is competition	

		4 3 2 1
		I actually do this
	Cooperation	
	during or after e-learning:	
79.	I would like to see cooperation occurs naturally in class	
80.	I value cooperation highly during web discussion sessions	
81.	I am aware that cooperation is a useful real-life skill	
82.	I realize that cooperation can build up interpersonal skills	

		4 3 2 1
		I actually do this
	Recognition	
	during or after e-learning:	
83.	I am more motivated if Recognition is visible to others	
84.	I am happier when the instructor recognises my work	
85.	I like people to admire me	
86.	I want classmates to think I am knowledgeable	

		4 3 2 1
	Extrinsic motivation	I actually do this
	External regulation	
	I sign up for e-learning class:	
87.	Because I will get into trouble if I don't	
88.	Because that is what I am supposed to do	
89.	So that the teacher won't punish me	
90.	Because that's the rule	

		4 3 2 1
		I actually do this
	Introjected Regulation	
	I sign up for e-learning class:	
91.	Because I want the instructor to think I am a good students	
92.	Because I want other students to think I am skilful	
93.	Because I would feel ashamed if I do not	
94.	Because it bothers me when I don't	

		4 3 2 1
		I actually do this
	Identify regulation	
	I sign up for e-learning class:	
95.	Because I want to improve my understanding in this class	
96.	Because I can learn skills that I could use in other areas of my life	
97.	Because I follow my friends	
98.	Because I value this class	

		4 3 2 1
		I actually do this
	Integrated regulation	
	I sign up for e-learning class:	
99.	Because I know I will do well in this class	
100.	Because I want to associate with classmates	
101.	Because I can tolerate and accept difference in classroom delivery methods	
102.	Because I am an open-minded person	

		4 3 2 1
		I actually do this
	Ability beliefs	
	I will not sign up for e-learning class:	
103.	Because I don't have what it takes to do well in this class	
104.	Because I don't have the knowledge required to succeed in this class	
105.	Because I'm not good at university	
106.	Because the tasks demanded of me went beyond my abilities	

		4 3 2 1
		I actually do this
	Effort beliefs	
	I will not sign up for e-learning class:	
107.	Because I'm a bit lazy	
108.	Because I do not feel like doing it	
109.	Because I am too busy with my homework	
110.	Because I don't have the energy to study	

		4 3 2 1
		I actually do this
	Value of Task	
	I will not sign up for e-learning class:	
111.	Because, for me, school holds no interest	
112.	Because studying is not valuable to me	
113.	Because I have no good reason to study	
114.	Because studying is not important to me	

		4 3 2 1
		I actually do this
	Task Character	
	I will not sign up for e-learning class:	
115.	Because I find that studying is not excited	
116.	I don't like studying	
117.	Because I have the impression that it's always the same thing everyday	
118.	Because my assignment is not stimulating	

Thank you

Appendix 3.6
Ethics Approval letter

memorandum

To	Dr Lina Pelliccione, Education
From	A/Professor Stephan Millett, Chair, Human Research Ethics Committee
Subject	Protocol Approval **HR 62/2009**
Date	08 July 2009
Copy	Li Funn Phung, Education Graduate Studies Officer, Faculty of Humanities

Curtin University of Technology
Office of Research and Development

Human Research Ethics Committee

TELEPHONE 9266 2784
FACSIMILE 9266 3793
EMAIL hrec@curtin.edu.au

Thank you for your application submitted to the Human Research Ethics Committee (HREC) for the project titled "*Engaging Students in E-Learning in Malaysian Universities*". Your application has been reviewed by the HREC and is **approved**.

- You have ethics clearance to undertake the research as stated in your proposal.
- The approval number for your project is **HR 62/2009.** *Please quote this number in any future correspondence*.
- Approval of this project is for a period of twelve months **07-07-2009** to **07-07-2010**. To renew this approval a completed Form B (attached) must be submitted before the expiry date **07-07-2010**.
- If you are a Higher Degree by Research student, data collection must not begin before your Application for Candidacy is approved by your Faculty Graduate Studies Committee.
- The following standard statement **must be** included in the information sheet to participants:

  This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR 62/2009). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. Its main role is to protect participants. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University of Technology, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au.

Applicants should note the following:

It is the policy of the HREC to conduct random audits on a percentage of approved projects. These audits may be conducted at any time after the project starts. In cases where the HREC considers that there may be a risk of adverse events, or where participants may be especially vulnerable, the HREC may request the chief investigator to provide an outcomes report, including information on follow-up of participants.

The attached **FORM B** should be completed and returned to the Secretary, HREC, C/- Office of Research & Development:
When the project has finished, or

- If at any time during the twelve months changes/amendments occur, or
- If a serious or unexpected adverse event occurs, or
- 14 days prior to the expiry date if renewal is required.
- An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Regards

A/Professor Stephan Millett
Chair Human Research Ethics Committee