The Epistemological Beliefs of Undergraduates towards Information Science

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Dalal Saoud Alsumait

School of Information Systems, Computing and Mathematics

Brunel University

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Abstract

In the past four decades considerable efforts have been taken by higher education to understand learner’s differences and learning. Learners have different levels of learning ability associated with their different learning motivations, attitudes and thoughts which are built through years of studying at university. The more the researchers understand the learner's differences the better results they will achieve in covering all levels of learning abilities providing the effective learning for learners. The focus of this study is about studying learning thoughts of academic learners which are scientifically called as the epistemological beliefs. Studying the epistemological beliefs from different angles is important to explore its vital role in learning development.

The main aim of this study is to investigate the general and specific epistemological beliefs of undergraduates who study information literacy modules as part of information science. The study focuses on the influence of the independent variables (gender, major and academic level) and the interactions between the independent variables and information literacy on undergraduates’ epistemological beliefs. Two questionnaires are used to measure the general and specific epistemological beliefs of the undergraduates; the Schommer Epistemological-Beliefs Questionnaire (SEQ) and the Discipline-Focused Epistemological Belief Questionnaire (DFEBQ). The participants in the study are undergraduates from the College of Education at Kuwait University. SPSS is used to test the internal consistency of the data against the questionnaires. Analysis of variance (ANOVA) is used in order to analyse the data.

The study confirms that undergraduates hold both general and specific-domain beliefs while they hold more general beliefs in their first year in the college they develop toward more specific domain beliefs in the fourth year. A final result shows that the undergraduates specific domain beliefs – rather than their general beliefs – are more affected by the variable of previous knowledge of information literacy, as well as a clear impact of the interaction between the independent variables but is not so clear on the general beliefs.

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Publications

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Chapter 1 INTRODUCTION

1.1 Research Context

In a changing, developing world, educators face a big challenge in preparing the learners to deal with the evolution of information and how to locate, evaluate, use and store information (Syamalamba, 2011). Educators are also concerned with designing an ideal learning model that could undertake the range of learning characteristics for the users (Song, 2003) so as to meet all individual personality requirements and reach each learner's needs matching their different learning styles (Koc, 2005). Much research has been done by educators and psychologists in defining and clarifying the factors that have effects on teaching and learning and also on how these factors can be employed significantly in the educational process.

Higher education, as the leading presenter of knowledge within societies, has an immense responsibility to provide teaching which takes into considers the personality of learners (Lozano, 2012). This responsibility, especially in the modern learning environment, depends on technology and huge amounts of information (Darwesh et al., 2011). In fact, taking care of individual differences will positively enhance the interest of students and encourages them to make more of an effort to take an active part in the cognitive processes (Tóth, 2014; Hatami, 2013; Mayer et al., 2004). It is important whilst the learning process is taking place that educators are aware of the characteristics of their learners and that they try to take into account the learning style for each of them making their individual differences the critical indicator with which to guide the teaching process (Kim, 2012; MacLaren, 2004; Alecu, 2011; ChanLin, 2009; Magoulas et al., 2003).

Students, whether undergraduate or postgraduate, need to be information literate people for their academic and life success. Zurkowski (1974) introduced the term Information Literacy to distinguish between information literate and illiterate people while it refers to the person "*who is able to recognize when information is needed and has the ability to locate, evaluate, and use effectively the required information*" (The American Library Association, 1989). To reach such a person, Information literacy programmes were established as part of a new academic discipline to teach the learners information skills. At the worldwide level, the concept of information literacy differs from one country to another suggesting that the culture factor might play a vital role in influencing the educational levels of people. Many claim that people from the West are more information literate than those from the East because they have produced many publications regarding this concern (Al-Muomen et al., 2011; Rader, 2002). Some argue that there is a lack of interest in information literacy in some areas/cultures of the world, and this includes the Arabian Gulf region in general and Kuwait in particular. In other words, such students face some educational barriers caused by English language, information technology, and the traditional educational system found in such a region/culture (Ashoor, 2005; Ur Rehman, 2008; Al-Muomen et al., 2011; Spaven and Murphy, 2000). Closer focus can be drawn to the state of Kuwait as a good example in understanding attempts to apply information literacy programmes in the Middle East region. To encourage the students, particularly undergraduate ones, as this is where most of the work needs to be done in helping students with information literacy given that undergraduates, compared to postgraduates, are more likely to lack the skills and abilities involved in information literacy, educators need to understand the characteristics and interests of their students toward learning information skills.

Individual differences are an essential cognitive element in teaching and learning for both online and traditional learning. There are psychological elements of personality which play an important role in influencing learners' knowledge. Some examples of psychological factors are emotions, passions and thoughts (Bråten and Olaussen, 2005) as well as epistemological beliefs. Epistemological beliefs is about how knowledge is structured and how knowing occurs. Much research has been conducted in the field of educational psychology focusing on personal epistemology since researchers have realized the importance of individual beliefs about knowledge in the learning process (Schraw, 2001).

The initial work in studying epistemological beliefs, started by Perry in the 1970s, proposed a unidimensional model assumed that beliefs consist of a number of dependent dimensions where the development of every individual belief depends on the development of all the others. However, Schommer (1990) provided a developed multidimensional model showing that each dimension of the beliefs develops independently of all the others. Schommer’s model opened the research area for other suggested models enabling assessment of the learners' beliefs whilst still preserving the multidimensionality, for instance Jehng et al. (1993), Schraw et al., (1995), Kuhn et al., (2000), Qian and Alvermann, (1995), Hofer and Pintrich, (1997) and Hofer (2000). Efforts resulted in several tools able to measure the belief dimensions of learners, although the most popular remains Schommer's (1990) epistemological beliefs questionnaire (SEQ) used to measuring general-domain beliefs; the discipline-focused epistemological beliefs questionnaire (DFEBQ) is also a well-known and often used scale (Hofer, 2000).

The trend of studying epistemological beliefs then became slanted towards exploring their relationship with many other aspects of learning and teaching (Schutz et al., 1993; Buehl and Alexander, 2005; Richardson, 2013). Certainly the development of beliefs from lower to higher - or more sophisticated levels - could affect the way the learners received and expressed the knowledge that they were being taught. This means that what learners believe about knowledge and knowing is reflected in their learning motivations, performances and achievements (Conn et al., 2010; Bråten et al., 2009; Muis et al., 2011; Sahin, 2010; Lin et al., 2013). This is a productive area of investigation and will be useful in the quest to improve learning processes and outcomes (Mohamed, 2014; Lin et al., 2013; Schraw and Sinatra, 2004).

The relationship between learning and epistemological beliefs raises an important question in literature as to whether epistemological beliefs of learners are domain-general or domain-specific (Alexander, 2006; Hofer, 2006; Muis et al., 2006). In other words, do individuals hold their beliefs about knowledge - and knowing about knowledge - in general regardless of any particular fields of knowledge, or, do individuals' beliefs in knowledge - and knowing - vary according to the nature of the field of study. Some studies have demonstrated that a belief regarding specific knowledge has an influence on the behaviour of learners (Qian and Alvermann 1995; Hofer, 2000). However, other studies have claimed that the general knowledge is the main and only effective influence on individuals' beliefs. This assumes that epistemological beliefs are similar across domains (Schommer and Walker, 1995). Obviously studying and exploring the generality or specificity domain of beliefs in isolation is not enough. What is important to any study is to determine how to choose the most advantageous tool from all the measurements available in accordance with the goal to be reached.

In this regard learners' beliefs in certain domains have now been investigated widely. The research looked at learners' beliefs in the recognized disciplines, for example, chemistry Pulmones (2010), biology and physics (Tsai,2006), mathematics (Op'tEynde et al., 2006), statistics (Muis et al.,2011), language learning (Mori,1999), and history (Buehl et al.,2002). The modern discipline of information literacy which is now considered an important academic discipline and is currently being taught in both schools and universities (Bates, 2007) has not yet been under the scope of epistemological belief studies. Similar to the other disciplines, such investigations should now take steps in assessing learners' beliefs towards investigating specific-domain knowledge in information literacy.

It should be noted that whether the beliefs held by individuals are the same or differ in general knowledge and across disciplines, epistemological beliefs of individuals may be shaped and developed by the effects of many factors. For example, some factors may be related to individual characteristics such as age, academic achievements, field of major, gender and a learner's culture and background.

It has become apparent that the development and changes in learners' epistemological beliefs are connected to the changes in their characteristics and backgrounds (Whitmire, 2004). The more the experiences and knowledge the learners have gained the more changes may occur in their beliefs (Marzooghi et al., 2008; Tanriverdi, 2012). Their fields of study and the nature of the discipline could influence the way students think about knowledge including whether it is general knowledge or a specific subject knowledge (Trautwein and Lüdtke, 2007). The differences in gender may cause some changes too (Terzi et al., 2012; Muis and Gierus, 2014). How the variables influence and shape each dimension of epistemological beliefs and how they interact needs further examination because knowing more about the relationship between the changes in learners' beliefs and the different variables will help towards gaining an in-depth understanding of epistemological beliefs.

To conclude, the debates continue and studies are still finding critical and interesting contributions regarding the complicated issues of human thoughts and beliefs thus providing the educational field with great possibilities for growth and development.

1.2 Significance of the Study

Whilst the relationship between general and specific-domains of the epistemological beliefs has been looked at in some disciplines, further research is required to fill gaps in the literature when it comes to examining the relationship between general and specific-domains of epistemological beliefs within the particular discipline of information literacy from both the general and specific perspectives. Information literacy, as a new discipline in the educational classification for domains and fields of study, is an important discipline that has a tied relationship with learners' successes and their lifelong learning habits and should, therefore, be addresses in the study. With the number of studies examining other disciplines such as mathematics, science and psychology, more investigation is needed to support or deny the claim that epistemological beliefs of individuals are independent when they are specific. It is necessary to have a wide range of disciplines empirically studied and to have the findings compared in order to see the influence of the specific-domain and to discover whether it is limited to the particular discipline or expands to all disciplines. To date, as far as can be ascertained, there are no studies which have investigated the influence of information literacy as a discipline on participants' epistemological beliefs; rather studies have focused on the factors influencing learners' beliefs about information literacy. There is therefore a need to study the relationship between the general-domain and the specific-domain of epistemological beliefs of students regarding information literacy specifically looking at the influence of individuals' characteristics, and to do so in the context of a particular region/culture given that it is argued that this is culture-specific. .

1.3 Research Questions

With great attention being given to the impact of epistemological beliefs on education and participation in enhancing the learning process and elevating learners performances, more understanding of the differences between learners' beliefs about general knowledge and specific knowledge will be examined. The need to clarify the influences of individual characteristics shaping learners' beliefs give rise to the following specific questions guiding this research:

1. What are the general-domain and the specific-domain for Kuwait undergraduates' epistemological beliefs?
2. To what extent do the general-domain and the specific-domain for Kuwait undergraduates' epistemological beliefs interact with their characteristics?
    a. Does gender impact the general-domain and specific-domain beliefs?
    b. Does major impact the general-domain and specific-domain beliefs?
    c. Do academic levels impact the general-domain and specific-domain beliefs?
    d. Does previous knowledge in information literacy impact the general-domain and specific-domain beliefs?
3. Does the interaction between the independent variables (gender, academic level, major) impact the general-domain and the specific-domain on Kuwait undergraduates' epistemological beliefs?
4. Does the interaction between information literacy and independent variables impact the general-domain and the specific-domain on Kuwait undergraduates' epistemological beliefs?
5. Are the epistemological beliefs domain-general or domain-specific?

1.4 Research Methods

This study will collect data following a survey strategy and use a case study method focusing only on Kuwaiti university students. Questionnaires of two well-known ready-prepared measurements of individuals' epistemological beliefs will be used to collect empirical data including background information on the Kuwait undergraduates. The first will be used to assess general-domain beliefs, this is the Epistemological Beliefs Questionnaire (SEQ) developed by Schommer (1990); the second will be used to assess specific-domain beliefs, this is the Discipline-Focused Epistemological Belief Questionnaire developed by Hofer (2000). The population of the study is Kuwait undergraduate students. The sample is collected from first-year and fourth-year students studying in college of education at Kuwait University. The questionnaire data will be analyzed using SPSS with several statistical analysis techniques. Ethical approval and consent form will be taken into consideration before conducting this study.

1.5 Definition of Terms

Epistemological beliefs: "how individuals come to know, the theories and beliefs they have about knowing, and the manner in which such epistemological premises are part of and an influence on cognitive processes of thinking and reasoning" (Hofer and Pintrich, 1997, p.435).

General-domain: general knowledge

Specific-domain: knowledge in a particular subject (Information literacy) .

Sophisticated Beliefs: beliefs which refer to knowledge that is complex, tentative, derived by reason, acquired gradually and where the ability to learn can be altered.

Naïve Beliefs: beliefs which refer to knowledge that is simple, absolute, handed down by authority, acquired quickly or not at all and where the ability to learn is unchanged from birth.

1.6 Structure of the Study

This thesis consists of six chapters, the above being the first; the remaining chapters are structured as follows:

Chapter one – provides a context of the study, the significance of the study, the research questions and how the chapters are organized.

Chapter two - looks at the relevant literature for the main scope of the study: aspects relating to information literacy as a module and teaching and learning in higher education including the matters of individual differences and epistemological beliefs, factors affecting epistemological beliefs, generality or specificity domains for epistemological beliefs, and finally presenting the contribution of this study to the literature

Chapter three - presents the theoretical framework of the case study and describes the research methodology, identifies the research instruments that will be used to test research hypotheses and answer the research questions, it includes also a full description of sample, data collection, data analysis techniques, and finally gives the research hypotheses.

Chapter four – presents the results and discussion of the findings for the general-domain and specific-domain epistemological beliefs' profiles including data and factor analyses, and validity and reliability tests of the questionnaires.

Chapter five – includes the results from the questionnaires and a discussion on the findings of the general-domain and specific-domain epistemological beliefs related to the influence of the independent variables (gender, academic levels, major), i.e. previous knowledge of information literacy; it will also present and discuss the interaction between information literacy and the independent variables.

Chapter six – provides a summary of the findings which contains a summary of the study, its contribution to knowledge as well as any limitations and the possibility for future research.

Chapter 2 LITERATURE REVIEW

Introduction

The aim of this chapter is to review the literature related to information literacy as a part of information science and its importance for education in general and for higher education specifically. It will also show the influence of culture on the information literacy; this means that some of the challenges facing information literacy programs in the new technology environment and the lack of learners' interest in information science make them less information literate than they need to be in a world where such skills and abilities are essential. For more understanding about how learners think about information literacy the epistemological beliefs are also reviewed in this chapter shedding light on the development of its theories, importance and relationship with learning. The chapter will also cover the following sections: Section 2.1 introduces information literacy its definitions, importance and application; Section 2.2 focuses on epistemological beliefs and reviews its foundation, models and importance; Section 2.3 discusses the factors relating to learners' characteristics, i.e. gender, major and the academic levels affecting epistemological beliefs; Section 2.4 presents a debate on the generality and specificity of the epistemological beliefs section. The chapter ends with the contribution of this study to the existing literature.

2.1 Information Literacy

Knowledge is growing rapidly and information is increasing in a very fast manner causing challenges in dealing with huge amount of information located in different resources and presented in multi forms. Information users need to be aware and educated about the many forms of information and how to locate and use it to benefit from the explosion of information and to get accurate updated and useful knowledge.

Nowadays, information science is considered an interdisciplinary area which relates to various fields of study, although information science has become an important stand-alone academic discipline. At the same time, information science is connected to information and practices in different disciplines (Saracevic, 1999; Webber and Johnston, 2000).

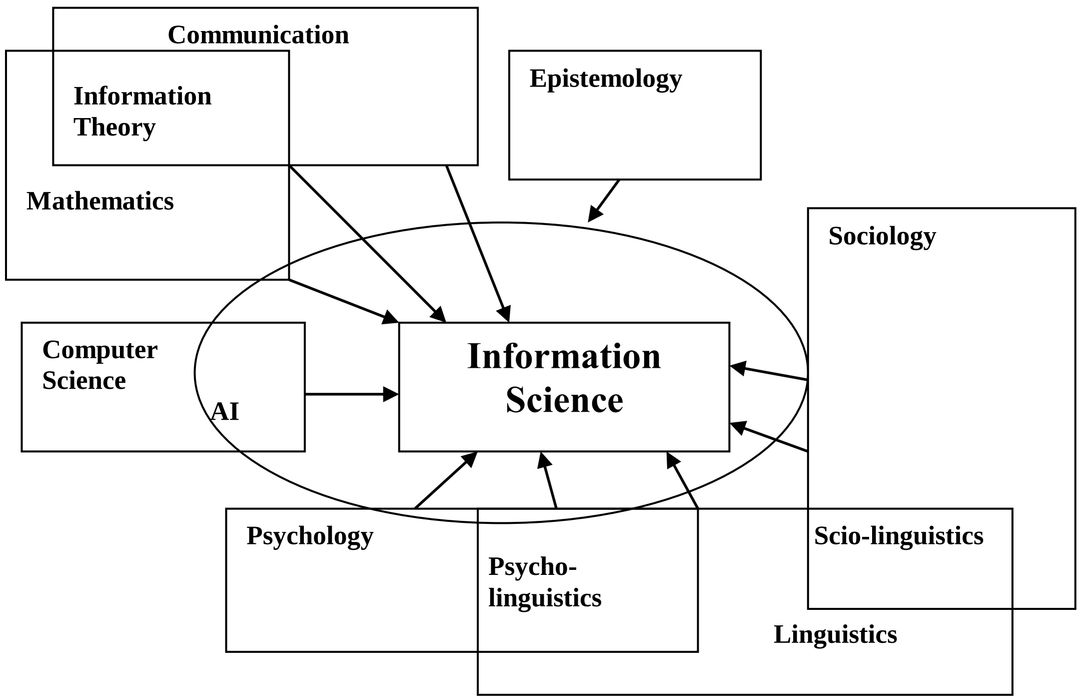

Figure 2 Interdisciplinary information science (Ingwersen 1991, p.8)

Ingwersen (1991) illustrates the interdisciplinary in Figure 1 which shows how information science either provides or receives a vital contribution with other disciplines such as: computer science, engineering, psychology, mathematics and communication. Many Researchers stated that information literacy is a part from the concept of information science so that the term "Information Literacy" as a module related to information science will be explained next.

The term Information Literacy was introduced for the first time in 1974 by Zurkowski. The goal of information literacy is to have information literate people who could also be described as *"people trained in the application of information resources to their work. They have learned techniques and skills for utilizing the wide range of information tools as well as primary sources in molding information solutions to their problems"* (Zurkowski, 1974, p.6). The American Library Association (ALA, 1989) describes someone who is *'information literate'* as being "*a* *person who is able to recognize when information is needed and has the ability to locate, evaluate, and use effectively the required information. To reach such people, schools and colleges have to integrate the concept of information literacy into their learning programmes and play a leadership role in preparing individuals and institutions to take advantage of the opportunities inherent within the information society. Ultimately, information literate people are those who have learned how to learn. They know how to learn because they know how knowledge is organized, how to find information and how to use information in such a way that others can learn from them. They are people prepared for lifelong learning, because they can always find the information needed for any task or decision at hand*".

Two further definitions have been given by the Association of College and Research Libraries (2000) and UK's Chartered Institute of Library and Information Professionals (2005). The first claims that information literacy *"is a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information"* (ACRL, 2000). The second describes information literacy as when and why you need information, where to find it, and how to evaluate, use and communicate it in an ethical manner (CILIP, 2005).

Further attempts to clarify the concept defined information literacy and an information literate person in outcome measures and clear steps have been arranged according to the terms of definition. (Doyle, 1992) Where the information literacy is *"the ability to access, evaluate, and use information from variety of sources",* the information literate person is one who: recognizes the need for information; recognizes that accurate and complete information is the basis for intelligent decision making; formulates questions based on information needs; identifies potential sources of information; develops successful search strategies; accesses sources of information - including computer-based and other technologies; evaluates information; organizes information for practical application; integrates new information into an existing body of knowledge; and finally uses information in critical thinking and problem solving (Doyle ,1994,p3).

Furthermore, new approaches to defining information literacy lists seven conceptions of information literacy to specify the meaning by use of the following: 1) the use of information technology (IT); 2) the use of information sources; 3) executing a process; 4) controlling information for retrieval; 5) gaining knowledge; 6) extending knowledge; and 7) gaining wisdom (Bruce, 1997).

By analyzing information literacy definitions it should be noted that there are common characteristics shared by the definitions. In other words, the definitions regarding information literacy indicate a lack of dealing with knowledge, how it is organized, evaluated and used among information users. This lack requires information specialists and educators to make significant efforts to fill the gap in knowledge that is seen in students. Put this somewhere else. It seems that the definitions of information literacy agree that the objective of information literacy is to teach information skills to information users (Owusu-Ansah, 2005).

Other terms have also been used to reflect the concept of dealing with information, such as bibliographic instruction, library orientation, information fluency, library literacy, information competencies, information skills and information technology (Virkus, 2003; Lau,2006; Bawden,2001). Although information terms have been clarified to some extent, information literacy has more recently been added, with details to give the concept yet more clarification and specification (Doyle, 1992; Bruce, 1998; ACRL, 2000). Information skills and information technology are considered to be part of the broad concept of information literacy (SCONUL, 1999).

Information could come in a variety of forms and could be presented in different ways, for example: formal/informal, designed/fortuitous, and interpersonal/via information technologies. information literacy was found to be an adequate term covering all forms of information and has been chosen as the term used in the study described in this dissertation as the international term to describe the concept (Snavely and Cooper, 1997; SCONUL, 1999; Bawden, 2001; Webber and Johnston, 2000).

New trends have appeared in parallel in the interests of defining the concept of information literacy. Following the original concept of information literacy and its development, the information environment expanded and was combined with the growth of new approaches of education to theories and standards adding to the rapid growth of technology. Thus educators became aware that there was no need for further efforts to define the concept; however, what is needed is to adopt new perspectives and implications and to consider information literacy as a coherent field of study. Additionally, more work was required to set more detailed criteria to outline information literacy as a discipline and to examine the interaction of its concept with other disciplines (Webber and Johnston, 2000). In a very short time, information literacy started to become outlined as a separate discipline but interacting with the educational process and theories and began to be taught in schools and universities, it then became an important part of education and the main key to the development of academic knowledge (Lloyd and Williamson, 2008; Rader, 2002).

2.1.1 The Importance of Information Literacy in Higher Education

Higher education is the leader in creating knowledge and preparing professionals in most societies (Lozano, 2012; Deem and Lucas, 2006). The most important responsibility resting on universities is the preparation of learners by giving them the knowledge, skills and values to achieve an educated, developed and civilized society. A critical part of higher education lies in reaching a high standard of knowledge of the learning environment so as to facilitate learners in their studies and to enable them to consider newer trends and give them effective educational theories as proposed by scholars and specialists (Larrasquet and Pilnière, 2012; Delanty, 2002). At the same time higher education should create and manage most of the world's knowledge development since it is affected by the changes happening around the world largely because of these developments.

By looking at the undergraduates in information literacy programmes we can see that the majority of them, in particular, first year undergraduates are unable to use the library services and have a problems dealing with information resources and searching strategies. They enter the university with little or no background in how to access information and they suffer from limited experience in the basics of information skills and are unfamiliar with information searching tools (Idiodi, 2005; Mittermeyer, 2005). Their lack of information skills can be shown by their failure to use significant terms, to understand the role of the Boolean operators and to identify controlled vocabulary. They also lack knowledge of how to use the library catalogue and scholarly journal (Mittermeyer, 2005). The gap in knowledge of basic information skills starts at high school level; students believe that what they learn in high school is adequate for university but after their first meeting with the library and seeing its size and resources they realized that using the library and its information resources might be too difficult for them. While instructors expected their students to display their information skills from the first year and to carry out their assignments even though they required certain information skills right from the beginning of their academic courses, teachers believe that the students are capable of doing this (Gullikson, 2006).

Information literacy is an important aspect of academic society for all the users involved in dealing with information, i.e. faculty members, librarians and students (**S**yamalamba; 2011). Students, especially undergraduates have many reasons for knowing and understanding the information environment; for example, undergraduates will need information for research, assignments, tests, reports and even for making decisions as well as for the lifelong learning (Orme, 2008). Writing assignments and carrying out research in a scientific and academic manner will affect students' performances positively. For example, the GPAs of students enrolled in information literacy classes are found to be higher than those who do not enroll (Matoush, 2006). Furthermore, information literacy has an impact on students when they graduate and join the workforce. Students with information skills are preferred in the employment market and they are found to be remarkable at their jobs (Idiodi, 2005; Maybee, 2006). Some studies have determined the importance of information literacy in different work places, for instance, the value of information literacy in engineering education and practice (McCullough, 2006).

For these reasons there has been a significant increase in the amount of attention given within higher education to preparing graduates for an information-rich society concerns and this attention has been directed towards teaching information literacy, particularly for undergraduates (Mittermeyer, 2005). This greater interest can be shown by the number of research articles, where it can be seen that the majority have been related to the context of academic libraries (Lloyd and Williamson, 2008). To be more specific, about 60 percent of publications about information literacy published between 1973 and 2002 address information literacy in academic libraries and higher education (Rader, 2002).

The interest in teaching information literacy at academic libraries and universities rose higher after relating excellence in educational programmes with information literacy levels for university outcomes. The Accreditation Institutions for Higher Education developed sets of definitions and standards including the terms *information literacy and information literate* as evidence for the recognition of education programmes. This attention has been added to universities mission statements and has changed the goals of academic libraries (McGuinness, 2006).

In order to evaluate information literacy and to provide faculty/librarian guidelines to assess students' information skills performances, The Association of College and Research Libraries (ACRL, 2000) developed a framework of Information Literacy Competency Standards for Higher Education for the purpose of assessing the information literate individual. The competency contains five standards and twenty-two performance indicators. The standards and indicators added more clarification of the concept in higher education and has put its components in measurably accessible form (Owusu-Ansah, 2005).
The Middle States Commission on Higher Education (MSCHE), for instance, related the excellence in higher education to the importance of information literacy programmes provided for the students. This caused the academic libraries to revise their programmes in order to meet these standards (Ritchie and Ray, 2008). Other similar academic accreditation institutions which have developed their standards similar to the standards of ACRL are: The Commission of Higher Education (CHE), The National Education Association (NEA) and The American Association of Higher Education (AAHE) (Manchester Metropolitan University, 2007).

A more critical role for information literacy was found in teacher preparation programmes, where the importance of information literacy is not only to prepare teachers to update their own knowledge and skills in the new technology because this technology grows very fast and are needed in the classrooms but also because those who later become qualified teachers also needed to teach their students these same information skills (Asselin and Lee, 2002); in other words, teachers must be ready to answer the queries of their students correctly (Gandhe, 2011). Many professional organizations consider information literacy as a successful element for teacher preparation programmes relating information skills with school teaching activities.

One of the recommendations that the National Forum on Information Literacy (NFIL) declared is "*Teacher Education and Performance expectation should be modified to include Information Literacy concerns*"((ALA, 1998, #5). The National Council for Accreditation of Teacher Education (NCATE) stated in the description of the outcomes of recognized education schools "*They are able to appropriately and effectively integrate technology and information literacy in instruction to support student learning*" (NCATE Unit Standards, 2008). Furthermore, four out of six NCATE standards (2008) are equivalent with the information literacy standards affirmed by ACRL (2000) even if the words used are different the concept of the standards meets the information literacy standards stated by ACRL. For example, for NCATE Standard one which concerns teacher candidate's knowledge, skills, and dispositions requires the candidates to *"know and demonstrate the content, pedagogical and professional knowledge and skills and dispositions necessary to help all students learn"* (p.10) which is parallel with the ACRL Standard *"information literacy is the ability to recognize when information is needed and have the ability to locate, evaluate and use effectively the needed information"*. The same equivalent applies to NCATE Standard three Field Experience and Clinical Practice, Standard five faculty Qualifications, Performance, and Development and Standard six Unit Governance and Resources which show how the quality of educational programmes meet with the Librarian professional Associations' standards (Birch et al., 2008).

Developing standards to coincide with the care of information literacy programmes in higher education (especially for the students in teacher preparation programmes) clearly shows its importance, not only for academic uses but also for lifelong learning (Mittermeyer, 2005). Further reasons for making information literacy an essential part of education is its strong and interactive relationship with lifelong learning, in other words, the learning that continues during a person's lifetime (Brendle-Moczuk, 2006). As the environment at work is changing rapidly, universities should prepare students to continue learning even after graduating (Mittermeyer, 2005).

There are three components to lifelong learning. These are: cognition, behaviour, and information literacy. Information literacy is the keystone and the most important part (Karbanoglu 2003; ALA, 1989; ACRL, 2000; Bruce, 1994). Both information literacy and lifelong learning require people to be self-motivated, self-directed, self-empowering and self-actuating. In addition, both work to improve a set of personal choices and options, quality and utility of education and training, prospects of finding and keeping a job and effective participation in the social sphere (Lau, 2006). People with lifelong learning skills take the responsibilities of teaching themselves and effectively using the available information resources; they use information for problem-solving, decision making and to stay up-to-date in their fields (Macklin, 2001; Kurbanoglu, 2003).

To conclude, by teaching undergraduates information literacy they are being encouraged to compare and evaluate information resources and searching tools and are able to relate the concepts which they are studying to their daily lives (Brendle-Moczuk, 2006). Using this life-long values-based approach and problem-based learning in teaching information literacy will enable learners to realize the meaning and value of being literate and of thinking critically about their personal lives. It will make information literacy meaningful and a good way of solving problems in real life situations (Harley, 2001; Macklin, 2001).

2.1.2 Information Literacy in the New Learning Environment

The consensus for integrating the concept of information literacy into higher education has led to considering information literacy as a discipline and has established concerns about teaching undergraduates the need for information skills. At the same time, information literacy programmes, as with other disciplines, has been affected by the development of technology and the adoption of the new learning environment.

The development of technology running parallel with the explosion of information in recent years has had an impact on education. The recent technology tools and the massive amount of information has led to the creation of a new learning environment which has added many advanced features to teaching activities and services (Darwesh et al., 2011; Magoulas et al., 2003; Tutty and Klein, 2008). Higher education has been affected by these changes and needs to take advantage of the new technology and use it in several ways, for example to adopt a new learning environment, improve teaching methods and deliver educational instructions (Larrasquet and Pilnière, 2012; Mimirinis and Dafoulas, 2008). Universities should become aware of how to promote the new learning environment and how to benefit from the interactivity provided by information and communication technology (Preston et al., 2013).

Usually academic libraries play a significant role in cooperating with faculties to educate the students and provide them with the instructions needed in order to use the information resources correctly. The librarian's duty was to deliver library instruction programmes; these programmes were limited to teaching students certain directions in how to use the library's collections and services (Ashor, 2005). Changes have been made to the role of the librarian and to the ordinary storehouse image of the library to fit with the new interactive learning environment and with the development of information technology (McGuinness, 2006). In order to establish successful information literacy programmes, the new learning environment requires collaboration between the three main partners involved in universities, that is, the faculty, the librarian and the information technologists, so as to be able to face the challenges of the information expansion that exists in its many forms. The three should work together to teach the users how to locate, access, evaluate and use information (Crouse and Kasboh, 2008; Ducas and Michaud-Oystryk, 2003).

Learning information literacy is a developmental matter. Information literacy programmes can be started by learning the basics of information skills and can be developed to reach expert level. Throughout the levels the value of teaching information literacy has more benefits other than just dealing with information and using it in academic performances. Users will also learn other information related concepts such as media, information technology, culture and research literacy which can help to make them experts able to search more specifically in other disciplines such as health, finance, law, science and business (Mokhtar et al., 2007; 2008).

Technology tools have played an important function in developing and presenting information literacy programmes. With the new technology and interactive learning environment, teaching information literacy can be implemented in the educational curriculum and can be taught to learners using many different educational approaches, i.e. online (such as web-based guide or e-tutorial), stand-alone information literacy courses or through integration in core course. (Walton and Hepworth, 2012; Lloyd and Williamson, 2008; Corrall, 2007; Ocholla and Bothma, 2007) There is no one particular approach that can be considered the best. Information literacy programmes should be integrated in a method that equates with the institution's environment and meets the needs of the students (Ducas and Michaud-Oystryk, 2003).

To ensure that undergraduates will benefit from this implementation of information literacy programmes it is important to use the standards in developing and assessing them. In other words, collaboration can be described by integrating the librarians' standardized skills into the faculty curricula using the new technology tools (Mokhtar et al., 2008; Gulikson, 2006; Heckman, 2005). Regardless of what form information literacy programmes are presented in, the main components must be handled by the programmes to achieve their goals (Webber and Johnston, 2000). The information literacy programme consists of groups of several skills based on the needs of information users and related to their fields of study and future profession.

The Standing Conference of National and University Libraries has defined information skills in higher education and has proposed seven headline skills to represent information literate persons within the higher education environment (SCONUL, 1999). (See figure 2)

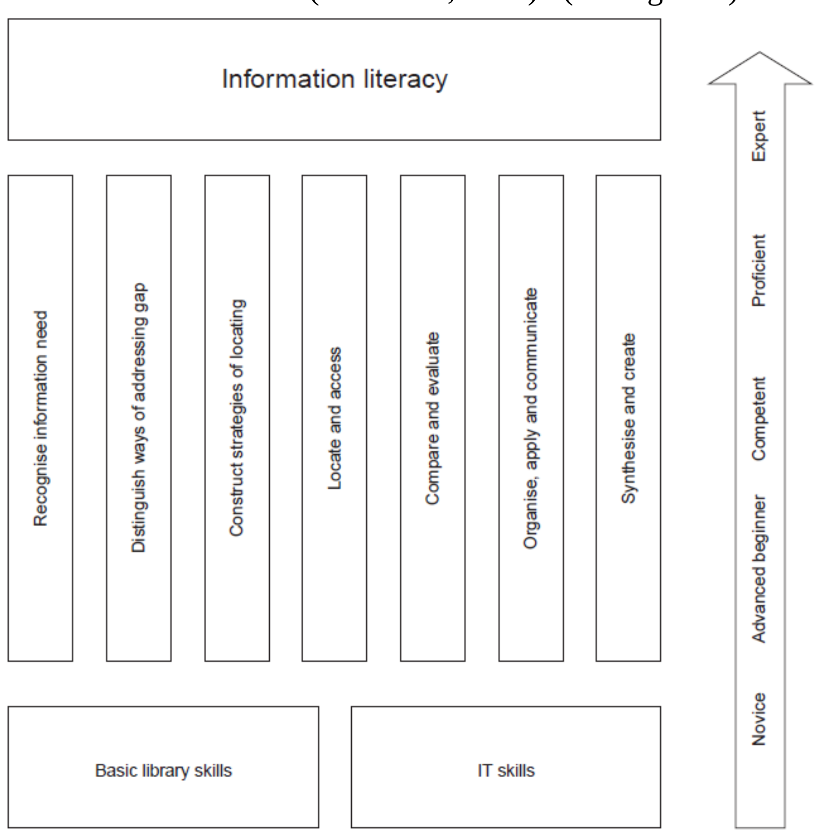

Figure 3 SCONUL Seven Pillars of Information Literacy (SCONUL, 1999, p6)

The suggested components in general are: basic library literacy, resource literacy, computer and internet literacy and application of information (Gandhe. 2011). For the necessary technology skills in precisely information users will need to learn about office applications, databases, library catalogues, CD-ROM, online searching, managing automated systems and using the internet (Buarki et al., 2011). There is a strong and positive relationship between the technology skills the information users learn and their ability to use library and information resources and facing the struggles of using computers and databases (Al-Muomen et al., 2011).

The new learning environment and the new technology have participated effectively in teaching information literacy programmes. The development of technology has affected information literacy in many ways, in particular, in the way information is stored, located and retrieved and in the way information skills are taught to the users.

2.1.3 Impact of Information Literacy on Different Cultures

Although the definition of information literacy is the same the world over, how to put it into practice, or how it is actually being done, may differ from country to country. The influence of culture on information literacy could be addressed by reviewing its establishment and development. In fact, significant initiatives in discussing and analyzing information literacy have been made by researchers from the United States and Australia. These are categorized as developed countries, industrialized ones, and ones that are English-speaking countries (Virkus, 2003). Furthermore, the majority of publications related to information literacy are from Australia, New Zealand, Canada, the United Kingdom, and other countries where articles and books are published in English and share the same concerns about teaching information skills. However, other countries, such as China, South Africa, Russia, Germany and other European countries have the same concerns (Al-Muomen et al., 2011; Rader, 2002), but there is far less literature on the issue of information literacy in such countries and cultures. In a short period of time, the concept of teaching library and information skills has become of international interest and it is important to look at it as both a global phenomenon but also as one which plays out differently in different cultural contexts.

To be able to understand and compare the impact of culture on information literacy it is essential to look closely at the status of information literacy in cultures other than developed countries where English is the language, for instance, regions where the mother language is not English such as the Middle East region. It is noticeable that there is a lack of publications related to information literacy in the Middle East and if there are articles they are rare and hard to find especially anything published in Arabic (Al-Muomen et al., 2011). What is called 'the Middle East' comprises many countries, and they vary enormously in many ways. It is therefore important if we are to look at any aspect of learning and teaching (or anything else) that it is looked at within a particular, specific, part of that region. Just as, say, Iceland is a part of Europe, it is very different indeed from, say, Italy, in many ways. Within the Middle East, one such area/context is the region known as the countries which comprise the Gulf Cooperation Council (GCC).

By looking at the GCC countries as a part of the Arab region we find that there are eight universities which have library and information Science educational (LIS) programmes classified as follows: six LIS programmes in four universities in Saudi Arabia, two LIS programmes in Kuwait, one LIS programme at Sultan Qaboos University in Oman and one in Qatar. The above LIS programmes in these GCC countries are presented either as undergraduate or graduate degree level (Ur Rehman, 2008). As for other academic libraries in the region most of them do not have enough interest in information literacy programmes and though few have tried to establish such programmes they have faced a lack of interests by the users (Al-Suqri 2010; Kanamugire, 1996).

Some of the reasons for this shortage of interest in information literacy can be seen as three major problems facing the libraries; these are listed as follows: 1) the traditional educational system; 2) the low literacy rate; 3) the low level of publishing and book production (Ashoor, 2005). Other factors are related to the problems of using English language and technology (Ur Rehman, 2008). The level of English of the students was the first challenge they had to face in order to learn information literacy (Al-Muomen et al., 2011; Spaven and Murphy, 2000). Although the students studied English at school, most school English teachers did not have English as their first language, students rarely used English outside classrooms so how could they understand instructions and terms explained in English; most information resources and publications are in English (Al-Muomen et al., 2011). Additionally, not all students are computer literate or know how to access internet or even how to use CD-ROMs (Ashoor, 2005; Spaven and Murphy, 2000). Even though the libraries have evolved electronic information services, legal attention was drawn to user education and training in how to use the services appropriately (Al-Muomen et al., 2011; Kanamugire, 1996).

Closer focus will now be drawn to the state of Kuwait as an example in understanding attempts to apply information literacy programmes in the region. Not many studies have been found regarding library and information science programmes in Kuwait making it difficult to have a complete idea of the subject (Al-Muomen et al., 2011; Buarki et al., 2011). Based on the few articles found, there are two library and information literacy programmes in Kuwait. The first was established in 1977 by the Public Authority for Applied Education and Technology (PAAET), and the second was established in 1996 by Kuwait University. While PAAET produces undergraduates with library and information literacy bachelor degree in education, Kuwait University has a Masters programme in LIS and a minor Bachelor in information studies. For Kuwaiti undergraduate students, the College of Social Studies represented by the Department of Library and Information Science has two required service courses on information skills for 650 students every year (Ur Rehman, 2008). The courses are compulsory for college students while they are electives for students from other colleges.

Regarding the role of the nine academic libraries in Kuwait University, it is worth mentioning that the librarians can present sessions in information literacy skills to the students but this is limited by rare requests from individual faculties and limited by time to one or two sessions only; what students learn through these session is not enough and is inadequate to improve their information skills (Al-Muomen et al., 2011; Ur Rehman, 2008). The official website of libraries administration contains no online guides and no tutorials are found to help the students in using information resources. Looking at information literacy among students in Kuwait high schools, the majority of students were found to be unfamiliar with basic requirements in searching skills, catalog use, information sources selection and library uses (Ur Rehman and Alfaresi, 2009).

The undergraduate students, when they join the university, are required to conduct assignments, research, projects or presentations as graded tasks that need to gather related and accurate information through use of the library using searching skills. While the instructors expect their students to enter the university with searching skills, no evidence has been found showing that students have these skills or have been encouraged to learn them.

According to studies on Kuwait and countries from the same region, some factors affecting the information literacy programmes have come to light: the programmes have been established only recently and are considered new to most of the students, the courses of information literacy are not compulsory and are presented by one department only for the students from a single college, students are already loaded with courses in their fields of study they have no interest or time to study information literacy, students' skills in the English language and/or in using technology may affect their desire to study an information literacy programme. All these factors may have led to a lack of interest in studying information literacy and may affect the way the students think about it as a discipline. In order to understand how information literacy can be improved and gain students attention and interests, it is important to know what kind of beliefs the students hold toward information literacy and to study the impact and the relationships between their characteristics and beliefs.

2.2 The Epistemological Beliefs

Individual differences is an important factor in designing appropriate learning instruction for both learning in a 'traditional' setting, that is, in a classroom, and also when learning via either distance learning or in a blended learning environment online. The central objective of studying individual differences is to determine the major differences between learners and, by so doing (it is argued) educators can capture them and use this knowledge in the design of learning instructions which will enhance students' learning performance as well as help to ensure that they are suitably motivated, satisfied and familiar with the learning process. It is claimed that learners will learn better and therefore perform better if the ways they have been taught match their preferred learning styles (Koc, 2005). It is therefore important to find out what that learning style is and to look at individual differences thus enabling educators to plan accordingly.

As has been shown above, one of the main purposes of education is for learners/students to gain knowledge. Educators and researchers pay great attention when it comes to identifying the factors that affect the learning process and the construction of knowledge. Individual differences in learning focus on the cognitive factors such as learners' ways of thinking and information processing. There are psychological factors related to personality that have influences on how learners gain knowledge. Some examples of the psychological factors are emotions, passions and thoughts (Bråten and Olaussen, 2005). One psychological factor is that it is related to knowledge and knowing; it has been widely studied to explore its impact on learning learners' beliefs about acquiring knowledge and knowing. What learners believe about how they acquire knowledge and what they believe about knowledge itself is called their *epistemological beliefs*. These are vital when it comes to looking at individual differences as, clearly, different individuals will hold different beliefs and it is important to understand these beliefs if we, educators, are to better support them in the classroom.

2.2.1 The Development of Epistemological Beliefs Theories

The term *epistemological* is derived from the Greek episteme (that is knowledge) and logos (that is explanation) (Buehl and Alexander, 2001:386). The term refers to what students think about knowledge (its structure and certainty) and knowing (its sources and justification of knowledge) (Buehl and Alexander, 2001). Hofer (2001:355) includes the explanation "the definition of knowledge, how knowledge is constructed, how knowledge is evaluated, where knowledge resides, and how knowing occurs".

The initial work related to the development of the epistemological belief in learning began with the study of Perry (1970) who tried to understand how students interpreted learning experiences. Perry's study led to the theory of intellectual development (Hofer and Pintrich, 1997). Perry's longitudinal study was based on using interviews with Harvard undergraduates who were generally male. Following this, he developed a framework which describes how students think about the nature of knowledge and the process of gaining or building knowledge throughout their college years (Hofer and Pintrich, 1997). Perry's model for intellectual development identified a series of nine stages during which students build up their knowledge as they face the intellectual and personal obstacles in their higher education (Moore, 1994). These nine stages have been combined into four categories as follows: dualism, multiplicity, relativism and commitment within relativism (Hofer and Pintrich, 1997, Moore, 1994).

The four categories of intellectual development proposed by Perry (1970) can be summarized as follows:

Dualism refers to viewing the nature of knowledge whether it is right or wrong, or whether it exists or not. At the dualistic level, students think that teachers know the truth and present it to the learner.

Multiplicity refers to amendments of dualism and the students at this level think that all views are equally acceptable and that personal opinion is respected.

Students at the *relativistic* level believe that knowledge is contingent and relative. They recognize that answers to questions are relative to a background context; the student's job is to see things from different perspectives and come to a reasoned decision about answers, meaning that individuals with more experience hold more relativistic beliefs (Hofer, 2000; Buehl and Alexander, 2001; Weinstock and Zviling-Beiser, 2009).

It is considered that students at the *commitment within relativism* level hold the highest and more complex level of beliefs. They confirm their personal identity among multiple responsibilities and appear committed through their jobs, values and relationships (Hofer and Pintrich, 1997).

In Perry's model, the personal epistemology developmental structure is reflected in a single dimensional approach which can be described as a unidimensional model where the development of one dimension leads to the development of the other dimensions (Ryan, 1984a, 1984b;

Schommer, 1990, 1994). Although Perry (1970) proved his theory regarding the development of students' beliefs about knowledge through his years of studying in college, he tried to simplify the process and replace the interviews with the Checklist of Educational Views (CLEV) - the paper-and-pencil questionnaires - to assess the students' beliefs. CLEV is simple and easy to use but it is suitable only for the use on college students, however, since it was devised some years ago some items no are longer pertinent for modern students (Duell and Schommer-Aikins, 2001).

Following Perry's unidimensional model, other instruments were developed to measure students' beliefs. The most well-known studies influenced by Perry's model are: the Reflective Judgment Model (Kitchener and King, 1981), Women's Ways of Knowing Interview (Belenky et al., 1986), the Measure of Epistemological Reflection (Magolda, 1987) and the Epistemic Doubt Interview (Boyes and Chandler, 1992).

The Reflective Judgment model proposed by Kitchener and King (1981) conducted a longitudinal study which continued for 15 years with a wide range of samples aged from 15 to 65 years. This model was interested in learners' intellectual development and describes the development of their assumptions about knowledge suggesting that people use different strategies and methods to justify their beliefs in solving ill-structured problems (King and Kitchener, 1994).

The model consists of seven stages of beliefs about knowledge categorized into three levels. The first level called *pre-reflective thinking* covers stages one, two and three. People in these stages see knowledge as being certain, and believe that knowledge can be gained by observation; there is no need to justify their beliefs because they reflect reality. The second level is *quasi-reflective* believing that stages four and five appear at this level where learners believe that knowledge changes according to the situational variables, that people can learn by themselves, that others, data and logic and beliefs can be justified by personal evaluation; they also define knowledge as true, false or uncertain. At the third level *reflective thinking* is the highest level of knowing, the more mature beliefs develop and few individuals, such as experts, only reach this level. People at this level see knowledge as uncertain, judgments driven by personal opinion and that learning occurs from critical thinking and reality comes from integrating and evaluating data, opinions and evidence (Duell and Schommer-Aikins, 2001).

After reviewing the summary of the Reflective Judgment model it can be said that the focus of this model is on the assumptions and methods of judgment of people solving ill-structure problems which do not lead to a full understanding of epistemological beliefs. People hold their beliefs about knowledge and knowing related to their education which affects their learning in regular, everyday situations. However the model can be used only by well-trained raters, and requires improvement (Hofer and Pintrich, 1997).

Another model based on Perry's study is The Women's Ways of Knowing Interview by Belenky et al. (1986). Their investigations into this model started in the late 1970s focusing on females' epistemological beliefs; the premise was to find a theory related to women's themes of knowing since the focus of Perry's theory had been on that of male beliefs (Duell and Schommer-Aikins, 2001).

The Women's ways of knowing model consists of five belief categories as follows:

1. *Silence* - women in this category considered that they were without a voice, they felt ignorant and relied on outside authority to know what to know;

2. *Received knowledge* – this is similar to Perry's dualistic position where knowledge is right or wrong, there is only one right answer delivered by authority there is no ambiguity or truth gradation;

3. *Subjective knowledge* - at this stage woman's beliefs about the source of knowledge shifts from outside authority to her own senses, she believes knowing is an intuitive response coming from personal experiences.

4. *Procedural knowledge* - this can take two forms *separate knowing* (impersonal and detached) and *connected knowing* (personal and judgmental emphasizing understanding), for this category the claims and thoughts are

doubtful even if coming from experts until evidence is provided to support them. At this stage, women use logical thinking and objective analysis,

5. *Constructed knowledge* - woman considers herself a part of the construction of knowledge, she integrates all the aspects in her life and uses outside sources to support her understanding and build objective knowing.

Belenky et al.'s (1986) approach to Women's Ways of Knowing attempts to understand female's beliefs about knowledge, identifying the relationship between beliefs and their social interactions although a noticeable concern regarding this model has been introduced by educators, especially at college level. The most important contribution of the model is the division of knowing as *separate knowing* and *connected knowing* which has led to a better understanding of gender differences in learning. The limitations of gender as scope of the study, for example female only interviews, raises the question of whether the gender-related nature of the findings can be generalized or not; additionally, could the findings be integrated with the findings of existing frameworks to become a comprehensive understanding of people's belief developments (Duell and Schommer-Aikins; 2001; Hofer and Pintrich 1997).

For further explanation as to the different findings about men and women's beliefs in Perry (1970) and Belenky et al.'s (1986) studies can be found in the study of Magolda (1987). A five year longitudinal study conducted by Magoldaon undergraduate and graduate students to explore students' ways of thinking using Perry's (1970) model focused on the possibility of gender-related implications. As a result of the investigation, Magolda introduced her model of student's ways of thinking in The Measure of Epistemological Reflection. This model consists of four different types of students' ways of knowing which are aligned with Perry's (1970) positions and Belenky et al.'s (1986) categories.

Magolda's four types of students regarding their ways of knowing as defined by (1987) are:

1. *absolute knower* – belief that knowledge is certain and authorities have all the answers;
2. *transitional knower* - start to believe that knowledge is uncertain and authorities are not all-knowing.

3. *independent knower* - have their own opinions and believe that authority is not the only source of knowledge;
4. *contextual knower* - is able to use evaluation and is able to judge evidence to structure personal perspectives.

In a later study, Magolda (1992) explained the differences between men and women regarding their ways of knowing. It appears that there are no gender differences between men and women in their ways of knowing at the cognitive structure level, since, the cognitive structure at the epistemological stages allows individuals to build from within their own judgments and justification of knowledge. However, the findings show that gender differences may occur at the reasoning structure level where the reasoning structure is the differences in thinking within the cognitive structure (Hofer and Pintrich1997; Whitmire, 2003).

Another study influenced by Perry's model focusing on adolescents' epistemic thinking was conducted by Boyes and Chandler (1992). They predicted that there would be a relationship between cognitive development and epistemic development. Boyes and Chandler (1992) presented their Epistemic Doubt Interview to assess the three stages they proposed that adolescents pass through in their epistemic development before they reach the highest level. The three stages can be defined as follow: stage one, called *Defended Realism,* is the lowest level of epistemic development where the subjective bias is considered and people's personal preferences lead to different opinions. The second stage is the *Dogmatism-Skepticism Axis* which refers to two concepts of dogmatic thinking where knowledge is seen as being controlled by authority. *Skeptic thinking* believes that knowledge is doubtful therefore, adolescents rely on personal sense to make decisions; at this stage the beliefs of knowledge are uncertain and complexities are noticeable. The third stage is called *Postskeptical Rational* this is an advanced level of the cognitive development where the adolescent evaluates decisions to choose the best and make rational decisions which can be made with only partial certainty of knowledge (Duell and Schommer-Aikins; 2001). It is worth mentioning here that the scoring of Epistemic Doubt Interview responses is complicated and not a clear process, it requires a lot of time therefore, researchers using this model require a full understanding of Boyes and Chandler's (1992) theory (Duell and Schommer-Aikins; 2001).

Previous longitudinal interviews have faced severe criticism for several reasons. One, this type of investigation requires a very long time to conduct since interviewing people individually and coding their responses is time consuming. Two, there is a lack or absence of directive and availability of trained raters. Three, for this type of study researchers are usually restricted by small samples. The difficulties relating to time, costs and effort spent in conducting the interviews and coding the data made investigating into this area frustrating and discourages researchers from this area of study (Hofer and Pintrich, 1997; Duell and Schommer-Aikins, 2001; Hofer 2000).

Perry's unidimensional model (1970) for the development of students' beliefs about knowledge has also been questioned. It is claimed that beliefs about the nature of knowledge are too complicated to be represented by a unidimensional concept (Ryan, 1984a, 1984b; Schommer, 1990, 1994). Based on the interest of how epistemological beliefs affect comprehension and academic performance (Schommer 1993b; Schommer, Crouse and Rhodes, 1992), Schommer's (1990) have taken a more analytic view of Perry's components of beliefs and hypothesizes that the structure of epistemological beliefs is a multidimensional model of five more or less independent dimensions where the development of one dimension may or may not lead to the development of other dimensions (Duell and Schommer-Aikins, 2001). From this point of interests, Schommer worked on developing her model of the structure of epistemological beliefs.

2.2.2 Schommer's Epistemological Beliefs Model

Schommer (1990) looked from the beginning to the relationship between characteristics of the learners and their epistemological beliefs. Schommer's participants were 117 junior undergraduates who were enrolled in an introductory psychology course and 149 undergraduates who were enrolled in either a basic course of educational psychology or a basic course of introductory physics who were administered a vocabulary test, Survey of student characteristics, a filler task and an Epistemological beliefs' Questionnaire (SEQ). Following this, Schommer studied the relationship between epistemological beliefs and comprehension. This study consisted of 86 junior undergraduates who also took part in the first study. The influences of epistemological beliefs were under control on - performance, conclusions on comprehension monitoring and a mastery test. The undergraduates read a text about nutrition or psychology and were questioned then asked to write down a conclusion for the text and to measure their confidence in comprehending the text.

Schommer's questionnaire consists of 63 short statements categorizing epistemological beliefs; they are classified into negative or positive extremes using the Likert scale from 1 (strongly disagree) to 5 (strongly agree) for respondents' rating of the statements. After conducting factor analysis the questionnaire was classified into 12 subsets of items graded into five factors. The five dimensions of epistemological beliefs presented by Schommer's epistemological beliefs' questionnaire (1990) are: *structure of knowledge*; *stability of knowledge*; *ability to learn*; *source of knowledge*; and *speed of learning*. Schommer's five dimensions were assessed by two or more subsets of items, a summary of Schommer's factors and subsets with examples of items for each subset is presented as follows:

The first dimension *structure of knowledge* proposes a range of beliefs from that knowledge which are simple, unambiguous and isolated pieces, to which knowledge is complex with highly interrelated concepts. There are two subsets to assess this dimension: *Seek single answers* (for example, "Most words have one clear meaning") and *Avoid integration* (for example, "When I study I look for specific facts").

The second dimension *stability of knowledge* proposes a range of beliefs from - knowledge is absolute and certain, to - knowledge is changing and evolving. There are two subsets to assess this dimension: one, *Avoid ambiguity* (for example, "I don't like movies that don't have an ending"), and two, *Knowledge is certain* (for example, "Scientists can ultimately get to the truth").

The third dimension *ability to learn* proposes a range of beliefs from -intelligence is a fixed entity at birth, to - it is incremental and can be improved through experiences. This dimension is represented by three subsets: one, "can't learn how to learn" (for example, "Self-help books are not much help"), to, "success is unrelated to hard work" (for example, "The really smart students don't have to work hard to do well in school") and three, “ability to learn is innate”, (for example, “An expert is someone who has a special gift in some area”).

The fourth dimension *source of knowledge* proposes a range of beliefs from -knowledge is handed down by authority, to - it is derived by reason and evidence. There are two subsets to assess this dimension: one, *Don't criticize authority*, (for example, “People who challenge authority are overconfident." and two, *Depend on authority*, (for example, “How much a person gets out of school depends on the quality of the teacher”).

The fifth dimension *speed of learning* proposes a range of beliefs from -learning is quick to happen from the first time or not at all, to - learning is acquired gradually. This dimension is represented with three subsets: one, *Learning is Quick*,(for example, "Successful students learn things quickly"), to, *Learn first time*, (for example, "Almost all the information you can learn from a textbook you will get during the first reading "and three, *Concentrated effort is a waste of time*, (for example, "If a person tries too hard to understand a problem, they will most likely just end up being confused”).

After Schommer conducted her study, she examined the dimensions and tested the influence of participants’ beliefs. The findings showed that the undergraduates who believed in quick learning oversimplified conclusions and provided a poor performance on the psychology mastery test. The findings also specified that the more the undergraduates believed in certain knowledge, the more absolute conclusions they wrote. The study exposed an essential result that epistemological beliefs influence the undergraduates’ processing of information and monitoring of their comprehension. Schommer’s epistemological beliefs’ questionnaire started to become a well-known instrument for assessing people’s beliefs.

The importance of Schommer’s (1990) model is that it can be seen as a turning point in the development of epistemological belief theories since she presented a more quantitative model than those previously presented (Perry, 1970; Kitchener and King, 1981; Belenky et al., 1986; Magolda, 1987; Boyes and Chandler, 1992). Her work included a more critical analysis of the beliefs’ components. Additionally, the added value of Schommer’s model to the existing models can be recognized from three points of view, (Hofer and Pintrich, 1997). One, the epistemological beliefs are presented as a system of independent dimensions. Previous models reviewed earlier claimed that the development of personal beliefs occurs through a dependent stage-by-stage order basis. Two, it provides an empirical research methodology for assessing the suggested dimensions. As shown previously, the longitudinal studies conducted by previous researchers' models made investigation in this area very difficult and too long and required extraordinary skills. Three, it introduced a vital line of investigation relating to epistemological beliefs with different learning aspects (Clarebout et al., 2001; Hofer and Pintrich, 1997; Jehng et al., 1993). Schommer brought attention to not only her model but also to studying the relationship between epistemological beliefs and learning because she studied the relationship between students' beliefs and comprehension and their academic performance. Her work inspired other researchers to use the model and to look for more types of links between personal beliefs and other learning components (Clarebout et al., 2001).

Schommer's multidimensional theory and questionnaire (1990) have been modified and used by other researchers, although, some of them applied the model without any changes, for example, Bendixen et al.,1994 and Paulsen and Wells, 1998).Others tried to use Schommer's original work to introduce new or partly new models for their studies. These are: Jehng et al.(1993), Schraw et al.(1995),Kuhn et al.(2000), Qian and Alvermann, (1995),Hofer and Pintrich, (1997), Hofer (2000), Duell and Schommer-Aikins (2001), Clarebout et al. (2001) and Hofer and Pintrich (1997).

Jehng et al. (1993) introduced a model similar to Schommer's five dimensional model to assess the structure of epistemological beliefs. They used the same dimensions except the dimension of *structure of knowledge* because, they claimed, the traditional structured teaching environment does not help naive students to develop their own ways of thinking. Jehng et al. (1993) replaced the *structure of knowledge* with the *factor orderly* process, this means that the learning process occurs regularly rather than irregularly. An example of this dimension is *"I prefer classes in which students are told exactly what they are supposed to learn and what they have to do"* (Jehng et al. 1993, p28). This model does not appear to be used widely enough to be evaluated unlike Schommer's (1990) original model (Duell and Schommer-Aikins, 2001).

Schraw el al. (1995) also used the multidimensional theory to introduce the Epistemic Beliefs Inventory in an attempt to improve Schommer's model. They claim that, in some other studies using Schommer's model, when factor analysis is applied the items failed to be loaded under the five dimensions proposed by Schommer (Schommer, 1993b; Schommer et al., 1992). The development of the Epistemic Beliefs Inventory used 32 items to represent Schommer's five beliefs' dimensions most of which were new with the remaining few items similar to Shommer's (Duell and Schommer-Aikins, 2001).The model has been tested by Schraw et al. (1995) and the factor loading for the items represented the five dimensions and even though the same results were found by other studies, for example, Bendixen et al.(1998), Schraw et al.(2002) and Hardré et al. (2007). Conversely, the Epistemic Beliefs Inventory did not reflect the five dimensions when it was used in other studies, for example, Nussbaum and Bendixen (2002/ 2003) where the items scored under two or three factors only. Furthermore, the sample sizes used in the studies were considered too small to confirm the validity of the model. In the study by Schraw et al. (1995) the number was 212, in the study by Bendixen et al. (1998) it was 154, in that of Schraw et al. (2002) it was 160, and in that of Hardré el al. (2007) it was 227 (Debacker et al., 2008).

Kuhn et al. (2000) followed Schommer in proposing their unique multidimensional development model for knowing and understanding. They entitled their multidimensional model Epistemological Understanding by Judgment Domain; it consists of two approaches working together. They hypothesized four main levels for students' understanding and another multidimensional approach consisting of five judgment domains for the epistemological beliefs development. The four levels of understanding are: *realism*, *absolutist*, *multiplist* and *evaluativist* where students' understanding of knowledge was developed from the lowest level (believing in external sources of knowledge and not relying on critical thinking, to the highest level (believing in knowledge which can be evaluated and where critical thinking is important).

The five judgment domains of the structure of epistemological beliefs are: *personal taste*, *aesthetic judgment*, *value judgment*, *facts about the social world* and *facts about the physical world*. The development of students' understanding from *realism* to *evaluativist* occurs through the development of judgment domains from personal taste to facts about the physical world. To test the validity of the theory of epistemological understanding by the judgment domain, the instrument, which consists of 15 items, was carried out on different age and educational background groups that is from students in grade 5 to experts. The results showed modest confirmation of the developmental order as suggested in the theory that is excepting the experts' level which showed the highest level of beliefs' development (Kuhn et al.; 2000; Duell and Schommer-Aikins, 2001).

Another significant attempt to revise Schommers' model was carried out by Qian and Alvermann (1995) and Hofer and Pintrich, (1997). Their contribution was to define the main factors constructing the epistemological beliefs through items-based factor analysis rather than the subset-base factor analysis as Schommer proposed (Debacker et al. 2008; Hofer, 2001). More precisely, Qian and Alvermann (1995) in their shortened version of the Schommer model, believed that personal epistemology can be assessed with a fewer number of items, they therefore, eliminated many items starting with the fifth factor *Omniscient Authority* (the dimension of source of knowledge), they claimed it was not a significant factor in earlier studies (Schommer, 1990, 1993; Schommer and Dunnell, 1992; Schommer et al., 1992). They also eliminated items that had factor loadings of less than .30. A further contribution from the Qian and Alvermann model (1995) was the merging of the two factors -simple knowledge (*structure of knowledge*) and certain knowledge (*stability of knowledge*). The merging of these two factors may have been as a result of eliminating some other items (Hofer, 2000). The Three-factor model introduced by Qian and Alvermann (1995) where the factors are *simple/certain knowledge*, *quick learning* and *innate ability* have been entitled the domain-general epistemological beliefs model and have been used by other studies to investigate the relationship between personal epistemology and learning (Hofer 2000; 2001).

2.2.3 Hofer's Epistemological Beliefs Model

Unlike all previous researchers, Hofer and Pintrich (1997) proposed a model for epistemology beliefs by analyzing all the existing epistemological theories so as to identify the common elements and eliminate dimensions not related to knowing (for example the *factor quick learning* in the Schommer model) and to eliminate dimensions presented only in one model and never presented in other models (for example *fixed ability* in Schommer's model). Hofer and Pintrich (1997) classified the main structure of the epistemological beliefs theories into two general areas with two dimensions to each: the first area is the *nature of knowledge*; the two dimensions are *certainty of knowledge* and *simplicity of knowledge*. The second area is the *nature of knowing* and the two dimensions under this area are *source of knowledge* and *justification for knowing*. Hofer and Pintrich (1997) have suggested that more empirical studies are needed to confirm the usability of the model. The model was tested and used by Hofer (2000).

Hofer (2000) was interested in studying the structure of personal epistemology from a disciplinary-base. She claims that the current instruments related to personal beliefs were designed to assess beliefs about general knowledge and knowing rather than beliefs related to certain disciplines which may be different (Hofer and Pintrich, 1997, Hofer, 2000). Therefore attention was paid to introducing sensitive instruments to measure the differences in the beliefs about knowledge towards particular disciplines.

Hofer (2000) proposed the Discipline-focused Epistemological Beliefs Model adapting the four dimensions proposed by Hofer and Pintrich (1997). This model consists of items from Perry's model (1970), Schommer's questionnaire (1990) and Hofer and Pintrich's model (1997). Hofer's model was established to indicate the differences between individuals' beliefs about science and psychology disciplines for first-year undergraduates. The sample contained 326 undergraduates who were participating in a basic course in psychology. Each item in the questionnaire refers to either psychology or science and students were asked to keep in mind one of them while answering the questions (for example, "In this field, knowledge is certain." (Buehl and Alexander, 2001). Regardless of whether the discipline was science or psychology principal components' analysis produced a four factor solution. Similar to Qian and Alvermann (1995), certainty and simplicity dimensions of Schommer's model emerged because the items found under both dimensions were loaded under one factor. Therefore, the dimensions proposed in Hofer's model are as follows: *Certainty/Simplicity knowledge, Source of knowledge, Justification of knowing* and *Attainment of the truth* (Debacker et al., 2008).

In Hofer's model, *Certainty of Knowledge* represents an absolute truth within certainty (less sophisticated) but as knowledge is tentative (more sophisticated), whereas *Simplicity of Knowledge* is classified as knowledge being concrete, discrete and knowable truth (less sophisticated), knowledge is also categorized as relative, contextual, and contingent (more sophisticated). *Source of Knowledge* means that individuals think that knowledge comes from outside the self and resides in external authority (less sophisticated) or they believe that knowledge is created by the knower through contact with each other; the *Justification for Knowing* dimension measures how students rate knowledge through observation or authority (less sophisticated), or use rules of inquiry and begin to personally examine and combine the views of experts (more sophisticated). The fourth dimension, Attainment of the truth, means truth is attainable by experts (Hofer and Pintrich, 1997).

The findings of Hofer (2000) show that the science and psychology disciplines are significantly different in the four dimensions; in other words, students believe that knowledge in psychology is less certain than in science, and that they are less dependent on expertise and authority as the source of knowledge in psychology than in science. The students also think that on the one hand personal knowledge can be employed for justification of knowing in psychology more so than in science. On the other hand, they accept that truth is attainable by experts in science more than in psychology. The findings exposed a gender influence for both sources of knowledge and *certainty/simplicity of knowledge*, in that the male participants were more likely to believe knowledge as certain and to see authority as the source of knowledge than female participants. There was a significant relationship between the students' academic performance and their beliefs in certainty and simplicity of knowledge in both majors. The Discipline-focused Epistemological Beliefs Model proposed that the differences can be evaluated by using specific disciplines rather than a domain general tool.

The main reason for developing the Discipline-Focused Epistemological Beliefs Questionnaire (DFEBQ) by Hofer (2000) was to rate not only the multiple dimensions of epistemological beliefs but also to distinguish between individuals' beliefs in different disciplines. The items of DFEBQ are valid for domain-specific knowledge more so than the items of SEQ which was designed for general knowledge (Hofer, 2000). For this reason, DFEBQ has been used in many studies investigating learners' beliefs across disciplines rather than for science and psychology (Cazan, 2013; Topcu, 2012; Muis et al., 2011; Rizk et al., 2011).

2.2.4 Schommer and Hofer's Models across Cultures

Measuring people's general and specific-domain beliefs through Schommer's and Hofer's models has become valid and in common use in research around the world (Cazan, 2013). Regarding Schommer's epistemological beliefs' dimensions, it should be noted that review of the literature has shown that it has been adopted in different cultural populations and translated into many languages in order to study the general-domain of epistemological beliefs of the learners' (Hofer, 2010; Buehl and Alexander, 2001). In addition, Hofer's model for assessing the specific-domain beliefs was also found to be applicable across cultural studies. A wide range of studies has used the two models in different countries, for populations and languages; the findings of these investigations present great support for the models as they are compatible with people from different backgrounds. The following section will review some of the studies, in different countries, that have adopted Schommer's or Hofer's models.

On the subject of using Schommer's model, Sulimma (2009) conducted a cross-cultural study trying to use the cultural classifications to indicate the development of epistemological beliefs. This study was carried out in Germany and Australia using German and English versions of the epistemic beliefs' model. Sulimma (2009) found that although the two groups have the same three dimensions of beliefs (*structure of knowledge*, *source of knowledge*, and *knowledge acquisition*) the development of the epistemological beliefs' dimensions is different. For the dimension of *structure of knowledge*, German participants showed more sophisticated beliefs than Australian participants, a modest difference was found between the German and the Australians related to their beliefs about the source of knowledge and also for the dimension acquisition of knowledge, there was more sophisticated beliefs among the Australian participants who believe more in the ability to learn is an acquired skill.

An Iranian study carried out by Marzooghi et al. (2008) used Schommer's model. They investigated gender and grade level differences between the general epistemological beliefs of undergraduate students in an Iranian University. The study showed significant results and confirmed the relationship between the epistemological beliefs assessed by Schommer's model and the participants gender and grade levels thus confirming the validity of the tool. In another Iranian study, Jahromi et al. (2010) looked at the relationship of achievement goals and epistemological beliefs with computer anxiety using Schommer's questionnaire to measure the Iranian undergraduates' beliefs. The results revealed meaningful relationship between learners' beliefs and the achievement goals

Hong Kong teacher education students' epistemological beliefs were examined using Schommer's model (Chan and Elliot, 2002). The findings were similar to those discovered by Schommer (1990) with North American university students in that the nature of the dimensions is different but the quantity of dimensions is the same. The differences were found in cultural contexts, meaning that the difference in dimensions associated with authority–expert knowledge and effort and learning might be described by value differences between non-Western (Hong Kong Chinese) and Western (North American) cultures.

Turkish trainee teachers' epistemological beliefs were also assessed using Schommer's dimensions (Oĝuz, 2008). The study applied a Turkish version of Schommer's epistemological beliefs instrument to determine the belief levels of Turkish trainee teachers. Oĝuz, (2008) found that the participants had more sophisticated beliefs about learning depending on effort rather than ability whereas their beliefs about only one unchanging truth was at a naïve level. Female Turkish trainee teachers hold more sophisticated beliefs about ability to learn as compared with male beliefs.

Finally, Bråten and Olaussen (2005) measured the epistemological beliefs of Norwegian student nurses and business administration students using Schommer's epistemological beliefs dimensions. The study indicated differences among students' beliefs about knowledge and knowledge acquisition. Students who scored high levels of motivation believed that knowledge is evolving and is acquired gradually and by effort. On the other hand, students with lower levels of motivation believe knowledge is stable and that learning occurs quickly or not at all

With regard to the validity of Hofer's dimensions for the specific-domain beliefs adopted in studies from different countries around the world, this section will examine a study from Romania. Cazan, (2013) used a Romanian version of Hofer's questionnaire to test the validity of the questionnaire in assessing the students' beliefs about knowledge in psychology. The study findings confirmed the validity of the Romanian version of instrument and students' specific epistemological beliefs about psychology which were structured into the same four factors as defined by Hofer's (2000) model.

A Turkish version of the DFEBQ was used in a study to assess students' domain specific epistemological beliefs in physics, chemistry, and biology (Topcu, 2012). The study looked at whether students distinguished between disciplinary differences in the three domains when their beliefs were being measured. The instrument appears to have been reliable and valid in measuring the specific-domain beliefs of the Turkish participants. Where the findings support the factor structure proposed by Hofer (2000) in three dimensions: *certainty and simplicity of knowledge*, *justification for knowing*, and *source of knowledge* (only *attainability of truth* was not explored). Across the three dimensions, the beliefs in physics were different from the beliefs about chemistry and biology in a way that confirmed the domain specificity of the epistemological beliefs. Another study was conducted by Rizk et al. (2011) in Lebanon to measure Lebanese undergraduates' specific beliefs in science. They found that the DFEBQ (Hofer, 2000) was valid in assessing the Lebanese undergraduates' beliefs and the findings also approved Hofers' four dimensions of beliefs of the participants in the study.

The final study in this review investigated the Middle Eastern (Omani) and Western (United States) students' beliefs about knowledge (Karabenick and Moosa, 2005). Knowing in the sciences was compared in four dimensions of epistemology as suggested by Hofer and Pintrich (1997), these are the same four dimensions that Hofer (2000) adopted in the DFEBQ. The dimensions worked appropriately indicating the differences in the beliefs between participants from different cultures. The interesting findings of the study were that Omani students were more likely to accept scientific authorities as the basis of scientific truth than U.S students. In particular, Omani men were more accepting of authorities than were Omani women, but there was no gender difference among U.S. students. Omani students also believed that knowledge in the sciences was simpler and more certain than U.S. students did.

To sum up, the study of the development of epistemological beliefs has paid a great deal of attention to psychologists and educators. As reviewed in this section, this attention has led to the production of various models in order to understand the components of individuals' beliefs and how they develop. Based on the initial work started by Perry's 1997 study and all the subsequent models, the most popular and valid model studied and used in the literature is that of Schommer's epistemological beliefs' model (1990). Hofer's (2000) model followed Schommer's but adjusted it to measure beliefs toward certain domains. At this stage, knowledge collected regarding epistemological beliefs, there is no need to present more models, what is needed is to examine individual belief systems in different eras of people's lives focusing on how the development of their beliefs can affect their learning positively and how educators can work on improved teaching methods to develop these beliefs. As shown above, researchers have participated in different studies to find a link between students' epistemological beliefs and their different learning components. The following section will examine some of these studies.

2.2.5 The Importance of Epistemological Beliefs in Education

Four decades ago, many researchers linked epistemological beliefs and learning (Dweck and Leggett, 1988; Hammer, 1994; Hofer and Pintrich, 1997; Schraw et al., 1995). The study of people's epistemological beliefs is shared by psychologists and educators (Schraw and Sinatra, 2004) who have investigated the theories and models that are linked to epistemological beliefs and cognitive processes, thinking strategies and how this relationship is integrated in education (Hofer, 2004a; Hofer and Pintrich, 1997). A significant amount of research has been carried out about personal epistemology in the field of educational psychology because individual's beliefs about knowledge are important to the learning process in different ways (Richardson, 2013; Schraw, 2001). Personal epistemology is related to notions of learning and knowledge that influence the way that individuals approach and estimate information and the challenges they face in both the classroom and in their daily lives. These notions of learning and knowledge may be referred to as- cognitions, attitudes, beliefs, ways of thinking, or reasoning skills (Pintrich, 2002).

Many attempts have been made by educators in the past few years to link learners' epistemological beliefs with their efficiency at learning. The outputs of the studies have provided evidence for the influence of epistemological beliefs on related aspects of learning (Hofer, 1994; Ryan, 1984a; 1984b; Schommer, 1993b; Schommer, Crouse and Rhodes, 1992; Schutz et al., 1993; Buehl and Alexander, 2005; Richardson, 2013). Some of these aspects associated with epistemological beliefs are -academic performance (Ryan, 1984b, Schommer-Aikinsa and Easter, 2006; Mohamed and El-Habbal, 2013; Muis et al., 2011), moral reasoning (Bendixen et al., 1998), study strategies and motivational beliefs (Paulsen and Feldman, 1999; Schommer, Crouse, and Rhodes, 1992; Buehl and Alexander, 2005; Lin et al., 2013), and also reasoning about complicated issues (Kardash and Scholes, 1996; Schommer-Aikens and Hutter, 2002). What learners think about their learning affects the way they learn and their performances in many ways.

The level of students' epistemological beliefs has an effect on their learning, their performances in tests and in their strategies for test preparation. Schommer et al. (1992) carried out a study on undergraduates to measure the relationship between undergraduate epistemological beliefs, comprehension of statistical information as well as study strategies and learning. This study found a strong correlation showing that undergraduates with naïve beliefs in simple knowledge had poorer comprehension of statistical information. They also found a strong relationship showing that undergraduate epistemological beliefs in simple knowledge has both a direct and an indirect influence on test performances, with the indirect influences conveyed by test-preparation strategies.

With respect to defining relationships between epistemological beliefs and student motivation and self-regulated learning, Bråten et al., (2009) claim that students' epistemological beliefs may be essential for their academic motivation. For instance, students who believe in knowledge and effort integration are more positively motivated for academic tasks (Buehlet al., 2002). While for assessing the epistemological beliefs and university students' self-regulated learning, Phan

(2008) found that their epistemological beliefs have an influence on their approach to learning. Students with higher levels of belief in *ability to learn*, *structure of knowledge* and *stability of knowledge* are more likely to use goals, self-regulatory strategies and to be self-sufficient.

Epistemological beliefs have been tested also with the addition of two important elements in students' learning, academic success and conceptual knowledge. Conn et al. (2010) used epistemological beliefs' data to improve academic success. This data was gathered and studied so as to determine students' perceptions of knowledge and their levels of self-sufficiency and self-regulation. They found positive relationships between students' epistemological beliefs and their perceptions of knowledge and knowing, self-regulation and self-sufficiency. Regarding student comprehension, Sahin (2010) measured undergraduates' beliefs and conceptual knowledge using a problem-based learning environment. The outcomes indicated a positive correlation between the undergraduates' epistemological beliefs and their conceptual knowledge. This means that the more expert-like beliefs the undergraduates held, the higher their conceptual understanding scores at the end of the semester. In addition, Sahin (2010) concluded that the same instructional methods may have little or no impact on undergraduates' attitudes or beliefs even though such certain instructional techniques could improve undergraduate understanding of conceptual knowledge.

Another study applied topic-specific epistemic beliefs and several measures of the textual understanding of undergraduates to predict the strength of different dimensions of epistemological beliefs on their understanding of texts (Bråten et al, 2008). The outcomes showed a strong correlation between undergraduates' epistemology and comprehension of multiple texts, meaning that simplistic beliefs were a predictor of comprehension measures (Bråten et al, 2008). They also claimed that epistemological beliefs may be seen as an aspect of domain expertise; this relationship probably clarify why learners try to apply fewer heuristics than do experts when tackling multiple texts (Bråten et al, 2008).

Paulsen and Feldman (1999) conducted a study to look at the correlation between the epistemological beliefs' dimensions of Schommer's (1990) study, focusing on the undergraduates' epistemological beliefs and their motivation. As with Schommer (1992), the findings showed that the undergraduates' beliefs in simple knowledge was related to their motivation. This means that the more sophisticated beliefs in simple knowledge, the more students are motivated to learn.

It is obvious that epistemological beliefs have a significant relationship with learning. The connection between students' beliefs and their learning is described by Bromme et al. (2010). A series of studies to examine the influence of learning on undergraduates' epistemological beliefs confirm that their beliefs acted as a lens through which learners captured the task and thereby the knowledge which they assumed they had to acquire while working on these tasks (Bromme et al., 2010). Moreover, while undergraduates had the ability to understand the task through their epistemological lens, whether or not they decided to do so could be added to other factors. This study found that learners were able to select and use the lens of their epistemology, and could select whether to perform in a simple manner in specific situations and yet be more advanced in tasks due to external influences such as motivation for the task.

Learners' motivation, academic performances and successes, their self-regulated learning, comprehensive understanding, learning approaches and test-preparation strategies and more aspects related to their learning are connected to the thoughts and the beliefs they hold about what they learn (knowledge) and how they learn (knowing). The relationships found for the epistemological beliefs with all these aspects in learning raise interest in how people's beliefs can be shaped, affected and developed during their learning and growing stages. The characteristics of each individual as represented by gender, age, education and background can act as critical factors influencing their epistemological belief structure. The next section examines some of the factors relating to the interest and scope of this study.

2.2.6 The Epistemological Beliefs Models and Information Literacy

The main aim of this section is to confirm, from literature, whether Schommer (1990) and Hofer's (2000) models are still valid as questionnaires, in fact to decide whether the questionnaires themselves are clearly able to read information literacy as a module as a part of the discipline of information science.

As is known, Schommer developed a tool to measure general-domain beliefs in 1990, when the traditional learning environment was applied prior to the technology revolution of the internet. From 1990 until 2012, many who studied epistemological beliefs conducted their studies using Schommer's 1990 model. The majority of recent research were conducted in Asian countries (Indonesia, Taiwan, the Philippines, Singapore, Korea and China) confirming the validity of the SEQ in the Asian context (Hofer, 2010). In different contexts, many studies applied the SEQ (1990) for: studying the development of students' epistemological beliefs taking into account students' genders or academic level (Ismail et al., 2012); finding correlations between students behaviour and their beliefs (Terzi et al., 2012); looking at the differences in students' beliefs regarding their gender, academic level, field of study, academic success and their learning styles (Tumkaya, 2012); exploring the relationship between students' beliefs and their learning approach (Tanriverdi, 2012) and even more, to study the influence of students' beliefs in a knowledge forum environment using online course (Hong and Lin, 2010). The findings of the above studies proved that the SEQ questionnaire is still valid to measure learners' beliefs.

For the specific-domain beliefs, Hofer (2000) modified the SEQ developing a new questionnaire called DEFBQ in order to comply with different disciplines. Many studies using DFEBQ reflected the same factors for specific-domain beliefs which was developed by Hofer (Cazan, 2013), other studies found valid results when they measured students specific domain beliefs for science (Rizk, 2012), for statistic (Muis et al., 2011), for industrial technical fields (Zinn, 2012), for physics, and for chemistry and biology (Topcu, 2013). As evidence, both SEQ and DEFBQ questionnaires are still used in literature because they still provide valid findings for measuring epistemological beliefs of different participants.

As mentioned previously, information literacy is a new and important discipline which teaches the students how to deal with technology and information resources such as using computers, databases and the internet. In order to encourage the students to become involved in information literacy courses and raise their interest in it, educators need to know what students think about information literacy and look at their beliefs about learning information skills.

Educators should be aware of the role of the human aspect in the new learning environment since learners are the main users and they must bear in mind the need to understand learners' characteristics. (Biscontini, 2011) It is true that within the highest technology provided in schools nowadays, learners may become frustrated with technology; they might also feel insecure, stressed and discouraged (Preston et al., 2013; Hove and Corcoran, 2008). At the same time, new learning technology may have positive influences, for example, employing sound effects, music and narration in educational software could well: attract learners' attention; improve their performance; build their knowledge base which will eventually help them to achieve their learning goals (Bishop et al., 2008).

In this new learning environment, researchers need to be sure that the epistemological beliefs tools are able to read how students think about knowledge and learning and to measure the developments of the beliefs that caused by the changes in using technology and internet. It is true that SEQ 1990 as a measure tool covers a broad range of beliefs in individuals minds however there can be new additional dimensions of beliefs need to be considered and added to the instrument (Duell and Schommer-Aikins, 2001). In this regards, SEQ might not be accurate enough to be able to measure the epistemological beliefs of participants who have studied in the new learning environment.

Briefly, to study the interests of undergraduates toward information literacy it is necessary to look at the beliefs they hold towards gaining information skills. However, although information literacy is considered a new discipline using new technology, the tools used to measure epistemological beliefs were developed much earlier and might raise the question as to whether the existing tools of epistemological beliefs contain the new concepts as related to any anticipated impact of new internet technology on learners' beliefs.

2.3 Factors Affecting the Epistemological Beliefs

Epistemological beliefs are not stable solid beliefs systems; they can be formed, developed and changed throughout an individual's lifetime (Whitmire, 2004). Some of the factors that empower changes in individuals' beliefs relate to their personal characteristic, including: age, gender, GPA, cultural and social background, parents' education, major and academic level. The interest of this study is to find out more about the effects of gender, major and academic level on learners' beliefs. These three factors are discussed in more detail below.

2.3.1 Gender

The role of gender in the formation of epistemological beliefs is considered an important factor and has, therefore, been studied widely in the research (Hofer, 2000; Mason et al., 2006; Marzooghi et al., 2008; Ozkal et al., 2011; Özkan and Tekkaya, 2011; Ismail et al., 2012; Tümkaya, 2012; Kessels, 2013). The studies give different results showing the impact of gender on the epistemological beliefs of individuals. The influence of gender on epistemological beliefs can be classified as either significant or not significance in the differences found between male and female.

For examples, Schommer (1993) carried out a study which claimed that boys were more likely to believe in fixed ability and quick learning than girls. However, Chen and Pajares (2010) found that girls may have more of an innate view of ability than do boys. Similarly, Wood and Kardash (2002) also noted that there were significant differences in gender. They found that female undergraduates believe more in the dimensions of speed of knowledge acquisition and the characteristics of successful students whereas male undergraduates believed - more than females- in the dimension of *structure of knowledge* and knowledge construction and modification (Wood and Kardash, 2002). Unlike the above studies, Chen and Pajares (2010) claimed that other findings have shown no significant differences between the genders in terms of the formation of their epistemological beliefs. Hofer (2000) argued that overall it appears that there is no clear proof regarding the role of gender on epistemological beliefs. The following will show in more detail some of the literature and their findings covering the relationship between gender and epistemological beliefs.

Many claim that whenever gender is significant sophisticated beliefs will be held by females rather than males (Schommer and Dunnell, 1994; Paulsen and Wells, 1998; Hofer, 2000; Cano, 2005; Lodewyk, 2007; Marzooghi et al., 2008; Oguz, 2008; Cana and Arabacioglu, 2009; King and Magun-Jackson, 2009; Belet and Güven, 2011; Ozkal et al. 2011; Ismail et al., 2012; Terzi et al., 2012; Muis and Gierus, 2014). King and Magun-Jackson (2009) carried out a study on engineering undergraduates and graduates from two universities in Western Tennessee. The findings showed that females hold higher levels of belief in the dimensions of *fixed ability* and *speed of learning* than males. Two different studies conducted on undergraduates of colleges of education in Turkey and Malaysia found that there is a significant difference in males only in the dimension of the *ability to learn* (Belet and Güven, 2011; Ismail et al. 2012). Muis and Gierus, (2014) also found in their study that females hold more constructive beliefs (sophisticated) than males toward knowledge in physic.

On the other hand, few studies found significant differences in gender in one or more dimension of epistemological beliefs (Paulsen and Wells, 1998; Terzi et al., 2012). Males and females, in fact, both hold more sophisticated beliefs but in different dimensions. Paulsen and Wells's (1998) findings indicate that females hold more sophisticated beliefs than males in the dimensions of *fixed ability* and *speed of learning* whereas males hold higher level of beliefs only in the dimension of *structure of knowledge*. Similarly, another study carried out in Turkey testing the epistemological beliefs of undergraduates from different schools of education and engineering, the results confirmed that the epistemological beliefs of males have more sophisticated beliefs in dimension of *stability of knowledge* whereas females have more mature level of belief than males in the dimension of *ability to learn* (Terzi et al., 2012).

With regards to non-significant studies in gender, many studies have shown that there are no significant differences between the genders on epistemological beliefs at all (Chan, 2003; Schommer-Aikinsa and Easter, 2006; Erdem, 2007; Trautwein and Lüdtke, 2007; Tanriverdi, 2012; Tümkaya, 2012). Some studies have shown that gender has no significant impact on epistemological beliefs which means that males and females hold similar beliefs toward knowing and knowledge, gender is not considered a factor and has no influence on shaping an individual's epistemological beliefs. Schommer-Aikins and Easter (2006) used Kardash's epistemological beliefs scale (Kardash and Wood, 2000) to examine the epistemological beliefs of business school undergraduates from California State University. The findings showed no significant differences between males and females. Another research measured the level of epistemological beliefs for undergraduates attending a general chemistry course in Turkey these results indicated that there were no gender differences between males and females (Erdem 2007).

Furthermore, a study to measure the gender differences of the epistemological beliefs for the students from Hong Kong. The findings show that there are also no differences in gender (Chan, 2003). Tümkaya (2012) examined the epistemological beliefs of undergraduates from Turkey and the findings show that there are not any meaningful differences between males and females. Another study conducted on undergraduates in Germany, examining the epistemological beliefs of the undergraduates in *stability of knowledge* only. The findings suggested that there is no gender correlation between the epistemological beliefs of the undergraduates related to the dimension of *stability of knowledge*.

Gender was found to be an affecting factor in shaping the beliefs of learners in some studies and yet have no significant effects in others. The absence of gender effect in the results does not mean that there is no role of gender in epistemological beliefs. It may simply refer to the particular situation of the study at the time it was conducted; other factors may have influenced the impact of gender, for example the educational system where males and females receive the same learning opportunities which could influence their beliefs in a similar manner. To clarify this contradiction and to explore the role of gender in epistemological beliefs, more studies and investigations are needed with more identification and controlling of other factors which may affect the real impact of gender.

2.3.2 Major

The major refers to the different academic subject domains taught in schools and universities which differ in their concerns, instructions and contents (Alexander, 1992; Frederiksen, 1984; Spiro and Jehng, 1990). Learners' characteristics when studying the various majors may be different in accordance with the subject area they are studying. These differences based on the classification of the academic subject domains can be examined by studying the epistemological beliefs of the learners toward knowledge. Many studies found that the impact of learners' majors on their epistemological beliefs was a critical factor relating to how learners acquire their beliefs about knowledge and learning in their area of study.

Paulsen and Wells in their (1998) study measured the influences of undergraduates' majors on their epistemological beliefs. The findings confirm that the undergraduates studying applied fields (education and business) have lower levels of belief than undergraduates studying pure fields (social sciences and natural sciences) in the dimensions of *structure of knowledge, stability of knowledge* and *speed of learning*. Another study carried out by Jehng et al. (1993) found significant differences in majors among undergraduates. The results showed that undergraduates from soft fields (social science and arts/humanities) had more sophisticated beliefs about the dimensions of *certainty of knowledge*, *source of knowledge*, and *ability to learn* than undergraduates from hard fields (engineering and business). Trautwein and Lüdtke (2007) also studied undergraduates' majors focusing on *stability of knowledge* beliefs; their findings proved that undergraduates from social sciences held naïve level of belief in knowledge is certain than those who were studying medicine, business, engineering, math and sciences.

In addition, Erdem (2007) found that undergraduates in computer education, the instructional technologies department and the chemistry education department had more positive beliefs about knowledge than undergraduates studying in the chemistry education department. Another study claimed that undergraduates from English language teaching departments had more sophisticated beliefs about *structure of knowledge* and *ability to learn* than undergraduates from the science teaching departments. Terzi et al. (2012) demonstrated that undergraduates from colleges of education had more sophisticated beliefs in *ability to learn* than undergraduates from engineering and vocational schools.

Yet another study found that undergraduates from social sciences had less sophisticated beliefs in the *stability of knowledge* than undergraduates who were studying health and science-techniques (Tümkaya, 2012). Furthermore, Trautwein and Lüdtke's (2007) study rated the relationship of epistemological beliefs in the certainty of knowledge with college majors in Germany. The findings confirmed that social science undergraduates had more sophisticated beliefs in *stability of knowledge* than those who were studying business, engineering, and the math/natural sciences. A study was carried out regarding epistemological beliefs in Turkey to measure undergraduates who were studying the following programmes: social science education, elementary school education, Turkish language education and Pre-school education. The results showed that the beliefs of the undergraduates participated in the study were similar across the programmes they belong (Oğuz, 2008).

Chai et al. (2010) found undergraduates from hard sciences (mathematics, chemistry computer engineering and physics) majors hold less sophisticated beliefs than undergraduates from soft sciences majors (psychology, education and humanities). Meaning that the undergraduates in hard science majors believe more than undergraduates in soft science majors that knowledge is handed down by authorities' view as they are the source of knowledge and they believe knowledge is certain and unchanged.

The differences in the epistemological beliefs held by Chinese pre-service teachers in different major domains have been explored by Ren et al. (2009). Based on Biglan's (1973) classification for academic domains Ren et al. (2009) classified the majors of the participants into well-structured domains (mathematics, physics, chemistry, and computer sciences) and ill-structured domains (Chinese, political sciences, foreign languages, music, and arts). They then measured and compared their beliefs. The findings indicated that there was an impact by majors on participants' beliefs in three of the beliefs dimensions, which are Certain Knowledge, Omniscient Authority and Innate Ability. The beliefs of the participants from well-structured major domains were more about knowledge is absolute and certain, comes from authority and the ability to learn is innate rather than participants from the well-structured major domains.

As already shown, majors significantly influence the epistemological beliefs of learners. In the studies discussed above, learners from different majors showed variations in their levels of epistemological beliefs and how they could be developed and, additionally, how their beliefs could become more sophisticated in certain majors such as, the social sciences as compared with science majors. Knowing more about the impact of learners' majors by more research and investigation is an ongoing requirement for educators so that they can become more aware and ready to improve the learning process.

2.3.3 Academic Level

Academic level also play a vital role and are considered an important factor in shaping epistemological beliefs (Kuhn et al., 2000). The academic level means students moving from one level to a higher one either in the same school or when moving from school to university. This has attracted interest because, as students move from one level/year to another, it is argued that their beliefs may change, it has been noted that these beliefs become more complex as they move up academically (Jehng et al., 1993; King and Kitchener, 1994; Schommer, 1990; 1993a).

Jehng et al. (1993) carried out a study on 386 graduates and undergraduates from three different colleges in central Illinois. The results of the study indicated that the graduates have significant differences in their academic level in the three dimensions of *stability of knowledge*, *authority*, and *structure of knowledge*, meaning that graduates seem to hold more complex epistemological beliefs than undergraduates. While the undergraduates among themselves prove that the higher levels they reach as undergraduates, the higher level of beliefs they will hold. In other words, there is also a significant difference in academic levels in the same dimensions. Further research conducted in Turkey to examine undergraduates' academic levels resulted in confirmation that first-year undergraduates hold more sophisticated levels of beliefs in the dimension of *ability to learn* than second year undergraduates but they also hold less sophisticated beliefs in *stability of knowledge* (Eren, 2007).

Furthermore, Marzooghi et al. (2008) found in their study that fourth-year undergraduates hold more sophisticated beliefs than first-year undergraduates in the dimension of their *ability to learn* and in the *structure of knowledge*. Another study confirms that junior undergraduates hold simpler levels of belief than seniors in the dimensions of *stability of knowledge*, source of knowledge and *ability to learn* (Ren et. al., 2009). King and Magun-Jackson (2009) claimed that the junior undergraduates hold more naïve beliefs in the dimensions of *speed of learning* and *stability of knowledge* than seniors. Tanriverdi's (2012) research indicated that the there is a significant difference between first-year and third year undergraduates in the dimension of *ability to learn* where undergraduates believe that learning depends on effort as they move to higher academic levels. Chai et al. (2010) also found third year undergraduates hold more sophisticated beliefs than freshmen undergraduates believing that knowledge is derived from authorities' perception and learning is an innate ability by contrast, freshmen are more likely than third year students believe that learning happened through hard work.

Unlike the above studies, a Malaysian study conducted on undergraduates studying in a College of Education at the University of Malaya, discovered that there is a significant difference in the epistemological beliefs among the first, second, third and fourth-year undergraduates in the dimensions of the *speed of learning* and *ability to learn*. In other words, sophisticated levels of epistemological belief decrease as students move to a higher academic level (Ismail et al., 2012).

There are also a few studies which have noticed the absence of the role of the academic level on the epistemological beliefs of learners. For example, Paulsen and Wells (1998) conducted a study to measure the difference between undergraduates and graduates on their epistemological beliefs focusing on their academic levels. The findings indicated that there were no significant differences in the epistemological belief dimensions of both undergraduates and graduates because their beliefs did not change significantly as they moved to a higher educational level. Another study, also carried out in Turkey, attested to the fact that there is no significant effect of academic levels on the epistemological beliefs of undergraduates (Belet and Güven, 2011).

After looking at various studies about academic levels as described in this sub-section, it can clearly be seen that the majority of studies agree that academic levels can influence the epistemological beliefs of learners as they move from the lower to the higher academic levels and that, as students move from one level to another, their beliefs regarding knowledge and learning become more complex and sophisticated.

The impact of gender, major and academic level as characteristics of individuals on their epistemological beliefs has been shown. Gender has been found to be a critical factor that distinguishes learners' beliefs in some studies although other studies have found no impact of gender. Most of the studies looking at major found it to be an effective factor on learner's beliefs where learners from the arts, humanities and social sciences may hold different beliefs as compared with learners from majors of science, engineering and mathematics. Finally, academic levels of learners was found to cause them move to a higher level of beliefs as they gain more knowledge and experience over their years of study. More investigation is required to confirm the effects of these factors on the development of belief structures of learners whether by studying them separately or by finding the interaction between them. Additionally, the effects of these factors on learners' beliefs about other disciplines should also be studied further.

Finding out the impact of different factors on epistemological beliefs is also important to determine whether these beliefs are towards knowledge in general or towards the subject domain the learners are studying. It would be interesting to know about learners' beliefs measured if they were studying a particular subject domain, would they be the same if they were assessed while studying different disciplines. The argument about the nature of epistemological beliefs whether in general (general-domain) or across subject domains (specific-domain) will be discussed in the following section.

2.4 General-domain Versus Specific-domain for Epistemological Beliefs

The relationship between learning and epistemological beliefs leads to the line of argument as to whether the epistemological beliefs of learners are domain-general or domain-specific (Buehl and Alexander, 2006; Hofer, 2006; Muis et al., 2006). The concerns are related to whether the beliefs held by the learners are domain-independent, meaning are they held for the general knowledge and knowing including the different subject domains, or do they differ across the domains. This question requires more study focusing on developmental measurement tools that can assess the beliefs within the different subject domains. Schommer (1990) and Schommer and Walker (1995) claim that general knowledge has a direct influence on the epistemological beliefs of individuals. However, other studies argue that knowledge might also affect the behaviour of individuals when it is specific (Qian and Alvermann, 1995; Hofer, 2000). A compromise opinion between whether beliefs are general-domain or specific-domain limited, presents beliefs as general and specific-domain at the same level. It should be noted that most of the scholars investigating general and specific-domains of beliefs have applied dimensions of epistemological beliefs proposed by Schommer (1990) in their studies (Schommer and Walker, 1995; Hofer, 2000; Jacobson et al., 1997; Buehl et al., 2002).

On the side of the argument that considers epistemological beliefs are general-domain, it is believed that these beliefs and ways of thinking are more general and sophisticated than comes within domain boundaries (Schommer, 1994b).The followers of this claim started with Schommer and Walker (1995) arguing that general knowledge has a direct influence on epistemological beliefs of individuals and that they have similar epistemological beliefs across domains. Schommer and Walker (1995) carried out a study to investigate whether the epistemological beliefs of the undergraduates who read and answer texts from the social sciences have different beliefs than those in mathematics. The method they used was questionnaires; students were asked to keep a particular domain in mind. They predicted that epistemological beliefs of the undergraduates would be independently generalized across both domains. After comparing mathematical epistemological factors with those of the social science, they found that the text comprehension test for both domains were similar with a consistent level of epistemological sophistication across the two domains. They concluded that epistemological beliefs tend to be domain independent.

Similar findings were discovered by Jacobson et al. (1997). They researched the students' beliefs through four disciplines: physical sciences, liberal arts, business and social sciences. There were no significant differences in the domain specific beliefs across the four subject areas. From this point of view, some compromise opinions found beliefs likely to be general domain in a moderate way. Meaning that when individuals believe knowledge is simple and certain in one domain this will lead to the same belief in other domains, however, the level of beliefs in two different domains will not be the same. For example, believing on knowledge is certain found to be more towards mathematics than towards social science (Schommer-Aikins et al., 2001).

On the other side of the argument, there is a belief that characteristics of academic disciplines have different epistemologies. The interests about domain specificity is about the inquiry as to whether the individual's general beliefs about knowledge and knowing differ by domain. Researchers who support this claim believe that epistemological beliefs can be domain–specific because they differ through the disciplines and develop as domain-specific not as a domain-general (Hofer, 2006, 2000; Buehl and Alexander, 2006; Muis et al., 2006; Wheeler and Montgomery, 2009).

Some also believe that attempts to prove the generality of beliefs should be criticized and questioned. Furthermore, measuring the specific-domain beliefs within the general-domain beliefs is complicated and complex (Hofer, 2000; Muis et al., 2006). The method used by Schommer and Walker (1995) is imprecise because the tool they used was designed in the first place to assess general beliefs not to assess specific beliefs which raised concerns about the validity of the findings (Alexander and Murphy, 2001). Buehl and Alexander (2001) confirmed this, they stated that the similarity of beliefs across domains as found by Schommer and Walker (1995) refers to the lack of specificity in the instrument they used. Although the questionnaire they used SEQ is a well-known instrument it was designed to measure individuals' general-domain beliefs and was not meant to focus on items related to specific academic domain interests. This argument concludes that what is needed to examine the specific-domain epistemological beliefs is to develop a valid specific-domain instrument.

Based on the original interests of Schommer's multidimensionality framework, many attempts have been made by scholars to design an instrument that can assess individual beliefs in certain subject areas. Such an attempt was made by Buehl et al. (2002) and Hofer (2000). Buehl et al. (2002) developed a tool to measure the differences between students' beliefs regarding two disciplines that are mathematics and history. Their findings support their claim about domain specificity for academic epistemological beliefs. Students believe that more effort is required to learn mathematics than is required to learn history; they also believe that mathematics is more integrated into other areas of knowledge than history. With regards to Hofer (2000), she assumed that epistemological belief differs within domains such as science and psychology so she designed a tool to measure and compare between the beliefs of undergraduates who studied in the two disciplines. Hofer (2000) found that students have more complicated beliefs in psychology than in science where the beliefs were: knowledge in psychology is less certain than in science, in science the source of knowledge is held by authority and expertise, less use of personnel knowledge for justification in psychology than science and truth is attainable in psychology less than in science.

Disciplinary differences in learner' beliefs are found in other studies interested in measuring the epistemological beliefs of young learners. Students from fifth grade were tested for their views on learning mathematics and social studies (Stodolsky et al., 1991). The differences in students' beliefs found in the study are as follows: students believe that they do not have the ability to learn mathematics on their own although they think they can learn social studies because it does not need much knowledge requirements as does mathematics; students also believe teachers are the main source of knowledge when learning mathematics more than in social sciences; finally, self-instruction and text books are more likely to be used when studying social studies than when studying mathematics.

In addition to the argument of whether beliefs are general-domain or specific-domain, a third line point of view believes that the nature of epistemological beliefs can be in both general and specific-domains (Buehl and Alexander, 2005; Limon, 2006). That the nature of beliefs exists in general and specific-domains is presented as multidimensional and multilayered. Where multidimensional means that while beliefs are developed over time through education and experiences, beliefs move from being general to becoming more specific during development. Multilayered means that the level of beliefs is determined within the socio-cultural context (Muis et al., 2006). Identifying beliefs as general-domain or specific-domain relies on the level at which they are assessed. Students' beliefs about knowledge determine their beliefs about their specific-domains. Scholars have, at times, overstated the nature of beliefs by putting them into either the general form or the specific form only (Sternberg, 1989). The beliefs that learners hold are, sort of, both general-domain and specific-domain at the same time (Buehl et al., 2001).

In accordance with the above and based on the findings of measuring the beliefs of pre-service teachers in different majors, Ren et al. (2009) proposed in that epistemological beliefs held by learners are in both forms, domain-specific and domain-general. They are domain-general in the dimensions of *simple knowledge* and *quick learning*, but domain-specific in the dimensions of *certain knowledge*, *omniscient authority* and i*nnate ability*. This could explain how epistemological beliefs cannot be seen as either general beliefs or specific-domain beliefs but could be a combination of both working in parallel in a very complex manner to shape the construction of individuals' beliefs (Buehl et al., 2001; Sternberg, 1989).

After reviewing the arguments regarding the nature of people's beliefs, it could be said that epistemological beliefs may be in either the general-domain, the specific-domain or in both. The form of beliefs held by learners towards either general or specific knowledge can be related to different learning circumstances. For more understanding about beliefs and their relationship to learning, studying the epistemological beliefs from different academic domains will add more value and explanations as to how learners develop their forms of belief about knowledge and how to effectively apply the developmental of their beliefs to improving the learning process. This fact makes it clear that there is a need to carry out further investigations to find out more about epistemological beliefs across different academic disciplines as seen below.

2.4.1 Epistemological Belief across the Disciplines

As mentioned above, the area of study into epistemological beliefs across the disciplines is flourishing and is resulting in valuable recognition of the structure of the thoughts and beliefs individuals hold about knowledge and knowing in certain domains and how it is related to enhancing learning performances and learning as a whole (Bromme et al., 2010; Hofer, 2006; Muis et al., 2006; Schraw and Sinatra, 2004). The relationship between epistemological beliefs and the disciplines has been interpreted widely through many studies (Muis and Gierus, 2014; Lin et al., 2013; Franco et al., 2012). This section will focus on how other investigations were carried and what has been discovered through the considerable number of findings; studies have been selected from different disciplines and will be reviewed in the following sections.

Regarding students' beliefs about chemistry and its influences on students' learning behaviour, Pulmones (2010) assessed the epistemological beliefs of students studying chemistry focusing on the level of students' beliefs and their metacognitive behaviours. It was found that students' metacognitive behaviour is influences by their epistemological beliefs in positive ways when the beliefs are more sophisticated. Students with naïve beliefs adopted study strategies that called for right or wrong answers because they view knowledge as absolute truths. They depend on memorizing rather than understanding and they do not believe in the value of studying chemistry because of the computations and calculations. On the other hand, students with sophisticated beliefs who see knowledge as complex and evolving depend on themselves as a source of knowledge and seek for meaning; they are able to apply their knowledge and skills to other learning experiences.

In another study focus on the same discipline, chemistry, Geban and Çam (2010) examined students' attitudes and beliefs toward chemistry after applying case-based learning instructions instead of traditional instruction. As a result of using case-based learning instructions for six weeks, students from the eleventh grade showed improvements with positive effects in their attitudes toward studying their subject and their epistemological beliefs towards it also developed. The students showed more understanding of the construction of knowledge and started to make connections about concepts. They were also active in the learning process and involved in learning for themselves, finally, they participated in groups to search and share and exchange ideas and then discussed them with the class. In both studies the specific-domain of epistemological beliefs about chemistry played a critical role in teaching and learning chemistry effectively.

Biology and physics are two different domains of science where learners may have different beliefs about the nature of knowledge and knowing in these two domains. Tsai (2006) studied the differences between the students' specific beliefs, in order to assess their beliefs in knowledge the researcher found that their biology beliefs were more tentative than their knowledge of physics; they believed more in the stability of physics than biology, but they had similar beliefs about the creative nature of biology and physics as the knowledge in both domains is always open to free invention. To benefit from these findings in learning, Tasi (2006) suggested that teachers may help students to get more understating of physics if they were shown the tentative or changing nature of physics' knowledge and it could also help students to explore the uncertainty and the diversity of knowledge of biology by developing more open-ended inquiry activities.

Regarding mathematics, students' specific-domain beliefs influenced their intellectual and understanding. Interesting results were found by Op'tEynde et al. (2006) where the students tended to believe in mathematics as an active discipline useful for everyday life. They also considered mathematics to be a social activity; additionally, mathematics, they believed, represents a domain of excellence where students who are good at mathematics are recognized as more academic than the others. Op'tEynde et al. (2006) found that the nature and structure of domain-specific beliefs about mathematics are different as compared to the nature and structure of general epistemological beliefs as there is no way to link them.

Learners' beliefs regarding calculus courses may develop through education and experience. Liu (2009) conducted a study to examine whether there was any sign of change or development in epistemological beliefs about calculus over the course of a year. The majority of undergraduates did experience some development in their epistemological beliefs over this time, but the degree of this change varied from one undergraduate to another. Similarly, another study conducted by Wheeler and Montgomery (2009) investigated undergraduates' epistemological beliefs about mathematics' learning and their experiences in mathematics. The results showed that the undergraduates who held positive beliefs about their educators were linked to more positive beliefs about mathematics, including perceived ability.

Muis et al. (2011) has also conducted a study about the development of the students' specific beliefs who attended advanced course in statistics. The results for DFEBQ showed a positive relationship between their examination performance and their beliefs, in particular, in the dimensions of *justification of knowledge, attainability of truth* and *source of knowledge*

Beliefs about language learning and learning in general can be related in some constructs (Mori, 1999). Although the learners of the Japanese language in Mori's study (1999) showed their general knowledge beliefs and specific language learning beliefs as independent dimensions, relationships between the general and specific beliefs were found in both directions positively and negatively across three dimensions. The positive correlations found in the learners who believed general knowledge is simple were also found to believe that foreign language is not difficult to learn and learners who believed that educators were the main source of general knowledge believed also that the best source of learning foreign languages is from first language educators. For the negative correlation, learners who believed learning occurs quickly in general knowledge also believed less in learning foreign languages from mistakes but from effort and patience. A modest correlation was observed between learner's specific beliefs and their achievement in foreign language learning.

Learners' beliefs about dealing with information have appeared in a few studies in the literature. These studies include information seeking behaviour, online searching and information systems. Regarding learners' beliefs and information seeking behaviour, two studies (Whitmire, 2003; 2004) explored the relationship between undergraduates' beliefs and information-seeking behaviour in digital environments. By using the epistemological reflection model of Magolda (1992) (as discussed earlier) the findings proved the relationship between learners' beliefs and their behaviour while searching for information for their assignments. Undergraduates with more advanced epistemological beliefs were found to have better ability to evaluate information sources and recognize authority.

Online searching for information also has its influence on learners' beliefs. A study carried out by Mason et al. (2011) measured the epistemological beliefs of students doing online searching for information for a certain topic. They predicted that epistemic beliefs would be activated either because they were related to individual characteristics or because learning from the online searching would be affected by epistemological beliefs in action and the ability to identify fallacies in arguments. The results showed that the majority held beliefs about all dimensions; meaning that epistemological beliefs developed into more sophisticated beliefs and could be presented as follows: evaluation - the source of knowledge, high level of beliefs in justification of knowing, more sophisticated beliefs about complexity of knowledge and beliefs that knowledge in the searched topic area was evolving and changing rapidly. In short, this finding confirms that epistemological beliefs add to converting information accessed on the Web into knowledge (Kuiper et al., 2005).

Another study assessing the effects of attending courses in information systems on undergraduates' levels of beliefs was carried out by Tolhurst (2007). The epistemological beliefs of undergraduates who were studying for 12 weeks on an information systems course were measured twice, that is, pre-test and post-test. The results revealed that epistemological beliefs were developed during the course implementation and that undergraduates with more complex epistemological beliefs reached better findings in the course.

Those who studied the specific-domain epistemological beliefs in different disciplines showed that beliefs differ by discipline and also differ in the way they interact with learning. The effects of the development of the students' beliefs within disciplines provide positive effects on learners' attitudes, behaviours and achievements. The reviewed studies covered a wide range of academic disciplines including: chemistry, physics, biology, mathematics, languages, and information systems. However, it is critical to research other disciplines which need far more clarification about the specific beliefs of learners and to describe the relationship between their beliefs and other important aspects related to learning and teaching the discipline. Information literacy as a discipline is one of the disciplines which should be investigated to explore learners' beliefs about this area of study. In addition to the importance of the discipline in learners' lives, investigation into this area needs to be explored.

2.5 Contributions to the Literature

As shown in Chapter 2, there are a great many concerns which educators have about people's epistemological beliefs. These concerns have emerged from the magnitude of beliefs and thoughts held by people about their learning regarding various trends, for example learning performance, motivation to learn and learning strategies. For the sake of more understanding of these beliefs, educators have raised an argument as to whether the construction of people's beliefs about knowledge and knowing comes in the form of general knowledge where the beliefs are generalized across domains, for example, if individuals believe knowledge is certain they would believe the same about mathematics, science or history. However, their beliefs may vary according to the differences between the domain's nature and structure, for example knowledge is certain in mathematics but is changeable in psychology. As reviewed in the chapter above, the argument has three basic lines of consideration as to the nature of beliefs; these are 1) epistemological beliefs are general-domain (Schommer and Walker, 2) epistemological beliefs are specific-domain (Qian and Alvermann 1995; Hofer, 2000) and 3) epistemological beliefs are both general and specific-domain (Buehl et al., 2001; Sternberg, 1989).

The above debate has led to more interest in exploring people’s beliefs in particular subject domains. Educators have become more curious to know about learners’ beliefs in specific-domains and how their beliefs interact with their learning. Many have studied specific beliefs in different disciplines and found important aspects related to improvement of their learners’ abilities and the learning process. The interest was basically directed at the well-known disciplines, for example mathematics, sciences, history etcetera. These subjects have been covered in most studies and research. However, new disciplines, for examole, information literacy, have largely been absent from the literature. The few studies found have handled separate related aspects of information literacy (such as online searching) but have not reflected the nature and the content of the information literacy discipline. Even with the great importance of this discipline for learners’ academic lives and their lifelong learning, the discipline of information literacy has not appeared to receive a sensible amount of attention in respect of the epistemological beliefs studied. There is a need for more investigation into learners’ epistemological beliefs both in general and in specific areas regarding information literacy.

Therefore, this study will focus on individuals' epistemological beliefs as a general-domain and also specific-domains regarding information literacy and will identify relationships between them both. Focus will particularly be on the impact of the factors which may influence the shape and the development of beliefs. These factors are gender (male and female), academic level (first-year and fourth-year) and major (science and art). Furthermore, the impact of variables on previous knowledge on information literacy will be measured with the inclusion of interaction of the independent variables (gender, academic levels, major) on both the general and specific-domain beliefs. The results of this study can be used to improve the academic success for the learners by helping them to develop their interests in studying information skills.

2.6 Summary

This chapter has reviewed the relative literature and introduced information literacy as an academic discipline and the concept of epistemological beliefs as a critical type of individual difference in learning. The importance of learners' beliefs in the development of their knowledge and in improving their performances and motivation has been reviewed. The factors of individual characteristics, for example gender, major and academic level which may impact the learners' beliefs has also been explained in the literature. This chapter concludes by defining the gap shown in previous studies in relating learners' epistemological beliefs with their interests toward information literacy courses. The next chapter will give a full description of how this research will be conducted and what tools will be used to answer the research questions.

Chapter 3 METHODOLOGY

3.1 Chapter Overview

Having reviewed the related literature, stated the research questions and objectives for the study in Chapters 1, this chapter will discuss the research methodology used in the study to find answers to the research questions. The chapter includes descriptions of the research design, population and sample selections, instruments of the study and methods used to analyze data. The structure of this chapter is as follows: Section 3.1 identifies restatement of the problem; Section 3.2 justifies the appropriate research approach of the study; Section 3.3 presents the pilot study and its main outcomes; Sections 3.4 to 3.7 present the methods used within the research approach with descriptions of the samples, data collection instruments and procedures; Section 3.8 presents data analysis and the statistical techniques used; Section 3.9 focuses on strengths of the adopted research instruments; Section 3.10 discusses data analysis; Sections 3.11 and 3.12 give the research ethics and the proposed research hypotheses, respectively. Finally, Section 3.11 provides a summary of the chapter.

3.2 Restatement of Problem

This study aims to measure the epistemological beliefs of learners in two forms, that is the general-domain beliefs and the specific-domain beliefs. It also aims to define the relationships between each independent dimension of learners' beliefs and other variables (gender, major and academic level). For the domain-specific beliefs, the subject domain under the scope of the study is information literacy. Kuwait university undergraduates' previous knowledge of information literacy is a factor that will also be examined. A further interest is to explore to what extent the participants' beliefs in general knowledge is related to their beliefs towards information literacy and in what way gender, major, academic level and previous knowledge of information literacy affect shaping the learners' epistemological beliefs.

3.3 Research approach

The goal of conducting scientific research emanates from human curiosity and the need to understand the world by solving problems, answering a query or gaining new knowledge. The quality of the research lies in the results reached by well-defined methodologies. The methodology is a systematic approach that organizes research and provides the researcher with practical guidelines leading the way to accurate and reliable answers (Neale and Liebert, 1973). Research methodology is about using the right techniques when collecting and analysing data to test research hypotheses and to obtain the best answers to the research questions (Redmen and Mory, 2009). If the researcher fails to clarify the methodology correctly their research could result in meaningless results and unsolved problems.

There are two types of research; pure research and applied research. While pure research provides a better understanding of the advancement of knowledge with no requirement to apply the results in a practical way, applied research is conducted to solve a particular, practical problem or to find answers to everyday questions (Blanche et al., 2006). If the objective of the research is to investigate people the term *social research* is used (Neuman 2005). On the other hand, applied research provides valuable information for the area under investigation and can be used by any researchers in a similar field.

Answering applied research questions can be done by either a qualitative or quantitative approach, or by a combination of both. The qualitative approach has broad research questions and the form of data is given more as explanations and analysis of general trends. Whereas the quantitative approach is a systemic approach which depends mostly on numbers and applies statistical data analysis to obtain the required results (Neuman, 2005). The variables using the qualitative approach cannot be controlled or manipulated; however, using the quantitative approach the variables are well-defined before addressing the research hypothesis and applying statistical calculations (Grinnell, 1997). Although these approaches differ in certain areas they share similar features in others, for example, both approaches reach conclusions by reasoning and evidence, both apply comparisons and both avoid errors and misleading results.

Assessing people's thoughts and personal beliefs are central to psychological and educational research. As the field of investigation in this study is in both areas, several research methods and approaches could be used by the researcher (Myers and Avison, 2002). To reach the best answers, the research approach should be carefully selected following the requirements as determined by the research questions (Johnson and Onwuegbuzie, 2004).

The quantitative approach is one of three main paradigms related to research in education which also include the qualitative approach and the critical theory approach (Soltis, 1992). The quantitative approach provides explanations and predictions of events happening regularly as a base for human activities and the social world (Hussey and Hussey, 1997). This approach can also define the types of relationship between different components of events (Burrell and Morgan, 1979). For this reason, the quantitative approach is involved in testing hypotheses handled by theories capable of estimating the range of the phenomenon under the scope. In other words, this approach is appropriate for the phenomenon that regularly occurs and to examine any existence of relationships between the variables of the phenomenon by gathering the data and applying a large number of cases to represent the target population. It is also useful in formulating conclusions for the population based on the data to be taken from the sample.

The qualitative approach, on the other hand, was not justified for this study based on the differentiation between the research questions and objectives when attempting to answer and reach the focus of the approach. The qualitative approach is embedded in people's experiences and used for exploring in-depth and for understanding; it also goes into greater detail with a smaller number of samples (Bryman, 1988). The quality of data collected and how it is analyzed and compared and good representatives of the outcomes in this approach relies on how good the questions are developed (Das, 1983). Crossley and Vulliamy (1997) claim that the qualitative approach collect data usually by observations and interviews. In research related to assessing people beliefs, as is mentioned earlier in chapter two, this types of data collecting has been criticized for its time consuming method, its small number of samples and the need for well-trained raters to obtain good outcomes

The research strategy adopted for this study was to collect data; Yin (1994) proposed five categories, these are: survey, experimental; case study; archival analysis; and historical. The survey refers to the procedure of gathering data about the characteristics, performance and attitudes of a large number of participants, called population (Pinsonneault and Kramer, 1993). The nature of the research problem determines which research strategy is best applied, so, based on the discussion in chapter two related to assessing epistemological beliefs, the needs and benefits of using questionnaires in this type of investigation were clarified especially since it was found in the relevant literature to be the most widely used research methodology (Jehng et al., 1993; Schraw et al., 1995; Kuhn et al., 2000; Qian and Alvermann, 1995; Hofer and Pintrich, 1997; Hofer 2000). Therefore the survey questionnaire was chosen as a collecting data tool in this study. To answer the research questions of this study and to examine the research hypotheses, the overall nature of this study is a case study focusing only on Kuwaiti university undergraduates using a quantitative method research in its data collection and analysis.

3.4 Case Study Method

The case is most often used in research in social science, psychology, anthropology and ecology. A case study is an in-depth study of a particular situation rather than a sweeping statistical survey (Berg, 2001). Case study methods involve systematically collecting enough information about a particular person, social setting, event, or group to allow the scholar to effectively comprehend how it works or functions. Case studies may concentrate on an individual, a group, or an entire community and may utilize a number of data technologies such as life histories, documents, oral histories, in-depth interviews, and participant observation (Hagan, 1993; Yin, 1994).
Given the scope of the method, case studies can be rather pointed in their focus, or approach a broad view of life and society. For instance, a researcher may focus their investigation on a single aspect of an individual's life such as studying a medical student's actions and behaviour in medical school. Or, the researcher might try to assess the social life of an individual and their entire background, experiences, roles, and motivations that influence their behaviour in society. Extremely rich, detailed, and in-depth information characterize the type of information gathered in a case study (Berg, 2001). In contrast, the often extensive large-scale survey research data may seem somewhat superficial in nature (Champion, 1993).

Case studies of communities can be defined as a systematic gathering of enough information about a specific community to give the researcher understanding and awareness of the things that go on in that community; why and how these things occur; who among the community members take part in these activities and behaviours, and what social forces may bind together members of this community. As with other variations of case studies, community case studies may be very general in their focus, offering approximately equal weight to all the various aspects of community life. Or, community case studies may specifically concentrate on some particular aspect of the community, or even some phenomenon that occurs within that community (Berg, 2001). In this study, the case study method has been adopted in order to investigate the epistemological beliefs of Kuwaiti university undergraduates only.

3.5 Research Framework

This section provides the research framework which represents the plan adopted in conducting this study. The research framework guides the readers through the investigations steps and the procedures moving from one stage to another up to and including the research findings. This narrative is important to clarify the scientific research approach used by the researcher and to support the quality of the findings and conclusion stated.

The focus of this study is to assess learners' epistemological beliefs in order to describe them regarding the belief dimensions. The study will also define the relationships, if found, between the belief levels at each dimension and other learner characteristics, for example their gender, major, academic level and previous knowledge. The learners' beliefs about general knowledge and knowing, specific-domain beliefs about knowledge and knowing about information literacy and the effects of the factors gender, major, academic level and previous knowledge in information literacy are presented in the following framework.

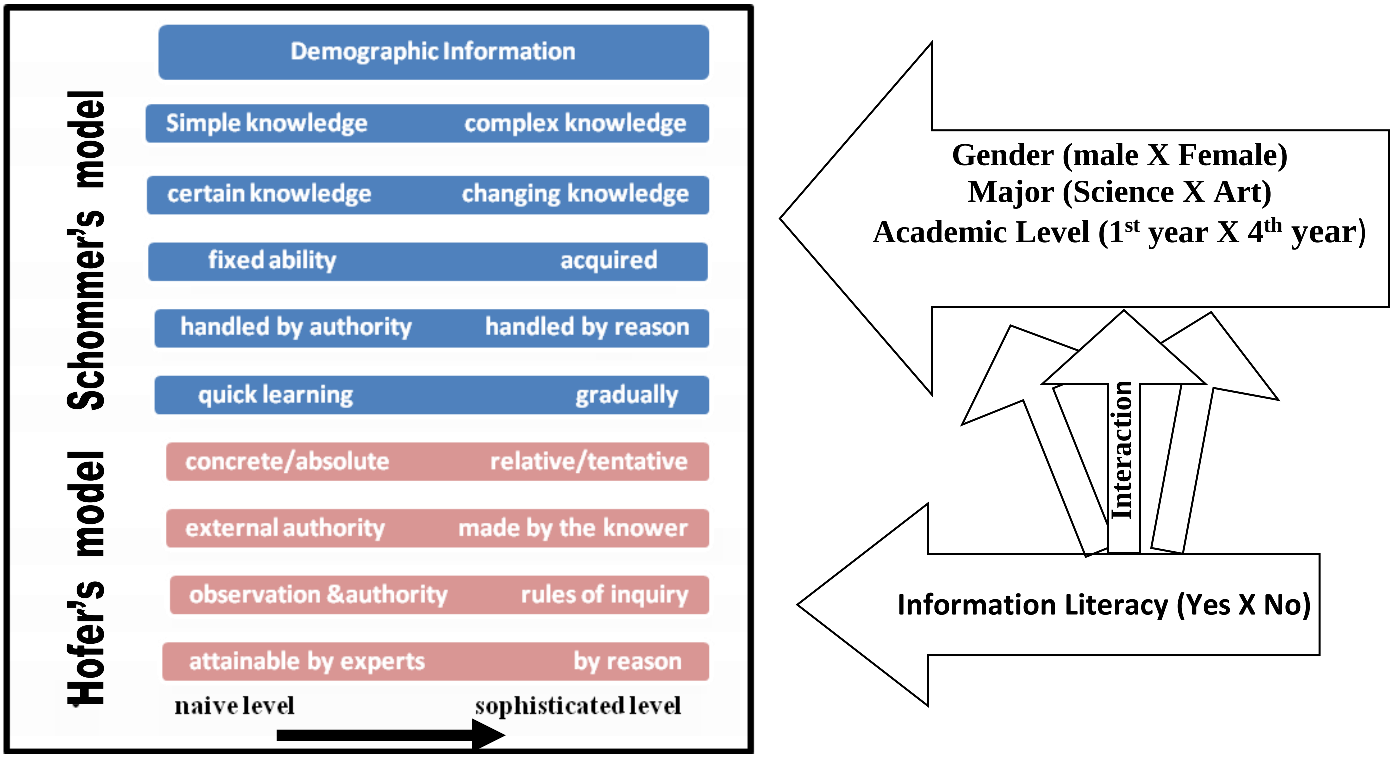

Figure 3 Study Framework

3.6 Pilot Study

The pilot study conducted before the main study and carried out for two weeks. A sample of twenty eight undergraduate students in their fourth year of study at the College of Education at Kuwait University was selected. The sample have been selected from two classes for the course called "235 computer in education" one for males and one for females. Fourteen students from the total sample had studied information literacy. The entire sample were informed about the main goal of the study and agreed to participate. Afterwards, the participants were provided with both questionnaires of the general and specific-domains of the epistemological beliefs in Arabic. At the end of the questionnaire the participants were asked to provide any notes, suggestions and difficulties about the questionnaires. At the end of the second week, the questionnaires were described and analyzed to clear, keep or modify procedures so as to make them more appropriate for the main study.

The pilot study revealed very positive and encouraging results and feedback which encouraged the researcher to amend some parts of the research instrument and carry on with this research methodology. The feedback showed some difficulties with the questionnaires that would not have been understood without the pilot session. These difficulties and some possible solutions are as follows:

1- After combining the two questionnaires (SEQ and DFEBQ), the participants faced difficulty with boredom in answering all questionnaires in one session. Therefore, it was recommended to take a 5 minute tea break in between. In addition, it was shown to be necessary to choose carefully the most suitable time for participants in order to ensure that they were free and relaxed.
2- The majority of participants did not speak English fluently therefore, the two questionnaires (SEQ and DFEBQ) were translated into Arabic. After distributing the questionnaires, many comments were received relating to the double meaning found in some questions. It seems that the translation needed more revising. The researcher then tested, amended and approved the translation of the questionnaires by taking feedback from five people whose English language skills are excellent.

After administering the questionnaires, invaluable comments were also received from the participants. They raised issues about the vague wording of some questions and the redundancy of others. To avoid this in the future, some words were simplified without changing the meaning of the questions. Additionally, some spelling mistakes were found and rectified in the final version of the questionnaires (see Appendix 1).

3.7 Population and Sample

The target population of the study was undergraduate students. Considering the difficulties of reaching all the undergraduates required, a sample of the population was selected to represent the population in the study. The total sample number was seven hundred and fifty undergraduate students studying for their Bachelor Degree in the College of Education at Kuwait University. The data was selected from the target academic level first-year students and fourth-year students, both male and female and from all majors. Further information about the process of adoption in selecting the sample of this study is discussed below.

Firstly, it should be noted that the educational system of Kuwait University separates males and females in classrooms; in other words, there are classes for males only and others for females only. In order to obtain a sample consisting of both males and females so as to conduct the questionnaire, both types of the classes were selected from each course. According to majors, the College of Education provides different fields of study preparing student-teachers for kg-12 for public schools in Kuwait. The fields of study included in this study are: Kindergarten (female only), Islamic studies and Arabic language (elementary), Islamic studies (middle and secondary), Arabic language (middle and secondary), English language, science including chemistry, physics, biology and geology (elementary, middle and secondary), mathematics (elementary, middle and secondary), social studies.

First-year students are not yet allowed to choose their field of study (major). They will be able to decide this in their second year in the college. Their acceptance in the college’s majors is related to their major in high school. High school in Kuwait forces students in the eleventh grade to choose between science or art studies. Students studying science majors at high school can chose from science, chemistry, physics, biology, geology or mathematics. Students from art majors at high school can choose from kindergarten, Arabic or English language, Islamic studies and social studies. For the purpose of this study, the major factor has been classified into two categories science and art. Science majors include science (all other related domains, for example chemistry, physics, biology and geology) and mathematics. Art majors include kindergarten, Islamic studies, Arabic and English language and social studies.

The reason behind the science/art classification is that education as an academic domain is considered an applied discipline classified by Biglan’s (1973) academic domains’ classification, while mathematics, science, chemistry, physics, biology and geology are classified as pure hard disciplines whereas psychology, languages, religions history and geography are classified as pure soft disciplines (Biglan,1973). The College of Education provides courses to prepare students for practical subjects reflecting the question of how to enable a teacher capable of teaching, for example teaching skills, by providing courses in teaching methods, curriculum, evaluation and classroom management. Whereas, preparing teachers for theoretical subjects, meaning how to familiarise them in their subject areas, is provided by other schools depending on their majors. Almost half of the total required credits for graduation (about 45 credits from a total of 126) are in this section of education. This means that students in mathematics and science (including chemistry, physics, biology and geology) will learn the concepts of their majors in colleges of science, students in Islamic studies will learn the concepts of their majors in Colleges of Sharia and Islamic studies, students from the Arabic and English language and social studies schools will learn the concepts of their majors in college of the arts and college of social studies. For the purposes of this study, pure hard majors are coded as *major science* and the pure soft majors are coded as *major art*.

The procedure adopted for selecting the courses was as follows: for first-year students, a compulsory non-credit course called “080 Introduction to college of education programmes” was required by all first-year students who were chosen to take part. The total number of classes was twenty one covering eight classes for male students and thirteen classes for female students.

For fourth-year students, the procedure adopted was to select courses allocated to students in their final year where they must have at least 90 credits as a requirement to register for the course. The total number of classes participating in the study is described below:

- One male class only from the courses called: “235 Computer in education”, “358 educational technology tools”, “370 teaching Islamic studies 2” , “421 Development of educational thought”.
- Two male classes from the courses called “372 Teaching English language 2”, “373 Teaching social studies 2” , “374 Teaching science 2”.

For the fourth-year female sample, the total number of classes is classified as follows:

- Seven female classes from the course called “235 Computer in education”
- Four female classes from the course called “358 educational technology tools”
- Two female classes from the course called “352 Educational communication tools”
- One female class only from the courses called: “370 Teaching Islamic studies 2”, “371 Teaching Arabic language 2”, 373 Teaching social studies 2”, “375 Teaching

Mathematics 2", "421 Development of educational thought", 440 Seminar kindergarten", "442 Seminar Arabic language", "446 Seminar English language (see Appendix 2).

Permission was needed for 20-30 minutes off lecture times to answer the questionnaire. All permissions and ethical approvals were given, consent forms signed and the aims of the research explained to the undergraduate students, volunteers were then asked for. The majority asked accepted and agreed to take part in the research. These students all shared the same cultural background and had received a similar education.

Table 1 below illustrates the total number of Kuwait University undergraduates studying at the College of Education who participated in the study. It also demonstrates the interaction between gender, academic levels, majors and Information literacy. The total number of participants was (750) participants, split into (259) male and (491) female students. They were classified according to academic level into first-year (342) and fourth-year (408), students with major science (385) and students with major art (365). For the purposes of this study, previous knowledge in information literacy was considered to be an independent variable in order to divide the participants into yet two further groups (Yes-IL group and No-IL group); this allowed comparison with group (yes) (those with previous knowledge in information literacy) with the (no) group (those with none). Therefore, the information literacy variable divided the participants into (189) yes-IL group and (561) no-IL group.

Table 1 Total Numbers of Kuwait University Participants

Variables	Classifications	No of Participants	Total
Gender	Male	259	750
	Female	491	
Academic Level	1st Year Undergraduate Students	342	750
	4th Year Undergraduate Students	408	
Major	Science	385	750
	Art	365	
Information literacy	Yes-group	341	750
	No-group	409	

3.8 Research Instruments

In order to gather data for this study the researcher distributed the required material among the participants which had to be answered at the same time. The material included three sections of information arranged as follows: 1) the demographic information; 2) an Arabic version of SEQ; 3) an Arabic version of Hofer's DFEBQ (see Appendix 3). The number of items to each section of the instrument is demonstrated in Table 2 below:

Table 2 Number of items per each section of the instrument

Sections	Numbers of questions	Source
Demographic background	6	Researcher
SEQ	63	(Schommer, 1990)
DFEBQ	18	(Hofer, 2000)

The demographic background included information about gender (male and female), academic level (first and fourth-year) and major (science and art majors). The study also included information about information literacy courses classifying the participants who had learned Information literacy from the ones who had not. Both questionnaires used a five point Likert-type scale where the participants' responses were: five for absolutely agree, four for agree, three for don't know, two for disagree and one for absolutely disagree. The participants were asked to take all the time needed to answer all the questions.

3.8.1 Demographic Information

The first part of the combined questionnaire was demographic information, which was designed to collect demographic data in order to fulfill the research objectives. Table 3 shows the five questions in part one:

Table 3 Questionnaire for Demographic Information

Demographic Information			
	Questions	**Responses**	
1	Gender	Male	Female

2	Academic level	1st -Year Undergraduate Level	3rd& 4th -Year Undergraduate Level
3	Major	Science	Art
4	IL	Yes	No
5	Institution	The College of Education – Kuwait University	

The purpose of this section is to collect simple personal and demographic data about the participants. The first question relates to the subject's gender so as to help the researcher to group participants according to their gender and to use that later in the between-group analysis to answer the research question about gender differences in their beliefs in general and their specific epistemological domain beliefs regarding Information literacy.

The academic level is an important variable in this study in order to measure the knowledge of the individual beliefs' of first-year and fourth-year students; the major variable is also essential because it is assumed that the participants who study science have different epistemological beliefs from the ones who have not.

3.8.2 Schommer's Epistemological Beliefs Questionnaire

In order to assess the general-domain beliefs, SEQ was adopted (see Appendix 4). As noted in chapter two, beginning in the 1990s Schommer (1990) designed a questionnaire as a self-report tool for measuring the epistemological beliefs of individuals (Buehl and Alexander, 2001). This epistemological beliefs' questionnaire is still widely used for the same purpose for relevant studies, and has been adopted in different cultural populations, translated into many languages and used with a wide range of ages (Buehl and Alexander, 2001; Sulimma, 2009).

The questionnaire consists of sixty three short statements. To make the instrument more accurate and to avoid response bias, the items of the questionnaire were written in both positive and negative forms and distributed evenly among the questionnaire. There were thirty five items written in a positive form from the naive level view; the other twenty eight items were written negatively to the naive level view (Schommer, 1990). After conducting factor analysis, the questionnaire was classified into twelve subsets of items categorizing epistemological beliefs into five factors for the general-domain beliefs (*structure of knowledge*, *stability of knowledge*, *ability to learn*, *source of knowledge* and *speed of learning*) with two or more subsets of items used as a variable to assess each dimension. The participants were asked for a response to each item. Their level of agreement was on the five-point Likert scale ranging from 1 strongly disagree to 5 strongly agree.

Table 4 shows the five dimensions of general-domain beliefs, the subsets in each dimension, an item as an example of each subset and the number of questions in each subset.

Table 4 Schommer's Questionnaire for General Epistemological Beliefs

Dimensions	Subsets	Item example	No of Questions
Structure of knowledge (19 Questions)	Seeking Single Answers	Things are simpler than most professors would have you believe	11 Questions Q1, Q10, Q15, Q25, Q26, Q28, Q29, Q34, Q55, Q57, Q58
	Avoid Integration	Being a good student generally involves memorizing facts	8 Questions Q6, Q8, Q27, Q35, Q37, Q39, Q53, Q62
Stability of knowledge (9 Questions)	Avoid Ambiguity	I don't like movies that do not have an ending	5 Questions Q17, Q31, Q42, Q44, Q63
	Knowledge is Certain	If scientists try hard enough, they can find the truth about almost everything	6 Questions Q3, Q7, Q11, Q13, Q48, Q60
Source of knowledge (10 Questions)	Don't Criticize Authority	People who challenge authority are overconfident	6 Questions Q5, Q18, Q22, Q24, Q45, Q46
	Depend on Authority	How much a person gets out of school mostly depends on the quality of the teacher.	4 Questions Q9, Q33, Q38, Q41
Ability to learn (13 Questions)	Can't Learn How to Learn	Self-help books are not much help.	5 Questions Q21, Q23, Q30, Q32, Q61
	Success is Unrelated to Hard Work.	The really smart students do not have to work hard to do well in school	4 Questions Q4,Q36,Q43,Q49
	Ability to Learn is Innate	The ability to learn is innate.	4 Questions Q2,Q47,Q54,Q56
Speed of learning (10 Questions)	Learning is Quick	Successful students understand things quickly.	5 Questions Q12,Q16,Q19,Q40,Q59
	Learn First Time	Going over a difficult textbook chapter, usually will not help you understand it.	3 Questions Q14,Q20,Q51
	Concentrated Effort is a Waste of Time	If a person tries too hard to understand a problem, he/she will most likely just end up being confused	2 Questions Q50, Q52

3.8.3 The Discipline-Focused Epistemological Belief Questionnaire

In order to measure the domain-specific beliefs in Information literacy, the Discipline-Focused Epistemological Belief Questionnaire (Hofer, 2000) was adopted using the same questions (see Appendix 4). As mentioned in chapter two, the Questionnaire was developed as a combination of items existing in Schommer Epistemological Questionnaire. However, extra items were also presented from the four proposed dimensions of epistemological theories by Hofer and Pintrich (1997). The purpose of Hofer's questionnaire was to indicate the differences in individual beliefs regarding the science and psychology disciplines but many studies adopted the same questionnaire to measure the specific-domain beliefs in other disciplines (Tolhurst, 2007; Kienhues et al., 2008). The factor analysis for the combined items organised the items under four factors representing Hofer's dimensions for specific-domain beliefs as follows: *Certainty/Simplicity knowledge; Source of knowledge; Justification of knowing; and Attainment of the truth.* To assess these four dimensions, the questionnaire consisted of eighteen items each item written in a form referring to the specific-domain of the study, an example of one item referring to the domain was *'In this field, knowledge is certain'* where the student's level of agreement was on a five-point Likert scale ranging from 1 strongly disagree to 5 strongly agree.

The specific-domain for this study was information literacy. As noted earlier, the concept of this field of information literacy may take different titles. Students may have courses in learning how to deal with information by searching, evaluating and using under different course title names. To be certain that students were aware of the field the questionnaire was asking about, a definition of information literacy was given at the top of the questionnaire.

Table 5 below, shows the four dimensions of the DFEBQ, one item is given as example of each dimension and the number of questions in each dimension.

Table 5 Hofer's questionnaire for specific epistemological beliefs

Dimensions	**Item example**	**No of Questions**
Certainty + Simplicity (8 Questions)	Truth is unchanging in this subject	8 Questions Q1, Q2, Q3, Q4,Q5,Q6,Q7,Q8

Justification/Personal (4 Questions)	Firsthand experience is the best way of knowing something in this field	4 Questions Q9,Q10,Q11,Q12
Source/Authority (4 Questions)	If my personal experience conflicts with ideas in the textbook, the textbook is probably right	4 Questions Q13, Q14, Q15,Q16
Attainment of Truth (2 Questions)	Experts in this field can ultimately get to the truth	2 Questions Q17, Q18

Both questionnaires, which are general-domain and specific-domain, of epistemological beliefs were designed mainly to produce quantitative data following a close-ended structure. The participants were given five different options, from which they were asked to choose any one option for a single question in the survey questionnaire. The questionnaire was distributed and collected under the supervision of the researcher who clarified the instructions and answered any questions put by the participants. As there were no right or wrong answers the participants were encouraged to give their opinions and not to leave any questions unanswered.

3.9 Strengths of the Adopted Research Instruments

Using the questionnaires is appropriate because of the objectives related to measuring learners' beliefs and trying to explore possible relationships between their beliefs and other factors in order to reach conclusions about the beliefs system of learners. Questionnaires are regarded as suitable in cases of exploratory and descriptive studies, they can find relationships which occurred either in the past, present or will take place in the future (Galliers, 1992). Thus it is the best type of research method to provide the greatest understanding of learners' beliefs and perceptions both quickly and accurately, therefore, they provide an organized and valid means of information collecting from the population (Zikmund, 2000).

Other benefits of using questionnaires are their low cost, they are less time consuming and give flexibility to learners to give the information needed by the researcher to allow knowledge of their learning backgrounds and environments (Marshall and Rossman, 1995). However, questionnaires do have disadvantages, for example they can be seen as artificial, relatively rigid, impersonal, incomplete and allow for superficial answers. However, it is the responsibility of the researcher to make sure that the questionnaire is the most suitable tool for the study. In fact, the researcher plays an important role in attempting to minimize the questionnaires disadvantages by convincing, encouraging and motivating the participants to be more serious and natural in answering them.

This study adopted the structure type of questionnaires due to the nature of the data needed for the mean study, that is, data regarding the relationships between general-domain and specific-domain epistemological beliefs of both male and female participants; these questions can be answered by using structured responses rather than selecting a semi-structured questionnaire this provides more flexibility to the respondents although outcomes from a large quantity of qualitative data that can be difficult to analyse and interpret.

Further steps were taken by the researcher before supplying the participants with the questionnaire; basically, a pilot study approach was adopted in the research methodology to support the strength of the instrument and discover in advance any weaknesses. The purpose of the pilot study was to imitate the real study conditions by selecting small samples of participants rather than starting with a large number. It is essential to test questionnaires before using them in genuine fieldwork and finding that they are somehow inadequate. Additionally, unexpected problems can be avoided and difficulties solved before actual participants experience problems due to the study procedures, instructions or the instrument itself. The role of the researcher is to consider the received feedback of the sample participants and modify the design of the study accordingly.

3.10 Data Analysis

Data analysis is an important part of research and should be defined carefully and clearly because, based on its findings, the study should end up with valid evidence which should not be misleading (Strauss and Corbin, 2008). This section presents the data analysis techniques used for the data collected through the questionnaires and clarification of how the results of the study were reached by the researcher.

In this study, statistical analysis was applied by using The Statistical Package for the Social Sciences software for Windows (SPSS version 19.0) since using SPSS for descriptive and inferential statistics can be done easily and quickly (Brace et al., 2006). The procedure started with preparing the data collected by entering them into the system, labeling the variables and coding the responses into a unified form. Following this data entry, the first step was to check the tendency and the dispersion to confirm the accuracy of the data and the data cleaning process to deal with missing values and input errors. One important action taken in dealing with the negative form of items was to detect them (28 items in Schommer’s questionnaire and 6 items in Hofer’s questionnaire) and re-code the responses to match the remaining items in their positive form representing the naive level. The next step was to adopt the descriptive statistics to provide an overall view of the data and the sample with a summary of the measures. The information provided in this step, for example the frequency distributions, the means, the variance and standard deviations, act as indicators for the researcher regarding the data of the study. The third step -after preparing the data and providing descriptive analysis - was the inferential statistical tests.

Choosing the appropriate technique for data analysis depends on the aim of the study and the nature of the data and research questions (Foster, 2001). The aim of the study, as noted earlier, was about assessing certain epistemological beliefs. The models adopted in this study (Schommer’s model 1990 and Hofer’s model 2000) measured the beliefs presented as multidimensional structures and, under each dimension, a number of subsets of items to represent the overall dimension of beliefs. The first stage of analysing beliefs items was to use the factor analysis technique. This technique leads to allocating the items related to each dimension to confirm the structure of the adopted models (Hatcher, 1994). At the same time, factor analysis was applied to evaluate the factor load of every item in the questionnaires, thus eliminating the factors with low factor loading <0.5 (Qian and Alvermann, 1995). This step reduces the number of items for more meaningful and representative subsets. For the best representative of factor analysis, the minimum responses required for each item in the instrument was five (Hatcher, 1994), meaning that for Schommer’s questionnaire, which consists of sixty three items - multiplied by five, the minimum number of responses for the sample size should not be less than three hundred and fifteen. The sample of this study was seven hundred and fifty participants meaning that it is more than adequate for the factor analysis test.

The importance of applying factor analysis in this study is to examine the items proposed by Schommer in 1990 and by Hofer in 2000. It provides us with a tool that is valid for measuring the beliefs of learners at the present time when internet and technology have been applied to learning and the environment is totally different from what it was in the nineties. If there are new dimensions to learners' beliefs created by the changes and the development of the new learning environment then factor analysis will show any new structures for the items/dimensions of the Schommer 1990 and/or Hofer 2000 models. In which case, the argument that the tools are no longer valid and the need for new epistemological beliefs tools will be critical.

In this study the factor analysis applies to the principal axes procedure and varimax rotation with an eigen value greater than 1.0 as a cutoff point for factors. In SEQ, the mean scores for the twelve subsets will be act as variables whereas the four dimensions in Hofer's DFEBQ will be the variables. For the reliability test, the adopted internal consistency for the questionnaire scale was determined by calculating Cronbach's alpha with significant level of Alpha value < 0.05.

Additional statistical analysis was required to test the research hypotheses related to whether there are significant differences between students' characteristics in their epistemological beliefs. Students' characteristics refer to their gender (male and female), major (science and art majors), academic level (first and fourth-year students) and their previous knowledge of information literacy (have studied and have not). The research hypotheses regarding group differences are: male and female may defer in their general and specific epistemological beliefs; first-year students may differ in their general and specific epistemological beliefs from student in the fourth-year; students from science majors may differ in their general and specific epistemological beliefs from student from art majors; finally students who had studied information literacy before may differ in their specific epistemological beliefs from students had not studied information literacy before. The analysis of variance MANOVA was adopted as the statistical test to determine group differences as it is considered to be an appropriate test for analysing two sets of scores, for example male and female in gender differences with accepted significant value of $p<.000$ (Foster, 2001; Brace et al., 2006).

The significant differences will be compared with the effect size value; this refers to the strength of association for the effect of different variables. The effect size value (Eta Squared η^2) can explain to what extent the differences in the dependent variables are related to the independent variable (Richardson, 2011). Eta Squared in ANOVA analysis is between 0 and 1 described as follows: η^2= 0-.1 a weak effect and will not be accepted in this study, η^2= .1-.3 a small effect, η^2= .3-.5 a moderate effect and η^2 =.5-1 a strong effect (Cohen, 1988).

To explore the significant effects of the variables, the analysis of variance ANOVA, the statistical technique, will be used to examine the relationships between the factors (gender, major, academic levels and previous experience in information literacy) and the beliefs' dimensions in both models, which are general beliefs and specific beliefs. For example, to examine the effect of gender on general epistemological beliefs, a 2 (gender) analysis of variance ANOVA for each subset in Schommer's epistemological beliefs' model as dependent variables. For the ANOVA tests the factor (gender, major, academic levels and previous experience in information literacy) are independent variables whereas the subsets of general epistemological beliefs and dimensions within specific beliefs are the dependent variables.

Finally significant effects caused by interaction between the factors (gender, major, academic levels and previous experience in information literacy) will be examined using the multivariate analysis of variance MANOVA. For example, to examine the changes in general beliefs regarding the three factors, (gender, major and academic levels), a 2 (gender) X 2 (previous knowledge) X 2 (academic level) multivariate analysis of variance (MANOVA) will use the twelve subset of Schommer's dimensions of epistemological beliefs as dependent variables.

3.11 Research Ethics

Any research involving human participants should have an ethical framework (Oates, 2006). Ethical approval was taken from the School of Information Systems, Computing and

Mathematics at Brunel University before conducting this study in the College of Education at Kuwait University (Appendix 5). To make sure that the ethical procedures were followed properly all participants were asked to provide written permission before taking part in the questionnaires. In other words, the participants in this research were provided with a consent form which provided the participants with all the necessary information about the research. The form assured them of the privacy, confidentiality and anonymity of their data. A brief summary of the mission and objectives of the study were explained to the participants after which the written permission forms were signed and collected from all participants.

3.12 Research Hypotheses

H_1: Undergraduates' general epistemological beliefs who study in Kuwait University may not be similar to their specific epistemological beliefs toward information literacy.

H_2: Undergraduates' general epistemological beliefs who study in Kuwait University may be influenced by other factors:

> H2a: Male and female Kuwait undergraduates may differ in their general epistemological beliefs.
>
> H_{2b}: first-year and fourth-year Kuwait undergraduates may differ in their general epistemological beliefs.
>
> H_{2c}: Science and art Kuwait undergraduates may differ in their general epistemological beliefs.
>
> H_{2d}: Kuwait undergraduates with and without previous knowledge and may differ in their general epistemological beliefs

H_3: Kuwait undergraduates' specific epistemological beliefs regarding information literacy may be influenced by other factors:

> H_{3a}: Male and female Kuwait undergraduates may differ in their specific epistemological beliefs.
>
> H_{3b}: Science and art Kuwait undergraduates may differ in their specific epistemological beliefs.
>
> H_{3c}: first-year and fourth-year Kuwait undergraduates may differ in their specific epistemological beliefs.

H_{3d}: undergraduates with and without previous knowledge and may differ in their specific-domain epistemological beliefs

H_4: The independent variables may interact with the general and specific epistemological beliefs.

H_{4a}: the independent variables (gender, academic level, major) may interact in the general and specific epistemological beliefs.

H_{4b}: information literacy may interact with the variables (gender, academic level, major) in the general and specific epistemological beliefs.

3.13 Summary

This chapter addressed the adopted case study research method, the research design and the data analysis techniques in order to test the research hypotheses and answer the research questions. The quantitative approach using questionnaires was selected for this study as the collecting data tool. The chapter also included a full description of how the data would be analyzed and what statistical techniques would be used. Additionally, further information about the pilot study, population, SEQ and DFEBQ were discussed in this chapter. The results found after data analysis will be discussed in the next two chapters.

Chapter four will explain sample and data collection, frequency analysis, and also present the findings and discussions for the data analysis regarding the general-domain and the specific-domain epistemological beliefs' profiles for Kuwait undergraduates including the factor analysis and the validity and reliability tests.

Chapter 4 DATA ANALYSIS AND DISCUSSION (1)

Introduction

Having shown the research methodology in chapter 3, including the research instruments, the participants and the collecting and analysis data strategies, the aim of chapters (4) and (5) is to answer the research questions by reporting descriptions of the statistical results and discussing the findings of the statistical analysis used in this study. The structure of chapter (4) is organized as follows: Section 4.1 shows the study sample and the data collection; Section 4.2 presents the distribution and frequency of the data; Section 4.3 provides discussion of data analysis regarding the general-domain and the specific-domain epistemological beliefs' profiles for Kuwait undergraduates; Section 4.4 demonstrates the data analysis of factor analysis and the validity and reliability test of research instruments; Section 4.5 discusses the factor analysis for the study data, validity and reliability tests for the adopted questionnaires; and Section 4.6 summarizes the findings and discussion of the previous sections.

4.1 Sample and Data Collection

As described in section 3.6, the target population of the study was undergraduate male and female students. The sample was selected from first and fourth-year students studying in the College of Education at Kuwait University. The total number of students who participated in the study was 750. There were 260 males and 490 females, 390 first-year and 360 fourth-year, 380 science major and 370 art major, 340 students with previous knowledge of information literacy and 410 students with none.

Table 6 below illustrates the total number of Kuwait University undergraduate students who participated in the study and demonstrates the interaction between gender, academic levels, majors, and Information literacy.

Table 6 Total numbers of Kuwait university participants

Variables	Classifications	No of Participants	Percentage	Total
Gender	Male	260	34.7%	750
	Female	490	65.3%	
Academic Level	1st Year Students	390	52.0%	750
	4th Year Students	360	48.0%	
Major	Science	380	50.7%	750
	Art	370	49.3%	
Information literacy	Yes-group	340	45.3%	750
	No-group	410	54.7%	

4.2 Frequency Analysis

Participants' responses to the questionnaire are shown in the Appendix 6. The variables of the questionnaire are represented as 12 subsets. The frequency distribution of the responses indicates the independency of the five general epistemological belief dimensions with variations of the results shown under each subset and the four specific-domain epistemological belief dimensions. The results support the predictions regarding the influences of the different factors on participants' responses. In order to answer the first research question of this study, that is, what are the general-domain and the specific-domain of learners' epistemological beliefs? The overall profile of participants' epistemological beliefs regarding a) their general epistemological beliefs and b) their specific-domain beliefs as regards information literacy, will be calculated and described by using the mean values for responses under each subset/dimension and will be shown in the next two subsections.

4.2.1 General-Domain Epistemological Beliefs of Participants

General epistemological beliefs are represented in five dimensions; under each dimension a number of subsets will explain these beliefs as related to the dimension being analysed. It should be noted that the subsets and items of beliefs are written in a simple belief form so that the responses absolutely agree and also agree with the scores 5 and 4 which refer to a simple level of beliefs. By analysing the data for each subset to indicate the overall view of participants' responses and to describe their general epistemological beliefs the mean values are calculated and represented (see Table 7). The overall description of the data for each dimension is stated below.

Table 7 mean values for the subsets of general beliefs

Dimensions	Subset Title	Mean
1.Structure of knowledge	Subset One: Seek single answers	2.8867
	Subset Two: Avoid integration	3.0720
2.Stability of knowledge	Subset Three: Avoid ambiguity	3.1811
	Subset Four: Knowledge is certain	3.1987
3.Source of knowledge	Subset Five: Don't criticize authority	3.3093
	Subset Six: Depend on authority	2.8600
4.Ability to learn	Subset Seven: Can't learn how to learn	3.0819
	Subset Eight: Success is unrelated to hard work	2.9680
	Subset Nine: Ability to learn is innate	3.0787
5.Speed of learning	Subset Ten: Learning is quick	3.1435
	Subset Eleven: Learn first time	2.8533
	Subset Twelve: Concentrated effort is a waste of time	3.1207

Dimension one - Structure of knowledge

The first dimension of epistemological beliefs is *structure of knowledge*. This dimension is about whether learners view knowledge as simple and absolute rather than as complex. The items describing this dimension of beliefs are divided into two subsets, that is “seek single answers” and “avoid integration”. The mean value of “seeking single answers” was 2.8867 which indicates that learners believe less in the concept of there being one single way to learn. Most of the responses were between the scores one and two pulling the value to the disagreement levels of believing on “seek single answers”.

The mean value of "avoid integration" was 3.0720 which shows a disagreement level where learners responded less to agree and absolutely agree for items under this subset. The overall view of the dimension of *structure of knowledge* indicates a low mean value for the two subsets which indicates a higher level of learners' belief in "knowledge is not simple".

Dimension two - stability of knowledge

The second dimension of the epistemological beliefs is *stability of knowledge*. This dimension is about whether the learners view knowledge as certain rather than tentative. The items describing this dimension of beliefs are divided into two subsets: "avoid ambiguity" and "knowledge is certain". The mean values of the first subset "avoid ambiguity" was 3.1811, the second "knowledge is certain" was 3.1987 which show similar levels of agreement in the certainty of knowledge. The participants responded a little more for the range agree and absolutely agree, for items belonging under these subsets. The overall view for the dimension of *stability of knowledge* is considered to have a naive level of beliefs among learners who tend to believe that knowledge is certain.

Dimension three - source of knowledge

Source of knowledge is the third dimension of epistemological beliefs, which is about whether learners depend on authority as the source of knowledge or on reasoning and evidence. Two subsets reflect the concept of this dimension, that is, "don't criticize authority" and "depend on authority". The mean value of the first subset "don't criticize authority" was 3.3093 which shows more agreement among learners towards accepting, without question, whatever experts say. While the mean value of responses to the second subset "depend on authority" was 2.8600 which shows a disagreement level in depending on authority as the source of knowledge. The overall view of the dimension of "source of knowledge" indicates differences in the two subsets "don't criticize authority" and "depend on authority", the reason for this difference can be explained by further analysis to test the factors which can be seen in the next sections.

Dimension four - ability to learn

Whether the *ability to learn* is innate from birth or can be acquired is the fourth dimension of epistemological beliefs. The three subsets presenting this dimension are: “can’t learn how to learn”, “success is unrelated to hard work” and “ability to learn is innate”. The mean value of the first subset “can't learn how to learn” was 3.0819 and the third subset “ability to learn is innate” was 3.0787, they are likely to have similar levels of a modest level of agreement for “learning is an innate ability”. Whereas the mean value of the second subset “success is unrelated to hard work” was 2.9680; this is considered as a level of agreement about the role of hard work and the self-ability to learn. The results of this dimension show that the majority of participants believe that learning abilities start at birth. The differences between the levels of agreement and disagreement across the three subsets need further analysis.

Dimension five - speed of learning

Finally the dimension *speed of learning*, that is, beliefs about learning happening at the first attempt to learn or not at all is the fifth dimension of epistemological beliefs. The three subsets representing this dimension are: “learning is quick”, “learn first time” and “concentrated effort is a waste of time”. The mean values of the subsets “learning is quick” and “concentrated effort is a waste of time” was 3.1435 and 3.1207 respectively and thus show a similar level of agreement in believing in quick learning. On the other hand, the mean value for the subset “learn first time” was 2.8533 tending to show less agreement about learning happening from the first time only. The results in this dimension show that the participants have more of a belief in quick learning.

4.2.2 Specific-Domain Epistemological Beliefs of the Participants

The specific-domain epistemological beliefs consist of four dimensions *certainty/simplicity of knowledge*; *justification of knowledge*; *source of knowledge*; and *attainment of truth*. The mean values for the four dimensions in this study are presented (see Table 8) below.

Table 8 mean values for the dimensions of specific-domain beliefs

Dimension	Mean
Dimension One: certainty/simplicity of knowledge	3.1032
Dimension Two: justification of knowledge	3.0033
Dimension Three: source of knowledge	2.9413
Dimension Four: Attainment of Truth	2.9207

The mean values shown in the previous table show that learners' beliefs regarding information literacy are close to each other ranging from *certainty/simplicity of knowledge* at 3.1032, *justification of knowledge* at 3.0033, *source of knowledge* at 2.9413 and *attainment of truth* at 2.9207. These values indicate that the overall specific beliefs regarding information literacy, for the participants in this study, scored at the middle range level of beliefs in all four dimensions, in other words, the participants believe that knowledge in information literacy is likely to be uncertain and complex, and is evaluated by personal experiences rather than expert knowledge, it is also less dependent on authority and, in fact, truth may be unattainable. To examine the dimensions with more focus on the differences of the level of learners' beliefs among the dimensions and to determine the factors affecting these differences further analysis techniques will be provided later in this chapter.

By reviewing the mean values of the dimensions of general and specific-domain beliefs scored by the participants in this study, it should be noted that there are different levels of belief across all the dimensions in both their general and specific forms with a slightly higher level for specific-domain epistemological beliefs than for general epistemological beliefs towards information literacy. To examine the scale and to provide more explanations for the data and the different belief levels further statistical analysis will be conducted and presented in the following sections.

4.3 Discussion of the Epistemological Belief Profiles for Kuwait Undergraduates

The first research question - *what are the general and specific-domains regarding Kuwait undergraduates' epistemological beliefs* - will be answered by describing the findings of the dimensions of the general knowledge and specific-domain beliefs about information literacy. The overall profile for beliefs held by the Kuwait undergraduates will be described using the twelve general belief subsets proposed by Schommer (1999) and the four specific-domain belief dimensions proposed by Hofer (2000). These have been verified as being able to explain the concept for the beliefs in each subset/dimension. More precisely, the general domain belief profile was retrieved by measuring the mean values for each subset under each dimension while the specific domain belief profile has been provided by using the mean values for each dimension. Examination of how the participants responded has shown that they do hold a developed level of beliefs towards both general knowledge and information literacy as described in the following two sections.

4.3.1 Undergraduates' Beliefs Profile Regarding General Knowledge

As already described in section 2.2.1, general epistemological beliefs are composed of *structure of knowledge*, *stability of knowledge*, *source of knowledge*, *ability to learn* and *speed of learning*. Studies conducted on undergraduates in different countries found that the learners join their colleges with a fairly sophisticated level of beliefs developed while studying at school for example from Germany (Sulimma, 2009), the South Pacific Region (Phan, 2008), Western Tennessee (King and Magun-Jackson, 2009) and Malaya (Ismail et al., 2012). Similarly, the overall findings of this study were also that the undergraduates hold similar sophisticated levels of general epistemological beliefs.

By looking at the range of the mean values of undergraduates' general beliefs focusing on each dimension independently, all subsets were found to be between 2.8 and 3.3 a result which is located a little higher or a little lower than the mid-point of the five-points of the measurement scale. This indicates that the undergraduates' beliefs have moderate differences between naive or sophisticated.

When each dimension was reviewed separately, the *structure of knowledge* showed that the undergraduates' beliefs indicated a moderate sophisticated level largely because they believe that knowledge is complex with interrelated concepts and there might be different answers or solutions to a single query. For the *certainty of knowledge*, the undergraduates' beliefs were found to be less sophisticated because they believe that knowledge is more often certain rather than tentative or tainted by doubts. With regards to *dimension of source of knowledge*, the findings confirm that the undergraduates believe in authority which is represented by, for example, experts, educators and parents who are not to be criticized; however, they do not depend on them as the only source of knowledge. The undergraduates hold almost equal beliefs showing that *ability to learn* is innate, that is, that people are born with their learning skills but they also believe that success might be reached by hard work. The undergraduates have less sophisticated beliefs about the *speed of learning* because they believe learning happens quickly, however, at the same time they hold more sophisticated beliefs since they think learning may occur after several trials.

To sum up, the overall beliefs about general knowledge and knowing found a fairly sophisticated level among the participants; this could be considered a little above the average across the five dimensions of general epistemological beliefs.

4.3.2 Undergraduates' Beliefs Profile Regarding Information Literacy

As already explained in section 2.2.2, specific-domain beliefs consist of *certainty/ simplicity of knowledge; justification of knowledge; source of knowledge;* and *attainment of truth.*

Many studies measuring specific-domain beliefs, within various disciplines, such as chemistry (Pulmones, 2010), biology (Tsai, 2006), mathematics (Op'tEynde et al., 2006), and language learning (Mori, 1999) found that the level of specific-domain belief is slightly affected by previous knowledge. The specific-domain beliefs of the learners studying chemistry, biology and mathematics were less developed than those of learners studying language. The result of this study regarding information literacy illustrates that the specific-domain beliefs in all four dimensions are either slightly lower (more sophisticated) or higher (less sophisticated) the mid-point of the scale.

The findings of each dimension of specific beliefs will be investigated for this study. With regard to *certainty/simplicity of knowledge*, the result clarifies that undergraduates' beliefs are more naive than sophisticated, in other words, knowledge in information literacy is certain and simple. The undergraduates believe that *justification of knowledge* is not naive and not sophisticated, meaning that it is equally evaluated by personal experiences and expert knowledge. The results demonstrate that undergraduates' beliefs regarding *source of knowledge* are less dependent on authority thus scoring the same level of sophisticated beliefs as held by the participants regarding the *dimension of attainment of truth* since the participants consider that the absolute truth in information literacy might be unattainable.

4.4 Data Analysis

This section includes the statistical data analysis used in the study to answer the research questions. The appropriate data analysis was used in order to check the consistency of the items and the strength of the instrument. Detailed findings are given in the next subsection where a factor analysis technique was adopted to test the coherence of the items under each subset or dimension in the general beliefs and specific-domain beliefs field to reduce any unnecessary items. After applying factor analysis the validity and reliability test was used to check the instrument of the study before investigating the relationships between the different factors under the focus of this study.

4.4.1 Factor Analysis

As described earlier, the subsets of the general beliefs and the dimensions of the specific-domain beliefs were treated as variables in the analysis process since they have been tested in previous studies and confirmed to be adequate representatives of the dimension of the learners' beliefs.

For the purpose of this study, the items under each subset/dimension were tested for their relativity and checked whether any unrelated items had to be extracted to give the instrument more strength and meaning in measuring participants' beliefs.

Firstly, to test whether the items were correct to conduct factor analysis, the Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity were measured. The value of KMO was located between 0 and 1, the higher the value of KMO the more the items have in common and are appropriate for conducting factor analyses. The KMO value close to one is a good indicator as to how to explain the correlation between pairs of variables by other variables. The minimum accepted value for KMO is 0.50, if it is < 0.50, factor analysis is not useful and will not do the task. (Kaiser, 1974) The Bartlett's test of sphericity examines correlations among the items, if they are located under the same factor looking for significance the Bartlett's test of sphericity should be < 0.05.

After checking that the value of KMO is > .50 and the significance of Bartlett's test of sphericity < 0.05, the data is ready to apply the factor analysis. For this study a sample size of 750 participants was considered a good enough sample to conduct the factor analysis; in fact, Hatcher (1994) recommended at least 5 respondents for each item in the instrument. The factor analysis was applied to each subset/dimension to check whether the items were relevant to each other and to delete those which were not. The principle component analysis with an orthogonal varimax rotation was adopted with the eigenvalue > 1. To show the factors yielded by the analysis the visual guide scree plot is provided. The items with factor loading < 0.60 will be extracted.

Factor analysis for general epistemological beliefs

The results of running the factor analysis for each item in the subsets of the general epistemological beliefs are provided (see Table 9).

Table 9 Factor loading for the items in each subset of the general beliefs

Subsets	Items										
	1	2	3	4	5	6	7	8	9	10	11
1. Seek single answers	.954a	.947a	950[a]	.938[a]	.944[a]	.949[a]	.951[a]	.948[a]	935[a]	.949[a]	.957[a]
2. Avoid integration	.948[a]	.951[a]	.951[a]	.955[a]	.954[a]	.959[a]	.963[a]	.963[a]			
3. Avoid ambiguity	904[a]	.900[a]	.912[a]	.869[a]	.881[a]						

4. Knowledge is certain	.844[a]	.801[a]	.801[a]	.809[a]	.502[a]	.500[a]
5. Don't criticize authority	.858[a]	.889[a]	.881[a]	.849[a]	.530[a]	.574[a]
6. Depend on authority	.756[a]	.790[a]	.076[a]	.798[a]		
7.Can't learn how to learn	.915[a]	.889[a]	.893[a]	.866[a]	.887[a]	
8. Success is unrelated to hard work	.773[a]	.789[a]	.777[a]	.790[a]		
9. Ability to learn is innate	.791[a]	.825[a]	.830[a]	.778[a]		
10. Learning is quick	.815[a]	.785[a]	.902[a]	.855[a]	.851[a]	
11. Learn first time 12.Concentrated effort is a waste of time	.806[a]	.828[a]	.828[a]	.846[a]	.868[a]	

☐ Remained items ☐ Extracted items

The findings of factor analysis for subset one "seek single answers" produced a KMO value of .947, the Bartlett's test of sphericity scored approximately Chi-Square = 3105.227 with 55 degrees of freedom which is significant at the .000 level. The factor analysis for eleven items under the first subset loaded more than 0.60 and yielded a one factor that explains 48.018% of the total items variation. No item extracted.

The findings of factor analysis for Subset two "avoid integration" produced a KMO value of 0.955, the Bartlett's test of sphericity scored approximately Chi-Square = 4356.370 with 28 degrees of freedom which is significant at the .000 level. The factor loading for the eight items under the second subset loaded more than 0.60 producing a one factor that explains 69.867% of the total item variation. No item extracted.

The findings of factor analysis for subset three "avoid ambiguity" produced a KMO value of .893, the Bartlett's test of sphericity scored approximately Chi-Square = 2893.598 with 10 degrees of freedom which is significant at the .000 level. The factor loading for the five items under the third subset loaded more than 0.60 producing a one factor that explains the 77.843% of the total items variation. No single item extracted.

The findings of factor analysis for subset four "knowledge is certain" produced a KMO value of .718, the Bartlett's test of sphericity scored approximate Chi-Square = 1699.542 with 15 degrees of freedom which is significant at the .000 level. The factor loading for four items under the fourth subset loaded more than 0.60 producing a one factor that explains 44.999% of the total items' variation. Two items, "nothing is certain but death and taxes" and "today's facts may be tomorrow's fiction," extracted because the factor loadings were <.06.

The findings of factor analysis for subset five "don't criticize authority" produced a KMO value of .822, the Bartlett's test of sphericity scored approximately Chi-Square =3182.551 with 15 degrees of freedom which is significant at the .000 level. The factor loading for four of six items under the fifth subset loaded more than 0.60 producing a one factor that explain 58.461% of total item variation. Two items, "often, even advice from experts should be questioned" and "I often wonder how much my teachers really know" extracted because the factor loadings were less than the accepted value 0.60.

The findings of factor analysis for subset six "depend on authority" produced a KMO value of .780, the Bartlett's test of sphericity scored approximately Chi-Square =2744.573 with 6 degrees of freedom which is significant at the .000 level. The factor loading for three of four items under the fifth subset loaded more than 0.60 producing a one factor that explains 70.216% of the total items variation. One item which it is "whenever I encounter a difficult problem in life, I consult my parents" is extracted because the factor loading is less than the accepted value 0.60.

The findings of factor analysis for subset seven "can't learn how to learn" produced a low KMO value of .888, the Bartlett's test of sphericity scored approximately Chi-Square = 3755.164 with 10 degrees of freedom which is significant at the .000 level. The factor loadings for the five items in this subset loaded more than 0.60 and remain to yield a one factor that explains 82.075% of the total item variation. All items under the subset remain since no item scored less than 0.60.

The findings of factor analysis for subset eight "success is unrelated to hard work" produced a KMO value of .782, the Bartlett's test of sphericity scored approximately Chi-Square =728.926 with 6 degrees of freedom which is significant at the .000 level. The factor loading for the four items of the eighth subset loaded more than 0.60 producing a one factor that explains 59.283% of the total item variation. No item in the eighth subset extracted.

The findings of factor analysis for subset nine "ability to learn is innate" produced a low KMO value of .804, the Bartlett's test of sphericity scored approximately Chi-Square = 1223.718 with 6 degrees of freedom which is significant at the .000 level. The factor loading for the four items under the ninth subset loaded more than 0.60 and remains to yield a one factor that explain only 68.347% of the total items variation. No item extracted.

The findings of factor analysis for subset ten "learning is quick" produced a KMO value of .834, the Bartlett's test of sphericity scored approximately Chi-Square = 2015.879 with 10 degrees of freedom which is significant at the .000 level. The factor loading for the five items loaded greater than 0.60 producing a one factor that explains 66.864% of the total item variation. No item in this subset extracted.

Since we cannot do factor analysis for two items, only the two items under subset twelve "concentrated effort is a waste of time" will be added to the items of subset eleven "learn first time". The findings of factor analysis for the combined subset produced a KMO value of .827, the Bartlett's test of sphericity scored approximately Chi-Square = 1231.864 with 10 degrees of freedom which is significant at the .000 level. The factor loading for the five items of this subset loaded more than 0.60 producing a one factor that explains 58.119% of the total item variation. No item in the eleventh and twelfth subset extracted. The tables of findings of factor analysis for all the subsets and the scree plot are provided in Appendix 7.

Summary of the findings of the factor analysis - there are five items loaded less than the accepted value of factor loading 0.6. Having a low factor loading value indicates that the item is not relative to the other items in the subset and its existence is unnecessary. To ensure using correlated items to have a strong instrument, the five items will be deleted from the upcoming analysis. Subsets eleven and twelve have been combined in one subset.

Factor analysis for specific-domain epistemological beliefs

Table 10 below shows the results of running the factor analysis for the items of each dimension of specific-domain epistemological beliefs.

Table 10 Factor loading for each item in the dimensions of the specific-domain beliefs

dimensions	factor	Items							
		1	2	3	4	5	6	7	8
1. certainty/simplicity of knowledge	1	.886[a]	.884[a]	.877[a]	.878[a]	.895[a]	.901[a]	.887[a]	.881[a]
2. justification of knowledge	1	.754[a]	.756[a]	794[a]	.819[a]				
3. source of knowledge and	1	.853[a]	.844[a]	.845[a]	.850[a]				
4. attainment of truth	2					.731[a]	.735[a]		

Remained items   Extracted items

The findings of factor analysis for dimension one *certainty/simplicity of knowledge* produced a KMO value of .886, the Bartlett's test of sphericity scored approximately Chi-Square = 1341.735 with 28 degrees of freedom which is significant at the .000 level. The factor analysis for the eight items under the first dimension loaded more than 0.60 producing a one factor which explains 42.594% of the total items variation. No item extracted.

The findings of factor analysis for dimension two *justification of knowledge* produced a KMO value of .776, the Bartlett's test of sphericity scored approximately Chi-Square = 767.242 with 6 degrees of freedom which is significant at the .000 level. The factor analysis for the four items representing the second dimension loaded more than 0.60 yielded into one factor explain 59.625% of the total item variation. All items remained.

Factor analysis cannot be run for two items only. The items of dimension three *source of knowledge* and dimension four *attainment of truth* will be combined to present one dimension to run the factor analysis and test how the items are related to reflect the concepts of both dimensions. The findings of factor analysis for the combined dimension produced a KMO value of .821, the Bartlett's test of sphericity scored approximately Chi-Square =1543.741with 15 degrees of freedom which is significant at the .000 level. Factor analysis for the items representing the dimension loaded more than 0.60 yielded into two factors; the first factor explains 52.372% of the total item variation and the second factor explains 18.380% of the total item variation. Once again the items of the fourth dimension *attainment of truth* were loaded under one factor. No item has a factor loading of less than 0.60 extracted from the new combined dimension.

As a result of factor analysis for general and specific-domain epistemological beliefs, factor loading for five items in the general beliefs scored less than 0.60 and were found to be not related and extracted from the scale whereas no items were extracted from the specific-domain beliefs dimensions. Because factor analyses can be run for three and more items, two subsets from the general beliefs "learn first time" and "concentrated effort is a waste of time" and two dimensions from the specific-domain dimensions *source of knowledge* and *attainment of truth* were combined. The two subsets of the general beliefs were loaded under one factor, the analysis will deal with the new combined subset "learn first time without concentrated efforts" while the two dimensions in the specific-domain beliefs were loaded under two factors so the analysis will deal with the two dimensions separately. The remained items are used in the following analysis starting with checking the validity and the reliability of the instruments.

4.4.2 The Validity and Reliability Test

The importance of testing the validity and reliability of the data collected in research is to support the findings of the research, to ensure that it is trustworthy and can be relied upon in related studies. The validity test refers to whether the research instrument actually measures what is intended to be measured. It tests the relationship between a scale and the measure of independent criterion variable to ensure that the instrument reflects the accurate construct it was built for. When the purpose of research is to measure a theoretically defined concept such as the multidimensional theory of epistemological beliefs, the construct validly denotes that the factor analysis test is to be used to ensure the instrument is measuring that theoretical construct. Reliability is about assessing the consistency and the repeatability of the instrument; it is related to the quality of the instrument which must have a degree of precision showing that the results will be the same if the instrument is used in similar conditions and showing that the finding can be generalized to other groups over time. The Internal Consistency Reliability Test is one of the tests used specifically to examine the consistency of results across items in the same study.

Cronbach's Alpha reliability analysis is the most popular test used to test how the set of items are closely related as a group and for internal consistency reliability. The higher the value of Alpha close to one the more the items are related and the instrument is reliable.

This study adopted Schommer's epistemological beliefs' questionnaire (1990) and Hofer's specific-domain epistemological beliefs' questionnaire (2000). Both instruments, as shown in the literature review, have been used widely in previous studies and their validity has been tested and approved. Both instruments have been conducted during different periods of time among different participants and categories and have produced accepted findings. For this reason, the validity of the research instrument used in this study is considered valid to measure both general and specific epistemological beliefs. For the reliability test, Cronbach's Alpha > 0.5 is considered an adequate value to accept the consistency of the data. The reliability statistics using Cronbach's Alpha test where Alpha > 0.50 was adopted for this study.

The results of running the reliability test for the data collected from the SEQ illustrates the statistically reliable epistemological beliefs subsets where the values of the mean, variance, standard deviation and Cronbach's Alpha are shown in Table 11 below. More detailed tables of the findings of the reliability test are listed in the Appendix 8.

Table 11 Reliability/Scale Statistics for general epistemological beliefs

subset	Mean	Variance	Std. Deviation	N of Items	Cronbach's Alpha
1.Seek single answers	31.78	109.711	10.474	11	.889
2. Avoid integration	24.58	98.234	9.911	8	.938
3. Avoid ambiguity	15.91	39.466	6.282	5	.929
4. Knowledge is certain	12.79	21.784	4.667	4	.839
5. Don't criticize authority	13.24	25.904	5.090	4	.944
6. Depend on authority	8.58	18.174	4.263	3	.966
7.Can't learn how to learn	15.41	43.572	6.601	5	.944
8.Success is unrelated to hard work	11.87	17.879	4.228	4	.771
9. Ability to learn is innate	12.31	20.835	4.565	4	.845
10: Learning is quick	15.72	28.211	5.311	5	.875
11: Learn first time 12: Concentrated effort is a waste of time	14.80	27.703	5.263	5	.818

The findings of the reliability test of the general epistemological beliefs listed in the previous table show that all the subsets scored Cronbach's Alpha value >0.5. The higher the Alpha value indicates that the items used are more reliable and reflect the beliefs' concepts that they are built to measure whereas a lower alpha value means that the items are less related as a group to measure the underlying construct of the subset. The highest Alpha value scored in the reliability test for the general beliefs subsets is for subset six "depend on authority" = .966 and the lowest

Alpha values scored for subset eight “success is unrelated to hard work” = .771, the other subsets Alpha values are: subset one “seek single answers”= .889, subset two “avoid integration”= .938, subset three “avoid ambiguity” = .929, subset four “Knowledge is certain”= .839, subset five “don’t criticize authority”= .944, subset seven "can't learn how to learn”= .944, subset nine “ability to learn is innate” = .845 and subset ten “learning is quick”= .875. Since the reliability test cannot be run for two items, the combined subset “learn first time” and “concentrated effort is a waste of time” scored Alpha value =.818.

For the specific-domain epistemological beliefs questionnaire, the next Table 12 presents the findings of the reliability test showing the values of the mean, variance, standard deviations and the Cronbach’s Alpha for each dimension. More detailed tables for the findings of the reliability test are listed in the Appendix 8.

Table 12 Reliability /Scale Statistics for specific-domain epistemological beliefs dimensions

subset	Mean	Variance	Std. Deviation	N of Items	Cronbach's Alpha
1. certainty/simplicity of knowledge	24.83	50.665	7.118	8	.807
2. justification of knowledge	12.01	17.276	4.156	4	.773
3. source of knowledge and 4. attainment of truth	17.60	34.353	5.861	6	.811

The findings presented in the table above show that the dimensions *certainty/simplicity of knowledge*, *justification of knowledge* and *source of knowledge* and *attainment of truth* scored Chronbach’s Alpha values .807, .773 and .811 respectively. The Alpha values are above the accepted > 0.50 indicating that the items in each dimension are related enough to reflect the construct of the beliefs. Again the reliability test cannot be run for two items for dimension four *attainment of truth* which has two items only combined with the items of dimension three *source of knowledge* in this test.

After applying the factor analysis and testing the reliability of the instrument used in this study it was found that after subset eleven and twelve were loaded under factor “learn first time without concentrated efforts”, eleven subsets with fifty eight items representing the general epistemological beliefs questionnaire and four dimensions with eighteen items representing the specific-domain epistemological beliefs questionnaire remained to be used in further analysis and to answer the research questions. Section (5.3) will show the findings of testing the relationships between the dependent variables which are subsets/dimensions of the general and specific-domain epistemological beliefs and the independent variables represented by the factors, gender, major and academic level.

4.5 Testing the Research Instruments

Both Schommer's epistemological beliefs' questionnaire (1990) and Hofer's specific-domain epistemological beliefs' questionnaire (2000) adopted in this study have been widely used and have provided acceptable findings in previous studies (Can and Arabacioĝlu, 2009; Belet and Guven, 2011; Ismail et al., 2012; Tümkaya, 2012); therefore no validity test was carried out in this study since they have already been tested and approved by other scholars (Bendixen et al.,1994; Paulsen and Wells, 1998). However, a reliability test was applied for the purpose of testing the internal consistency of findings across items in both the study instruments. After applying the reliability test, all data for both instruments are considered to be more reliable and consistent thus more accurately reflecting the developed epistemological beliefs of the participants.

A factor analysis test was carried out to examine each subset/dimensions in both instruments to see whether the items were relevant to each other or not. This was interpreted by measuring the factor loading of the item, meaning that the factor analysis undergoes two conditions, that is, if the item with factor loading is less than .6 it will be extracted and if the subset is less than two items of a subset it will be combined into a similar subset. Factor analysis was applied to both instruments and all items are within the accepted range of factor loading except for five items which were only extracted from the general epistemological beliefs questionnaire, as shown in Table 13.

Table 13 Factor Analysis for SEQ – extracted items

Dimensions	Subsets	Items	Factor loading > .6
Stability of knowledge	Knowledge is certain	"Nothing is certain but death and taxes"	.5
		Today's facts may be	.5

		tomorrow's fiction	
Source of Knowledge	Don't criticize authority	Even advice from experts should be questioned	.53
		I often wonder how much my teachers really know	.57
	Depend on authority	Whenever I encounter a difficult problem in life, I consult my parents	.07

Based on the nature of the participants who are from the same culture holding the same religious values and are from the same societal conditions, the items that have been excluded from the scale are not relevant to the other items and therefore have no meaning for this study. As clearly shown above, the items excluded from the scale they do not comply with the nature of the participants of this study. Death, respecting scholars and parents are aspects of life that are bound up with religious beliefs, in this case, those of Islam, that everyone must take into account in their thinking and behaviours. Taxes are not applied in Kuwait (no one pays taxes) and so for this reason any response to such a question would be meaningless for this area. The item "Today's facts may be tomorrow's fiction" seem ambiguous and unclear to the participants. Extracting these items from the scale is an indication that the participants responded carefully. Furthermore, examination of the items excluded shows that they do not comply with the nature of the participants of this particular study.

The following table (Table 14) shows that two subsets of the general epistemological beliefs have been combined since the factor analysis cannot be run for a subset with less than three items. The two subsets of the general beliefs were loaded under one factor. It is acceptable to have the items of the two subsets combined since they are related and reflect the same concept. It is logical to accept that when a person believes learning happens from the first attempt then there is no need for extra effort to be made.

Table 14 Factor Analysis for SEQ – combined subsets

Dimensions	Subsets	Combined Subsets	Items
Speed of Learning	Learn first time	Learn first time without concentrated effort	Q14. If I get time to reread a textbook chapter, I get a lot more out of it the second time.
			Q20.Going over a difficult textbook chapter usually will not help you understand it.
			Q51.You will get almost all the information you can learn from a textbook during the first reading.

	concentrated effort is waste of time		Q52. Usually you can figure out difficult concepts if you eliminate all outside distractions and really concentrate.
			Q50. If a person tries too hard to understand a problem, he or she will most likely just end up being confused.

It should be noted that the combined SEQ (63 items) and DFEBQ (18 items) questionnaires had 81 items in total which was believed to be too long and confusing for the participants to answer. In addition, many items were either repeated or very similar in the context while some items were unclear which confused the participants. There was also a belief that the SEQ questionnaire seems not able precisely to measure the epistemological beliefs of the Kuwait university undergraduates who were studying information literacy in particular, because the SEQ questionnaire was developed in 1990, that is, prior to the revolution of the internet and information technology. For this reason, it is argued here that information literacy should not be included in the questionnaires as a main factor.

4.6 Summary

This chapter was about finding an answer to the research question by analysing the data collected by using Schommer's (1990) epistemological beliefs questionnaire research instruments to measure the general beliefs and Hofer's (2000) discipline-focused epistemological beliefs to measure the specific-domain beliefs towards information literacy as a discipline. To have a general overview of the participants' epistemological beliefs towards general knowledge and information literacy as a discipline, the chapter started by describing the participants' responses to the questionnaires using the mean values for each subset/dimension for the epistemological beliefs. The overview of the beliefs was found by indicating the mean values and the frequencies' analysis for the research questions which helped to ensure the distribution of the responses and the existence of epistemological beliefs among the participants at different levels. Following this, the instruments of the research were tested using the factor analysis and reliability test for each subset of the general epistemological beliefs questionnaire and each dimension in the specific-domain epistemological beliefs questionnaire.

The finding has provided an answer to the research question; the findings are that by using SEQ and DFEBQ to measure epistemological beliefs the undergraduates were found to hold a moderate level of epistemological beliefs which were also found to be a little more sophisticated within the specific-domain beliefs than in the general-domain beliefs.

Chapter 5 : DATA ANALYSIS AND DISCUSSION (2)

Introduction

In the previous chapter, profiles for general and specific epistemological beliefs of Kuwait undergraduates' were presented and discussed. Factor analysis for data and validity and reliability tests were also described and discussed. In chapter 5, the focus will be on presenting and discussing relationships and interaction between the variables, that is, gender, major, academic level and previous knowledge of information literacy and the epistemological beliefs of Kuwait undergraduates.

This chapter includes the following sections: 5.1 analysis of relationships between variables and epistemological beliefs; 5.2 impact of the variables on the undergraduates' epistemological beliefs; 5.3 analysis of the variable interactions; 5.4 the impact of the interactions; 5.5 interaction between variables and information literacy; 5.6 discussion of the general and specific epistemological beliefs; 5.6 summary of the previous sections.

5.1 Analysis of Relationships between the Variables and Epistemological Beliefs

This section is about finding the relationship between factors related to participants' characteristics including gender, majors and academic level and their general and specific-domain epistemological beliefs. The analysis conducted for this study was to find answers to the research questions related to the relationship of the factors and participants' general and specific-domain beliefs which are:

- To what extent do the general-domain and the specific-domain regarding Kuwait university undergraduates' epistemological beliefs interact with their characteristics?
  a. Does gender impact the general or specific-domain beliefs?
  b. Do academic levels impact the general or specific-domain beliefs?

c. Does major impact the general or specific-domain beliefs?

d. Does previous knowledge in information literacy impact the general-domain and specific-domain beliefs?

In order to test a relationship between a dependent variable (subset/dimension) and independent variables with two groups (male/female, science/art and first/fourth-year), the analysis of variance (one-way ANOVA) was applied to find any significant interaction between the factors (two-way ANOVA and three-way AVOVA) were also applied. When running ANOVA analysis, general epistemological beliefs subsets and specific-domain epistemological belief dimensions were treated as variables after eliminating the unnecessary items. This means (for this analysis) that the factors gender, majors and academic levels are the independent variables whereas belief subsets/dimensions are the dependent variables looking for significant p value < 0.05 and effect size partial eta squared η2 > 0.01. The results of conducting ANOVA analysis are described in the next section.

5.1.1 Analysis of Relationship between Gender and Epistemological Beliefs

To answer the research question - *does gender impact general-domain and/or specific-domain beliefs?*- this section will test the relationship between males and females as independent variables and the general and specific-domain epistemological beliefs as dependent variables by applying ANOVA analysis looking for significant differences. The findings of the analysis for gender are shown below.

Table 15 Tests of Between-Subjects Effects for gender across general beliefs subsets

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[l]
gender	1.Seek single answers	8.695	1	8.695	9.683	.002	.013	9.683	.874
	Error	671.664	748	.898					
	2. Avoid integration	.303	1	.303	.197	.657	.000	.197	.073
	Error	1149.341	748	1.537					
	3. Avoid ambiguity	.373	1	.373	.236	.627	.000	.236	.077
	Error	1182.038	748	1.580					
	4. Knowledge is certain	.001	1	.001	.001	.974	.000	.001	.050
	Error	1019.772	748	1.363					
	5. Don’t criticize authority	3.137	1	3.137	1.940	.164	.003	1.940	.285

	Error	1209.473	748	1.617					
	6. Depend on authority	.424	1	.424	.210	.647	.000	.210	.074
	Error	1512.098	748	2.022					
	7.Can't learn how to learn	.381	1	.381	.219	.640	.000	.219	.075
	Error	1305.032	748	1.745					
	8.Success is unrelated to hard work	12.480	1	12.480	11.322	.001	.015	11.322	.919
	Error	824.502	748	1.102					
	9. Ability to learn is innate	12.423	1	12.423	9.650	.002	.013	9.650	.873
	Error	962.935	748	1.287					
	10: Learning is quick	.853	1	.853	.756	.385	.001	.756	.140
	Error	844.350	748	1.129					
	11: learn first time without concentrated efforts	.079	1	.079	.071	.790	.000	.071	.058
	Error	829.487	747	1.110					

Testing the first factor which is gender, one way ANOVA (see Table 15) and the descriptive statistics (see Table 16) show that the difference in participants' beliefs about "seek single answers" between males (*N* = 263, *M* = 3.0332, *SD* = .97413) and females (*N* = 487, *M* = 2.8075, *SD* = .93298) are statistically significant, F (1, 748) = 9.683, *p* = .002, η^2= .013. The difference in participants' beliefs about "success is unrelated to hard work" between males (*N* = 263, *M* = 3.1435, *SD* = 1.00432) and females (*N* = 487, *M* = 2.8732, *SD* = 1.07366) are statistically significant, F (1, 748) = 11.322, *p* = .001, η^2= .015. The difference in participants' beliefs about "ability to learn is innate" between males (*N* = 263, *M* = 3.2538, *SD* = 1.18715) and females (*N* = 487, *M* = 2.9841, *SD* = 1.10525) are statistically significant, F (1, 748) = 9.650, *p* = .002, η^2= .013. The other subsets for general beliefs were found to be non-significant p >.05. By looking to the mean values above it can be seen that in the three significant subsets the mean values for males (*M* = 3.0332, 3.1435 and 3.2538) are higher than the mean values for females (*M* = 2.8075, 2.8732 and 2.9841).

Table 16 Descriptive Statistics for gender and general beliefs

Dependent Variable	Gender	Mean	Std. Deviation	N
1.Seek single answers	Male	3.0332	.97413	263
	Female	2.8075	.93298	487
	Total	2.8867	.95308	750
2. Avoid integration	Male	3.0993	1.27197	263
	Female	3.0572	1.22176	487
	Total	3.0720	1.23891	750
3. Avoid ambiguity	Male	3.2114	1.23833	263
	Female	3.1647	1.26708	487
	Total	3.1811	1.25644	750
4. Knowledge is certain	Male	3.1968	1.18415	263
	Female	3.1997	1.15861	487

	Total	3.1987	1.16684	750
5. Don't criticize authority	Male	3.3973	1.13115	263
	Female	3.2618	1.34121	487
	Total	3.3093	1.27239	750
6. Depend on authority	Male	2.8276	1.37339	263
	Female	2.8775	1.44723	487
	Total	2.8600	1.42105	750
7.Can't learn how to learn	Male	3.1125	1.37162	263
	Female	3.0653	1.29269	487
	Total	3.0819	1.32018	750
8. Success is unrelated to hard work	Male	3.1435	1.00432	263
	Female	2.8732	1.07366	487
	Total	2.9680	1.05710	750
9. Ability to learn is innate	Male	3.2538	1.18715	263
	Female	2.9841	1.10525	487
	Total	3.0787	1.14115	750
10. Learning is quick	Male	3.1894	1.10289	263
	Female	3.1187	1.04000	487
	Total	3.1435	1.06228	750
11. Learn first time without concentrated effort	Male	2.9734	1.12666	263
	Female	2.9532	1.01159	487
	Total	2.9603	1.05267	750

To find the relationship between gender and specific-domain epistemological beliefs regarding information literacy, the ANOVA test was applied having the independent variable gender (male and female) and the dependent variables for the four dimensions of the beliefs.

Table 17 Tests of Between-Subjects Effects for gender for specific-domain beliefs

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[d]
gender	1. Certainty/simplicity of knowledge	.057	1	.057	.072	.789	.000	.072	.058
	Error	592.882	748	.793					
	2. Justification of knowledge	.011	1	.011	.010	.920	.000	.010	.051
	Error	808.731	748	1.081					
	3. Source of knowledge	.521	1	.521	.437	.509	.001	.437	.101
	Error	891.773	748	1.192					
	4. Attainment of truth	.756	1	.756	.513	.474	.001	.756	1
	Error	1102.273	748	1.474					

The results of ANOVA analysis (see Table 17) and the descriptive statistics (see Table 18) revealed that the difference in participants' beliefs about *certainty/simplicity of knowledge* between males (N = 263, M = 3.1150, SD = .90302) and females (N = 487, M = 3.0968, SD = .88336) are statistically not significant, F (1, 748) = .072, p = .789, η^2= .000. The difference in participants' beliefs about *justification of knowledge* between males (*N* = 263, *M* = 3.0086, *SD* = 1.10264) and females (*N* = 487, *M* = 3.0005, *SD* = 1.00430) are statistically not significant, F (1, 748) = .010, *p* = .920, η^2= .000. The difference in participants' beliefs about *source of knowledge* between males (*N* = 263, *M* = 2.9772, *SD* = 1.12376) and females (*N* = 487, *M* = 2.9220, *SD* = 1.07431) are statistically not significant, F (1, 748) = .437, *p* = .509, η^2= .001. The difference in participants' beliefs about *attainment of truth* between males (*N* = 263, *M* = 2.9772, *SD* = 1.12376) and females (*N* = 487, *M* = 2.9220, *SD* = 1.07431) are statistically not significant, F (1, 748) = .513, *p* = .474, η^2= .001.

Table 18 Descriptive Statistics for gender and specific-domain beliefs

Dependent Variable	Gender	Mean	Std. Deviation	N
1. Certainty/simplicity of knowledge	Male	3.1150	.90302	263
	Female	3.0968	.88336	487
	Total	3.1032	.88974	750
2. Justification of knowledge	Male	3.0086	1.10264	263
	Female	3.0005	1.00430	487
	Total	3.0033	1.03912	750
3. Source of knowledge	Male	2.9772	1.12376	263
	Female	2.9220	1.07431	487
	Total	2.9413	1.09147	750
4. Attainment of truth	Male	2.9639	1.26522	263
	Female	2.8973	1.18536	487
	Total	2.9207	1.21354	750

As shown in the results above, there is a modest significant difference for gender on students' general beliefs as appeared in three subsets only where females scored lower mean values than males although there is no significant difference between males and females in the specific-domain epistemological beliefs toward information literacy.

5.1.2 Analysis of Relationships between Major and Epistemological Beliefs

In order to answer the research question - *do majors impact on the general and/or specific-domain beliefs?* - the differences in the beliefs between participants from science major and art majors will be analysed in this section. The independent variable is major and the dependent variables are the subsets of the general beliefs and the dimensions of specific-domain beliefs which will be tested using ANOVA analysis.

Table 19 Tests of Between-Subjects Effects for major across general beliefs subsets

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[l]
Major	1.Seek single answers	46.564	1	46.564	54.955	.000	.068	54.955	1.000
	Error	633.794	748	.847					
	2. Avoid integration	77.153	1	77.153	53.810	.000	.067	53.810	1.000
	Error	1072.490	748	1.434					
	3. Avoid ambiguity	118.100	1	118.100	83.001	.000	.100	83.001	1.000
	Error	1064.311	748	1.423					
	4. Knowledge is certain	75.865	1	75.865	60.119	.000	.074	60.119	1.000
	Error	943.909	748	1.262					
	5. Don't criticize authority	115.588	1	115.588	78.813	.000	.095	78.813	1.000
	Error	1097.022	748	1.467					
	6. Depend on authority	273.741	1	273.741	165.290	.000	.181	165.290	1.000
	Error	1238.781	748	1.656					
	7.Can't learn how to learn	.385	1	.385	.220	.639	.000	.220	.076
	Error	1305.029	748	1.745					
	8.Success is unrelated to hard work	16.083	1	16.083	14.655	.000	.019	14.655	.969
	Error	820.899	748	1.097					
	9. Ability to learn is innate	1.897	1	1.897	1.457	.228	.002	1.457	.226
	Error	973.462	748	1.301					
	10: Learning is quick	11.426	1	11.426	10.251	.001	.014	10.251	.892
	Error	833.777	748	1.115					
	11: Learn first time without concentrated efforts	.300	1	.300	.270	.603	.000	.270	.081
	Error	829.676	748	1.109					

For the second factor, that is, major, the results of ANOVA analysis (see Table 19) and the descriptive statistics (see Table 20) show that the difference in participants' beliefs regarding "seek single answers" between science majors (*N* = 380, *M* = 3.1325, *SD* = .89811) and art majors (*N* = 370, *M* = 2.6342, *SD* = .94294) are statistically significant, F (1, 748) = 54.955, *p* = .000, η^2=.068. The difference in participants' beliefs regarding "avoid integration" between science majors (*N* = 380, *M* = 3.3885, *SD* = 1.15497) and art majors (*N* = 370, *M* = 2.7470, *SD* = 1.23950) are statistically significant, F (1, 748) = 53.810, *p* = .000, η^2= .067. The difference in participants' beliefs regarding "avoid ambiguity" between science majors (*N* = 380, *M* = 3.5726, *SD* = 1.09259) and art majors (*N* = 370, *M* = 2.7789, *SD* = 1.28771) are statistically significant, F (1, 748) = 83.001, *p* = .000, η^2= .100.

Table 20 Descriptive Statistics for major and general beliefs

Dependent Variable	Major	Mean	Std. Deviation	N
1.Seek single answers	Science	3.1325	.89811	380
	Art	2.6342	.94294	370
	Total	2.8867	.95308	750
2. Avoid integration	Science	3.3885	1.15497	380
	Art	2.7470	1.23950	370
	Total	3.0720	1.23891	750
3. Avoid ambiguity	Science	3.5726	1.09259	380
	Art	2.7789	1.28771	370
	Total	3.1811	1.25644	750
4. Knowledge is certain	Science	3.5125	1.00707	380
	Art	2.8764	1.23140	370
	Total	3.1987	1.16684	750
5. Don’t criticize authority	Science	3.6967	1.15301	380
	Art	2.9115	1.26787	370
	Total	3.3093	1.27239	750
6. Depend on authority	Science	3.4561	1.35692	380
	Art	2.2477	1.21079	370
	Total	2.8600	1.42105	750
7.Can't learn how to learn	Science	3.1042	1.28990	380
	Art	3.0589	1.35194	370
	Total	3.0819	1.32018	750
8. Success is unrelated to hard work	Science	3.1125	1.03851	380
	Art	2.8196	1.05685	370
	Total	2.9680	1.05710	750
9. Ability to learn is innate	Science	3.1283	1.06894	380
	Art	3.0277	1.21017	370
	Total	3.0787	1.14115	750
10. Learning is quick	Science	3.2653	.99314	380
	Art	3.0184	1.11646	370
	Total	3.1435	1.06228	750
11. Learn first time without concentrated effort	Science	2.9800	.98668	380
	Art	2.9400	1.11738	370
	Total	2.9603	1.05267	750

The difference in participants’ beliefs regarding “knowledge is certain” between science majors (*N* = 380, *M* = 3.5125, *SD* = 1.00707) and art majors (*N* = 370, *M* = 2.8764, *SD* = 1.23140) are statistically significant, F (1, 748) = 60.119, *p* = .000, η^2= .074. The difference in participants’ beliefs regarding “don’t criticize authority” between science majors (*N* = 380, *M* = 3.6967, *SD* = 1.15301) and art majors (*N* = 370, *M* = 2.9115, *SD* = 1.26787) are statistically significant, F (1, 748) = 78.813, *p* = .000, η^2= .095. The difference in participants’ beliefs regarding “depend on authority” between science majors (*N* = 380, *M* = 3.4561, *SD* = 1.35692) and art majors (*N* = 370, *M* = 2.2477, *SD* = 1.21079) are statistically significant, F (1, 748) = 165.290, *p* = .000, η^2= .181. The difference in participants’ beliefs regarding “success is unrelated to hard work” between science majors (*N* = 380, *M* = 3.1125, *SD* = 1.03851) and art majors (*N* = 370, *M* =

2.8196, *SD* = 1.05685) are statistically significant, F (1, 748) = 14.655, *p* = .000, η^2= .019. Finally, The difference in participants' beliefs regarding "learning is quick" between science majors (*N* = 380, *M* = 3.2653, *SD* = .99314) and art majors (*N* = 370, *M* = 3.0184, *SD* = 1.11646) are statistically significant, F (1, 748) = 10.251, *p* = .001, η^2= .014.

Whereas the difference in participants' beliefs regarding "can't learn how to learn" between science majors (*N* = 380, *M* = 3.1042, *SD* = 1.28990) and art majors (*N* = 370, *M* = 3.0589, *SD* = 1.35194) are statistically not significant, F (1, 748) = .220, *p* = .639, η^2= .000. The difference in participants' beliefs regarding "ability to learn is innate" between science majors (*N* = 380, *M* = 3.1283, *SD* = 1.06894) and art majors (*N* = 370, *M* = 3.0277, *SD* = 1.21017) are statistically not significant, F (1, 748) = 1.457, *p* = .228, η^2= .002. The difference in participants' beliefs regarding "learn first time without concentrated efforts" between science majors (*N* = 380, *M* = 2.9800, *SD* = .98668) and art majors (*N* = 370, *M* = 2.9400, *SD* = 1.11738) are statistically not significant, F (1, 748) = 10.251, *p* = .603, η^2= .000.

As shown in the eight significant subsets, the participants from science majors differ in their general beliefs from participants from art majors. By looking to the mean values for both groups regarding the eight significant subsets, it can be seen that the mean values for science majors (M= 3.1325, 3.3885, 3.5726, 3.5125, 3.6967, 3.4561, 3.1125 and 3.2653) are lower than the mean values scored by art majors (M= 2.6342, 2.7470, 2.7789, 2.8764, 2.9115, 2.2477, 2.8196 and 3.0184).

Regarding the relationship between participants' majors and their specific-domain epistemological beliefs toward information literacy, the results of ANOVA analysis (see Table 19) and the descriptive statistics (see Table 21) reveal that the difference in participants' beliefs regarding *certainty/simplicity of knowledge* between science majors (*N* = 380, *M* = 3.0372, *SD* = .86630) and art majors (*N* = 370, *M* = 3.1709, *SD* = .90939) are statistically not significant, F (1, 748) = 4.256, *p* = .039, η^2= .006. The difference in participants' beliefs regarding *justification of knowledge* between science majors (*N* = 380, *M* = 2.9730, *SD* = .99592) and art majors (*N* = 370, *M* = 3.0345, *SD* = 1.08216) are statistically not significant, F (1, 748) = .655, *p* = .419, η^2= .001.

Table 21 Tests of Between-Subjects Effects for major for specific-domain beliefs

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[d]
Major	1.Certainty/simplicity of knowledge	3.355	1	3.355	4.256	.039	.006	4.256	.540
	Error	589.585	748	.788					
	2.Justification of knowledge	.708	1	.708	.655	.419	.001	.655	.128
	Error	808.034	748	1.080					
	3. Source of knowledge	6.365	1	6.365	5.374	.021	.007	5.374	.639
	Error	885.929	748	1.184					
	4. Attainment of truth	5.861	1	5.861	3.996	.046	.005	3.996	.515
	Error	1097.169	748	1.467					

The difference in participants' beliefs regarding *source of knowledge* between science majors (N = 380, M = 3.0322, SD = 1.09619) and art majors (N = 370, M = 2.8480, SD = 1.08014) are statistically not significant, F (1, 748) = 5.374, p = .021, η^2= .007. The difference in participants' beliefs regarding *attainment of truth* between science majors (N = 380, M = 3.0079, SD = 1.24237) and art majors (N = 370, M = 2.8311, SD = 1.17816) are statistically not significant, F (1, 748) = 3.996, p = .046, η^2= .005.

Table 22 Descriptive Statistics for major and specific-domain beliefs

Dependent Variable	Major	Mean	Std. Deviation	N
1. Certainty/simplicity of knowledge	Science	3.0372	.86630	380
	Art	3.1709	.90939	370
	Total	3.1032	.88974	750
2. Justification of knowledge	Science	2.9730	.99592	380
	Art	3.0345	1.08216	370
	Total	3.0033	1.03912	750
3. Source of knowledge	Science	3.0322	1.09619	380
	Art	2.8480	1.08014	370
	Total	2.9413	1.09147	750
4. Attainment of truth	Science	3.0079	1.24237	380
	Art	2.8311	1.17816	370
	Total	2.9207	1.21354	750

As shown in the results above, no statistically significant differences were found between participants from science and art majors in their beliefs regarding knowledge about information literacy whereas they do differ very strongly in their general beliefs for the benefit of art majors.

5.1.3 Analysis of Relationships between Academic Levels and Epistemological Beliefs

To answer the research question related to academic levels,- *do academic levels impact the general and/or specific-domain beliefs?*-ANOVA analysis was applied to test the relationship between the independent variable academic levels and the dependent variables the subsets of the general beliefs and the dimensions of specific-domain beliefs seeking for significant results.

Table 23 Tests of Between-Subjects Effects for academic levels across general beliefs subsets

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[l]
Academic Level	1.Seek single answers	64.338	1	64.338	78.122	.000	.095	78.122	1.000
	Error	616.020	748	.824					
	2. Avoid integration	185.892	1	185.892	144.277	.000	.162	144.277	1.000
	Error	963.751	748	1.288					
	3. Avoid ambiguity	112.288	1	112.288	78.488	.000	.095	78.488	1.000
	Error	1070.123	748	1.431					
	4. Knowledge is certain	165.978	1	165.978	145.411	.000	.163	145.411	1.000
	Error	853.795	748	1.141					
	5. Don't criticize authority	134.810	1	134.810	93.559	.000	.111	93.559	1.000
	Error	1077.799	748	1.441					
	6. Depend on authority	178.764	1	178.764	100.255	.000	.118	100.255	1.000
	Error	1333.758	748	1.783					
	7.Can't learn how to learn	92.896	1	92.896	57.308	.000	.071	57.308	1.000
	Error	1212.517	748	1.621					
	8.Success is unrelated to hard work	144.517	1	144.517	156.108	.000	.173	156.108	1.000
	Error	692.465	748	.926					
	9. Ability to learn is innate	150.895	1	150.895	136.900	.000	.155	136.900	1.000
	Error	824.464	748	1.102					
	10: Learning is quick	110.228	1	110.228	112.182	.000	.130	112.182	1.000
	Error	734.975	748	.983					
	11 Learn first time without concentrated efforts	209.626	1	209.626	252.761	.000	.253	252.761	1.000
	Error	620.350	748	.829					

For the third factor, that is, academic level, results of the analysis (see Table 23) and the descriptive statistics (see Table 24) show that the difference in participants' beliefs regarding "seek single answers" between the first-year (*N* = 390, *M* = 3.1681, *SD* = .86524) and the fourth-year (*N* = 360, *M* = 2.5818, *SD* = .95117) are statistically significant, F (1, 748) = 78.122, *p* = .000, η^2=.095. The difference in participants' beliefs about "avoid integration" between first-year (*N* = 390, *M* = 3.6506, *SD* = 1.01795) and fourth-year (*N* = 360, *M* = 2.7090, *SD* = 1.12047) are statistically significant, F (1, 748) = 144.277, *p* = .000, η^2=.163. The difference in participants' beliefs about "avoid ambiguity" between first-year (*N* = 390, *M* = 3.5528, *SD* = 1.10098) and fourth-year (*N* = 360, *M* = 2.7783, *SD* = 1.29127) are statistically significant, F (1, 748) = 78.488, *p* = .000, η^2=.095.

Table 24 Descriptive Statistics for academic level and general beliefs

Dependent Variable	Academic level	Mean	Std. Deviation	N
1.Seek single answers	First-year	3.1681	.86524	390
	Fourth-year	2.5818	.95117	360
	Total	2.8867	.95308	750
2. Avoid integration	First-year	3.5503	1.06391	390
	Fourth-year	2.5538	1.20750	360
	Total	3.0720	1.23891	750
3. Avoid ambiguity	First-year	3.5528	1.10098	390
	Fourth-year	2.7783	1.29127	360
	Total	3.1811	1.25644	750
4. Knowledge is certain	First-year	3.6506	1.01795	390
	Fourth-year	2.7090	1.12047	360
	Total	3.1987	1.16684	750
5. Don't criticize authority	First-year	3.7167	1.14691	390
	Fourth-year	2.8681	1.25575	360
	Total	3.3093	1.27239	750
6. Depend on authority	First-year	3.3291	1.34834	390
	Fourth-year	2.3519	1.32108	360
	Total	2.8600	1.42105	750
7.Can't learn how to learn	First-year	3.4200	1.18626	390
	Fourth-year	2.7156	1.36113	360
	Total	3.0819	1.32018	750
8. Success is unrelated to hard work	First-year	3.3897	.90167	390
	Fourth-year	2.5111	1.02368	360
	Total	2.9680	1.05710	750
9. Ability to learn is innate	First-year	3.5096	1.00420	390
	Fourth-year	2.6118	1.09721	360
	Total	3.0787	1.14115	750
10. Learning is quick	First-year	3.5118	.96702	390
	Fourth-year	2.7444	1.01686	360
	Total	3.1435	1.06228	750
11. Learn first time without concentrated effort	First-year	3.4682	.95134	390
	Fourth-year	2.4100	.86447	360
	Total	2.9603	1.05267	750

The difference in participants' beliefs regarding "knowledge is certain" between first-year (*N* = 390, *M* = 3.1325, *SD* = .89811) and fourth-year (*N* = 360, *M* = 2.6342, *SD* = .94294) are statistically significant, F (1, 748) = 145.411, *p* = .000, η^2=.143. The difference in participants' beliefs regarding "don't criticize authority" between first-year (*N* = 390, *M* = 3.7167, *SD* = 1.14691) and fourth-year (*N* = 360, *M* = 2.8681, *SD* = 1.25575) are statistically significant, F (1, 748) = 93.559, *p* = .000, η^2=.111. The difference in participants' beliefs regarding "depend on authority" between first-year (*N* = 390, *M* = 3.3291, *SD* = 1.34834) and fourth-year (*N* = 360, *M* = 2.3519, *SD* = 1.32108) are statistically significant, F (1, 748) = 100.255, *p* = .000, η^2=.118.

The difference in participants' beliefs regarding "can't learn how to learn" between first-year (*N* = 390, *M* = 3.4200, *SD* = 1.18626) and fourth-year (*N* = 360, *M* = 2.7156, *SD* = 1.36113) are statistically significant, F (1, 748) = 57.308, *p* = .000, η^2=.071. The difference in participants' beliefs regarding "success is unrelated to hard work" between first-year (*N* = 390, *M* = 3.3897, *SD* = .90167) and fourth-year (*N* = 360, *M* = 2.5111, *SD* = 1.02368) are statistically significant, F (1, 748) = 156.108, *p* = .000, η^2=.173. The difference in participants' beliefs regarding "ability to learn is innate" between first-year (*N* = 390, *M* = 3.5096, *SD* = 1.00420) and fourth-year (*N* = 360, *M* = 2.6118, *SD* = 1.09721) are statistically significant, F (1, 748) = 136.900, *p* = .000, η^2=.155.

The difference in participants' beliefs regarding "learning is quick" between first-year (*N* = 390, *M* = 3.5118, *SD* = .96702) and fourth-year (*N* = 360, *M* = 2.7444, *SD* = 1.01686) are statistically significant, F (1, 748) = 112.182, *p* = .000, η^2=.130. The difference in participants' beliefs regarding "learn first time without concentrated efforts" between first-year (*N* = 390, *M* = 3.4682, *SD* = .95134) and fourth-year (*N* = 360, *M* = 2.4100, *SD* = .86447) are statistically significant, F (1, 748) = 252.761, *p* = .000, η^2=.253.

A significant main effect for academic levels on all subsets of general beliefs can be seen in the previous results. To determine how general beliefs differ for the academic levels, a comparison between mean values for first-year (M= 3.1681, 3.6506, 3.5528, 3.1325, 3.7167, 3.3291, 3.4200, 3.3897, 3.5096, 3.5118, 3.4682) and fourth-year (M= 2.5818, 2.7090, 2.7783, 2.6342, 2.8681, 2.3519, 2.7156, 2.5111, 2.6118, 2.7444, 2.4100) indicates that fourth-year students scored significantly lower mean values than first-year students.

The relationship between academic levels and the dimensions of specific-domain epistemological beliefs regarding information literacy was analysed by multivariate analysis of variance, the results are shown below.

Table 25 Tests of Between-Subjects Effects for AL for specific-domain beliefs

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[d]
Academic Level	1. Certainty/simplicity of knowledge	142.390	1	142.390	236.396	.000	.240	236.396	1.000
	Error	450.549	748	.602					
	2.Justification of knowledge	118.118	1	118.118	127.931	.000	.146	127.931	1.000
	Error	690.624	748	.923					
	3. Source of knowledge	112.902	1	112.902	108.355	.000	.127	108.355	1.000
	Error	779.391	748	1.042					
	4. Attainment of truth	73.050	1	73.050	53.051	.000	.066	53.051	1.000
	Error	1029.980	748	1.377					

The results of the analysis (see Table 25) and the descriptive statistics (see Table 26) show that the difference in participants' beliefs regarding *certainty/simplicity of knowledge* between first-year (N = 390, M = 3.5218, SD = .74144) and fourth-year (N = 360, M = 2.6497, SD = .81200) are statistically significant, F (1, 748) = 236.396, p = .000, η^2= .240. The difference in participants' beliefs regarding *justification of knowledge* between first-year (N = 390, M = 3.3846, SD = .93326) and fourth-year (N = 360, M = 2.5903, SD = .98994) are statistically significant, F (1, 748) = 127.931, p = .000, η^2= .146. The difference in participants' beliefs regarding *source of knowledge* between first-year (N = 390, M = 3.3141, SD = .99826) and fourth-year (N = 360, M = 2.5375, SD = 1.04461) are statistically significant, F (1, 748) = 108.355, p = .000, η^2= .127. The difference in participants' beliefs regarding *attainment of truth* between first-year (N = 390, M = 3.2205, SD = 1.14281) and fourth-year (N = 360, M = 2.5958, SD = 1.20577) are statistically significant, F (1, 748) = 53.051, p = .000, η^2= .066.

Table 26 Descriptive Statistics for academic level and specific-domain beliefs

Dependent Variable	Academic level	Mean	Std. Deviation	N
1. Certainty/simplicity of knowledge	First-year	3.5218	.74144	390

	Fourth-year	2.6497	.81200	360
	Total	3.1032	.88974	750
2. Justification of knowledge	First-year	3.3846	.93326	390
	Fourth-year	2.5903	.98994	360
	Total	3.0033	1.03912	750
3. Source of knowledge	First-year	3.3141	.99826	390
	Fourth-year	2.5375	1.04461	360
	Total	2.9413	1.09147	750
4. Attainment of truth	First-year	3.2205	1.14281	390
	Fourth-year	2.5958	1.20577	360
	Total	2.9207	1.21354	750

A significant main effect for academic level on all the dimensions of specific-domain beliefs in information literacy can be seen in the results above. To determine how the specific-domain beliefs differ for the academic level, a comparison between mean values for first-year (M= 3.5218, 3.3846, 3.3141, 3.2205) and fourth-year (M= 2.6497, 2.5903, 2.5375, 2.5958) indicate that fourth-year students scored significantly lower mean values than first-year students.

As shown in the results above, there are strong differences found between first and fourth-year students in their beliefs regarding knowledge in general and in specific-domain represented by information literacy. Fourth-year students are the ones that have higher sophisticated beliefs than the first-year students.

5.1.4 Analysis of Relationships between Previous Knowledge of Information Literacy and Epistemological Beliefs

In order to answer the research question - *does previous knowledge of information literacy impact on learners' general-domain and specific-domain beliefs?*-the relationship between the participants who had studied information literacy previously and those who had not and their general-domain and specific-domain beliefs will be examined. The ANOVA analysis will deal with the yes-group and the no-group as independent variables and the four dimensions of specific-domain beliefs as dependent variables.

Table 27 Tests of Between-Subjects Effects for IS in general beliefs

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[1]
Information	1.Seek single answers	.005	1	.005	.006	.939	.000	.006	.051

literacy	Error	680.353	748	.910					
	2. Avoid integration	17.391	1	17.391	11.489	.001	.015	11.489	.923
	Error	1132.252	748	1.514					
	3. Avoid ambiguity	18.832	1	18.832	12.106	.001	.016	12.106	.935
	Error	1163.579	748	1.556					
	4. Knowledge is certain	46.580	1	46.580	35.802	.000	.046	35.802	1.000
	Error	973.194	748	1.301					
	5. Don't criticize authority	6.010	1	6.010	3.726	.054	.005	3.726	.487
	Error	1206.599	748	1.613					
	6. Depend on authority	1.483	1	1.483	.734	.392	.001	.734	.137
	Error	1511.040	748	2.020					
	7.Can't learn how to learn	10.527	1	10.527	6.081	.014	.008	6.081	.692
	Error	1294.886	748	1.731					
	8.Success is unrelated to hard work	25.891	1	25.891	23.877	.000	.031	23.877	.998
	Error	811.091	748	1.084					
	9. Ability to learn is innate	35.515	1	35.515	28.265	.000	.036	28.265	1.000
	Error	939.844	748	1.256					
	10: Learning is quick	10.885	1	10.885	9.758	.002	.013	9.758	.877
	Error	834.318	748	1.115					
	11 Learn first time without concentrated efforts	39.138	1	39.138	37.018	.000	.047	37.018	1.000
	Error	790.838	748	1.057					

For the fourth factor, information literacy, results of the analysis (see Table 27) and the descriptive statistics (see Table 28) show that the difference in participants' beliefs regarding "avoid integration" between yes-group (N = 340, M = 2.9048, SD = 1.19143) and no-group (N = 410, M = 3.2107, SD = 1.26166) are statistically significant, F (1, 748) = 11.489, p = .001, η^2=.015. The difference in participants' beliefs regarding "avoid ambiguity" between yes-group (N = 340, M = 3.0071, SD = 1.16414) and no-group (N = 410, M = 3.3254, SD = 1.31212) are statistically significant, F (1, 748) = 12.106, p = .001, η^2=.016. The difference in participants' beliefs regarding "knowledge is certain" between yes-group (N = 340, M = 2.9250, SD = 1.15161) and no-group (N = 410, M = 3.4256, SD = 1.13146) are statistically significant, F (1, 748) = 35.802, p = .000, η^2=.046. The difference in participants' beliefs regarding "success is unrelated to hard work" between yes-group (N = 340, M = 2.7640, SD = 1.14524) and no-group (N = 410, M = 3.1372, SD = .94658) are statistically significant, F (1, 748) = 23.877, p = .000, η^2=.031.

The difference in participants' beliefs regarding "ability to learn is innate" between yes-group (N = 340, M = 2.8397, SD = 1.20059) and no-group (N = 410, M = 3.2768, SD = 1.05033) are statistically significant, F (1, 748) = 28.265, p = .000, η^2=.036. The difference in participants' beliefs regarding "learning is quick" between yes-group (N = 340, M = 3.0112, SD = 1.12949) and no-group (N = 410, M = 3.2532, SD = .99121) are statistically significant, F (1, 748) = 9.758, p = .002, η^2=.013. Finally, the difference in participants' beliefs regarding "learn first time without concentrated effort" between yes-group (N = 340, M = 2.7094, SD = 1.05194) and no-group (N = 410, M = 3.1683, SD = 1.00817) are statistically significant, F (1, 748) = 37.018, p = .000, η^2=.047. The remaining subsets of general beliefs "seek single answers", "don't criticize authority", "depend on authority" and "can't learn how to learn" were found to be non significant p >.05. By looking to the mean values for the seven significant subsets above it can be seen that the mean values for the yes-group scored less than the mean values for the no-group.

Table 28 Descriptive Statistics for information literacy and general beliefs

Dependent Variable	Gender	Mean	Std. Deviation	N
1.Seek single answers	Yes-group	2.8896	1.00450	340
	No-group	2.8843	.90946	410
	Total	2.8867	.95308	750
2. Avoid integration	Yes-group	2.9048	1.19143	340
	No-group	3.2107	1.26166	410
	Total	3.0720	1.23891	750
3. Avoid ambiguity	Yes-group	3.0071	1.16414	340
	No-group	3.3254	1.31212	410
	Total	3.1811	1.25644	750
4. Knowledge is certain	Yes-group	2.9250	1.15161	340
	No-group	3.4256	1.13146	410
	Total	3.1987	1.16684	750
5. Don't criticize authority	Yes-group	3.2110	1.30143	340
	No-group	3.3909	1.24349	410
	Total	3.3093	1.27239	750
6. Depend on authority	Yes-group	2.9088	1.44102	340
	No-group	2.8195	1.40475	410
	Total	2.8600	1.42105	750
7.Can't learn how to learn	Yes-group	2.9518	1.35290	340
	No-group	3.1898	1.28409	410
	Total	3.0819	1.32018	750
8. Success is unrelated to hard work	Yes-group	2.7640	1.14524	340
	No-group	3.1372	.94658	410
	Total	2.9680	1.05710	750
9. Ability to learn is innate	Yes-group	2.8397	1.20059	340
	No-group	3.2768	1.05033	410
	Total	3.0787	1.14115	750
10. Learning is quick	Yes-group	3.0112	1.12949	340
	No-group	3.2532	.99121	410
	Total	3.1435	1.06228	750
11. Learn first time without concentrated effort	Yes-group	2.7094	1.05194	340
	No-group	3.1683	1.00817	410
	Total	2.9603	1.05267	750

Regarding the relationship between participants' academic levels and their specific-domain epistemological beliefs toward information literacy, results of the analysis (see Table 29) and the descriptive statistics (see Table 30) are listed below.

Table 29 Descriptive Statistics for information literacy and specific-domain beliefs

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[d]
IS	1. Certainty/simplicity of knowledge	205.531	1	205.531	396.835	.000	.347	396.835	1.000
	Error	387.408	748	.518					
	2. Justification of knowledge	373.938	1	373.938	643.290	.000	.462	643.290	1.000
	Error	434.804	748	.581					
	3. Source of knowledge	190.772	1	190.772	203.411	.000	.214	203.411	1.000
	Error	701.522	748	.938					
	4. Attainment of truth	103.244	1	103.244	77.243	.000	.094	77.243	1.000
	Error	999.786	748	1.337					

The difference in participants' beliefs regarding *certainty/simplicity of knowledge* between yes-group (N = 340, M = 2.5283, SD = .67303) and no-group (N = 410, M = 3.5799, SD = .75615) are statistically significant, F (1, 748) = 396.835, p = .000, η^2= .347. The difference in participants' beliefs regarding *justification of knowledge* between yes-group (N = 340, M = 2.2279, SD = .70911) and no-group (N = 410, M = 3.6463, SD = .80394) are statistically significant, F (1, 748) = 643.290, p = .000, η^2= .462. The difference in participants' beliefs regarding *source of knowledge* between yes-group (N = 340, M = 2.3875, SD = .92632) and no-group (N = 410, M = 3.4006, SD = 1.00200) are statistically significant, F (1, 748) = 203.411, p = .000, η^2= .214. The difference in participants' beliefs regarding *attainment of truth* between yes-group (N = 340, M = 2.5132, SD = 1.20617) and no-group (N = 410, M = 3.2585, SD = 1.11293) are statistically significant, F (1, 748) = 77.243, p = .000, η^2= .094.

Table 30 Descriptive Statistics for IS and specific-domain beliefs

Dependent Variable	IS	Mean	Std. Deviation	N
1. Certainty/simplicity of knowledge	Yes-group	2.5283	.67303	340
	No-group	3.5799	.75615	410
	Total	3.1032	.88974	750
2. Justification of knowledge	Yes-group	2.2279	.70911	340
	No-group	3.6463	.80394	410
	Total	3.0033	1.03912	750
3. Source of knowledge	Yes-group	2.3875	.92632	340
	No-group	3.4006	1.00200	410

	Total	2.9413	1.09147	750
4. Attainment of truth	Yes-group	2.5132	1.20617	340
	No-group	3.2585	1.11293	410
	Total	2.9207	1.21354	750

A statistical difference was found between yes-group students and no-group students in their beliefs regarding knowledge in information literacy. To determine how the beliefs toward information literacy differ based on previous knowledge of information literacy, a comparison between mean values of yes-group (M= 2.5283, 2.2279, 2.3875, 2.5132) and no-group (M= 3.5799, 3.6463, 3.4006, 3.2585) indicate that yes-group students scored significantly lower mean values in the four dimensions than the no-group students.

As shown in the results above, previous knowledge in information literacy has a modest significant difference on students' general beliefs and a strong significant difference on the specific-domain beliefs. In both findings the yes-group students scored higher level of sophisticated beliefs than the no-group ones.

The relationship between the factors (gender, majors, academic levels and information literacy) and the subsets/dimensions of the general and the specific-domain epistemological beliefs were tested by applying ANOVA analysis which found significant results. The significant relationships found mean that some of the participants' characteristics, that is, gender, major, academic level or previous knowledge, as hypothesized, could influence their beliefs either in the general form, specific-domain form or in both. To find the relationship interaction between the factors and the epistemological beliefs further analysis was carried out, the results are presented in the following section.

5.2 Discussion of the Impact of the Variables on the Undergraduates' Epistemological Beliefs

The main goal of this section is to study the general-domain and the specific-domain for learners' epistemological beliefs focusing on the effect on their characteristics (gender, major, academic level, and information literacy).

5.2.1 The Impact of Gender on the Undergraduates' Epistemological Beliefs

According to various studies carried out to measure the effect of gender on the epistemological beliefs, some argue that there is a clear difference between males and females (Can and Arabacıoğlu, 2009; So et al., 2010) but whenever it is found some claim that the more sophisticated beliefs will be held by females (Schommer and Dunnell, 1994; Paulsen and Wells, 1998; Hofer, 2000; Cano, 2005; Lodewyk, 2007; Marzooghi et al., 2008; Oguz, 2008; Cana and Arabacioglu, 2009; King and Magun-Jackson, 2009; Belet and Güven, 2011; Ismail et al., 2012; Terzi et al., 2012; Muis and Gierus, 2014). However, in contrast, others claim that there are no differences between factors of gender (Chan, 2003; Schommer-Aikinsa and Easter, 2006; Erdem, 2007; Trautwein and Lüdtke, 2007; Tanriverdi, 2012; Tümkaya, 2012). This study is concerned with the claim of the impact of gender on the epistemological beliefs to answer the related research question as to whether or not gender impacts the general-domain and specific-domain beliefs.

After analyzing the data of this study to measure the general and specific epistemological beliefs of the undergraduates focusing on the differences of gender, the findings reflect that the general epistemological beliefs for undergraduates have differences in only two dimensions (*structure of knowledge*, and *ability to learn*) whereas the rest of three dimensions (*stability of knowledge*, *source of knowledge*, and *speed of learning*) were not significant. With regards to the specific epistemological beliefs of the undergraduates, there were no gender differences between males and females.

Table 31 Effect of Gender on SEQ

Dimensions	Subsets	Sig.	Partial Eta Squared	Mean values	
				Males	Females
Structure of Knowledge	Seek single answers	.002	.013	3.0332	2.8075
Ability to learn	Success is unrelated to hard work	.001	.015	3.1435	2.8732
	Ability to learn is innate	.002	.013	3.2538	2.9841

The table (Table 31) above demonstrates that males were more likely to believe in simple knowledge and innate ability than females. It is true there is difference between the two dimensions but such a difference is very small. In other words, the value of effect size for differences between male and female considered to be too small which is between .01 and .02 (Cohen, 1988). In addition, not all the subsets under such dimensions are significant, meaning that the subset of “seek single answers” under the *structure of knowledge* dimension is only significant while the subset of “avoid integration” was insignificant. With regards to the *ability to learn* dimension, the subset of “can't learn how to learn” was insignificant which indicates that the small differences were only found in two subsets rather than three subsets of the dimension.

The difference between males and females in their epistemological beliefs does not appear as expected. The absence of the clear impact of gender on the participants’ beliefs in this study may be explained by many assumptions which need more investigations to be verified. One of the assumptions is the absent of diversity among the participants of this study since they are from the same culture, nationality, language and religion. Another assumption may refer to the similarity of educational background for the participants because Kuwaiti educational system provides equal education opportunities for boys and girls from KG to the college which they learn the same curriculum without distinguishing the difference between them.

Contrarily, the difference between males and females was found significant in many studies for the following reasons: the sample was from different countries, for example, comparing between US students and Middle Eastern students (Karabenick and Moosa, 2005), or from different cultures such as Asian Americans and European Americans (Schommer-Aikins and Easter, 2008), or the study conducted in countries where the formal education is built differently based on gender differences such as in Korean culture where male students taught Korean values related to leadership, autonomy and adaptability more emphasizing than to female students (So et al., 2010).

5.2.2 The Impact of Majors on Undergraduates’ Epistemological Beliefs

Following Biglan’s (1973) classification of academic domains, they have been categorized in this study into two types - science and the arts. The science domain covers mathematics, science, chemistry, physics, biology and geology whereas the arts domain consists of psychology, languages, religious history and geography.

Examining research in the field of *majors*, many studies claim that differences in learners' beliefs depend on their field of study. More specifically, the majority of the studies reviewed found that the arts majors have more influence on the development of learners' epistemological beliefs than the science majors (Paulsen and Wells, 1998; Jehng et al., 1993; Trautwein and Lüdtke, 2007; Terzi et al., 2012; Ren et al., 2009; Chai et al., 2010). However, some found that the science majors have influence (Tümkaya, 2012); yet others argue that there are no major differences seen between the two disciplines (Oğuz, 2008). This argument has raised the research question - do majors impact the general-domain and specific-domain beliefs? This study will answer this question.

After investigating the epistemological beliefs of the undergraduates studying their majors in either science or the arts, the results illustrate that art majors are more positively associated than science majors with the *structure of knowledge, stability of knowledge, source of knowledge, ability to learn and speed of learning dimensions* of epistemological beliefs. It should be noted that there was no influence found on majors for the specific-domain beliefs of the undergraduates.

Table 32 Effect of Major on SEQ

Dimensions	**Subsets**	**Sig.**	**Partial Eta Squared**	**Mean values**	
				Science	**Art**
Structure of Knowledge	Seek single answers	.000	.068	3.1325	2.6342
	Avoid integration	.000	.067	3.3885	2.7470
Stability of Knowledge	Avoid ambiguity	.000	.100	3.5726	2.7789
	Knowledge is certain	.000	.074	3.5125	2.8764
Source of knowledge	Don't criticize authority	.000	.095	3.6967	2.9115
	Depend on authority	.000	.181	3.4561	2.2477
Ability to learn	Success is unrelated to hard work	.000	.019	3.1125	2.8196
Speed of Learning	Learning is quick	.001	.014	3.2653	3.0184

As can be seen in Table 32, the major differences in undergraduates' beliefs are strongly significant within the realm of *structure of knowledge, stability of knowledge, and source of knowledge.* The effect of the size of the dimensions was not only high but also significant for all subsets under these dimensions.

However, the dimensions of *ability to learn* and *speed of learning* are not significantly as strong as the first three dimensions because the difference between major art and science has a low effect size value, that is, between .01 and .02. In addition, the subsets of the *ability to learn and speed of learning* dimensions are not significant; in fact, the subset of *success is unrelated to hard work* and that of learning *is quick* are the only significant ones. Examination of the mean values of the major art and science disciplines shows that the undergraduates studying art majors have more sophisticated general beliefs than those undergraduates studying science majors.

The undergraduates' general epistemological beliefs are more influenced by an art major than be a science major in developing their beliefs to become more sophisticated; this is affirmed by previous studies (Paulsen and Wells, 1998; Jehng et al., 1993; Trautwein and Lüdtke, 2007; Terzi et al., 2012; Ren et al., 2009; Chai et al., 2010). From the sample of this study, majors have a noticeable impact on the undergraduates' general beliefs about knowledge (its structure, stability and source) and a modest impact on the general beliefs about knowing (*ability to learn* and *speed of learning*). Similar to the above mentioned studies, art majors have more influence than science majors on developing the dimension of general beliefs of the participants while the impact of majors on specific-domain beliefs actually disappears since the undergraduates' beliefs regarding information literacy is not influenced by the majors of either science or art major.

A possible explanation for majors having an obvious influence on the general beliefs and no influence at all on the specific-domain beliefs could be that with respect to the general beliefs questions, the participants responded based on the nature of the different majors they are studying. The differences between science and art majors as illustrated in Biglan's (1973) academic domains' classification is based on the different structure of each domain, meaning that art domains are loosely structured but science domains are more tightly structured. This difference can be seen in the way that the participants observed the knowledge and reflected it in their answers. However, this was not the case when the participants responded to the specific-domain beliefs questionnaire, in fact, the difference between art and science vanished. It is argued here that the absence of the impact of majors on the specific-domain beliefs depends on the nature of the discipline examined. Information literacy as a discipline (see 2.5.2) is considered an interdisciplinary field which is connected to all other academic domains including loosely structured and tightly structured domains (Saracevic, 1999; Webber and Johnston, 2000). The participants' responses to the specific-domain epistemological beliefs questionnaire were based on their own perspectives and experiences of information literacy regardless of the influence of their majors.

5.2.3 The Impact of Academic Level on Undergraduates' Epistemological Beliefs

Reviews of research on academic level (as explained in the literature review chapter) shows that the majority of research agrees that academic level can affect the epistemological beliefs of learners as they move from lower to higher academic levels.

When comparing the epistemological beliefs of learners from different academic levels, most studies found that learners from higher academic levels had developed more sophisticated beliefs than those of the lower levels (Jehng et al., 1993; Marzooghi et al., 2008; Ren et. al., 2009; King and Magun-Jackson, 2009; Tanriverdi, 2012). However, some studies have argued that learners at higher academic levels have more naive epistemological beliefs than those in the lower levels (Ismail et al. 2012; Chai et al., 2010). Yet other studies claim that there are no academic level differences between the learners' beliefs (Belet and Güven, 2011). In this section, the discussion will answer the research question about the impact of academic levels on the general-domain and the specific-domain on learners' epistemological beliefs.

The data in this study reflects a clear influence that academic levels have on the epistemological beliefs of the learners. The fourth-year students show more development in both general and specific beliefs than the first-year students, meaning that their beliefs are gradually improving from simple beliefs to complex beliefs as they move from the first to the fourth year.

Table 33 Effect of Academic levels on SEQ

Dimensions	Subsets	Sig.	Partial Eta Squared	Mean values	
				First-year	Fourth-year
Structure of Knowledge	Seek single answers	.000	.095	3.1681	2.5818
	Avoid integration	.000	.162	3.6506	2.7090
Stability of Knowledge	Avoid ambiguity	.000	.095	3.5528	2.7783
	Knowledge is certain	.000	.163	3.1325	2.6342
Source of knowledge	Don't criticize authority	.000	.111	3.7167	2.8681
	Depend on authority	.000	.118	3.3291	2.3519
Ability to learn	Can't learn how to learn	.000	.071	3.4200	2.7156
	Success is unrelated to hard work	.000	.173	3.3897	2.5111
	Ability to learn is innate	.000	.155	3.5096	2.6118
Speed of Learning	Learning is quick	.000	.130	3.5118	2.7444
	Learn first time without concentrated efforts	.000	.253	3.4682	2.4100

As illustrated in the above table (Table 33), the findings show that there are significant differences between first and four year undergraduates in all dimensions of general epistemological beliefs. Fourth year undergraduates hold more complex epistemological beliefs than first years, showing that the effect size value of all the dimensions was very high. The moderate range between the mean values for both groups point to the fact that fourth year undergraduates are more likely to demonstrate that general knowledge is not a simple unchanged knowledge and it is not handed down by authorities as the only source of knowledge, they also believe that hard work and concentrated effort can make learning happen and that learning can be achieved through multi attempts not from only one.

In contrast, first-year students are more likely to believe that knowledge is certain, stable and derived from authority and that learning is an innate ability and a quick process which happens from the first efforts.

Table 34 Effect of academic level on DFEBQ

Dimensions	Sig.	Partial Eta Squared	Information literacy	
			First-year	Fourth-year
1. Certainty/simplicity of knowledge	.000	.240	3.5218	2.6497
2. Justification of knowledge	.000	.146	3.3846	2.5903
3. Source of knowledge	.000	.127	3.3141	2.5375
4. Attainment of truth	.000	.066	3.2205	2.5958

Similarly, academic levels once again have been found to strongly affect the specific-domain epistemological beliefs of the undergraduates. The table above (Table 34) confirms the clear differences between the specific-domain beliefs of fourth and first-year undergraduates in the all dimensions, that is, *certainty/simplicity of knowledge, justification of knowledge, source of knowledge* and *attainment of truth.* The findings demonstrate that the higher the level that the undergraduates reach, the more sophisticated level of beliefs they will hold. This indicates that the fourth year students believe that knowledge of information literacy is complex and changing and is created by contact between learners rather than from outside sources. They also believe that there is no absolute truth and that experts' views can be questioned and tested. The values of the effect size were also very high in all dimensions of the specific beliefs indicating that the effect of the academic level on the specific-domain beliefs has a very strong influence in forming and developing the way that undergraduates review the discipline of information literacy.

It is true that both the general-domain and the specific-domain epistemological beliefs are strongly affected by the academic levels of the learners among all dimensions for both scales, however, the size of effect of the academic level on the specific-domain beliefs is much higher than it is on the general epistemological beliefs. This means that although fourth year undergraduates hold more sophisticated general and specific-domain beliefs than first year undergraduates, at the same time fourth year undergraduates show higher levels of sophisticated beliefs about information literacy as a specific-domain than those they hold about general knowledge. The finding of this study regarding the impact of academic levels on epistemological beliefs answered the research question showing that it is compatible with the findings of those studies which claim that epistemological beliefs are developed to a higher sophisticated level as learners move from one academic level to the next.

5.2.4 The Impact of Previous Knowledge in Information Literacy on Undergraduates' Epistemological Beliefs

The main aim of this section is to discuss the impact of information literacy as a discipline on the learners' general-domain and specific-domain beliefs answering the research question - *whether previous knowledge of information literacy impacts learners' general-domain beliefs and* *specific-domain beliefs*. Some claim that epistemological beliefs are general-domain and learners hold similar beliefs across all disciplines (Schommer, 1990; Schommer and Walker, 1995) while others argue that the epistemological beliefs of learners are specific-domain meaning that their beliefs are developed differently across disciplines and may be affected and changed while studying a particular subject (Qian and Alvermann, 1995; Hofer, 2000; Pulmones, 2010; Geban and Çam, 2010; Mason et al., 2011).

The findings confirm that undergraduates classified as a 'yes-group' for information literacy show more improvements with positive effects in their beliefs than those from the 'no-group'; this is on both general and specific-domain epistemological beliefs. The findings also confirm that the learners' specific-domain beliefs show a more positive interaction with the information literacy 'yes-group' than with their general-domain beliefs.

Table 35 Effect of information literacy on SEQ

Dimensions	Subsets	Sig.	Partial Eta Squared	Mean values	
				Yes-group	No-group
Structure of Knowledge	Avoid integration	.001	.015	2.9048	3.2107
Stability of Knowledge	Avoid ambiguity	.001	.016	3.0071	3.3254
	Knowledge is certain	.000	.046	2.9250	3.4256
Ability to learn	Success is unrelated to hard work	.000	.031	2.7640	3.1372
	Ability to learn is innate	.000	.036	2.8397	3.2768
Speed of Learning	Learning is quick	.002	.013	3.0112	3.2532
	Learn first time without concentrated efforts	.000	.047	2.7094	3.1683

The table (Table 35) above demonstrates that yes-group learners of information literacy hold more developed general beliefs in *structure of knowledge, stability of knowledge, ability to learn* and *speed of learning* than those of the no-group. No influence was seen for the dimension of *the source of knowledge*. All subsets of the dimensions of *stability of knowledge* and *speed of learning* were strongly significant whereas the subsets of the *dimensions of structure of knowledge and ability to learn* were only seen in *avoid integration*, *success is unrelated to hard work and ability to learn is innate*, respectively. The values of effect size of the subsets range from between small to medium. Additionally, the range of the mean values between the two groups is small. In other words, the yes-group undergraduates hold a little higher level of sophisticated beliefs than the no-group. All the above indicates that the effect of the information literacy course on the general beliefs of undergraduates, although appearing significant and effective in four belief dimensions, in fact, the difference made on the beliefs between the two groups can be considered to be very small.

Table 36 Effect of IS on DFEBQ

Dimensions	Sig.	Partial Eta Squared	Information literacy	
			Yes-group	No-group
1. Certainty/simplicity of knowledge	.000	.347	2.5283	3.5799
2. Justification of knowledge	.000	.462	2.2279	3.6463
3. Source of knowledge	.000	.214	2.3875	3.4006
4. Attainment of truth	.000	.094	2.5132	3.2585

As shown in the table above (Table 36), the findings confirm that the impact of information literacy courses on the specific-domain beliefs of the yes-group show them to hold more sophisticated beliefs than those of the no-group. Not only are all dimensions of the specific beliefs strongly significant but also the values of the effect size of these dimensions has a very high effect. It should be noted that the dimension of *source of knowledge* was found to be significant for the specific-domain beliefs but insignificant for the general domain beliefs.

In other words, the undergraduates who studied a course in information literacy believe that knowledge in information literacy is tentative and categorized as relative, contextual, and contingent, they also believe that knowledge is created by the learners through contact with each other, using rules of inquiry, examining the views of experts, and finally they believe there is not only one truth to be reached by learners.

Although the findings of this study show that there are signs of developments in all dimensions of specific-domain beliefs for the information literacy group, other studies have only found developments in some dimensions. For example, many found that the specific domain beliefs of participants are sophisticated in *simplicity/certainty knowledge* and *source of knowledge* for chemistry (Pulmones, 2010; Geban and Çam, 2010), in *simplicity of knowledge*, the source *knowledge, and justification for knowing* for online searching (Mason et al., 2011), in *justification of knowledge*, *attainability of truth* and *source of knowledge* for statistics (Muis et al., 2011), and in simple *knowledge* and *source of knowledge* for mathematics (Op'tEynde et al., 2006).

The degree of influence varies from one discipline to another. For example, Pulmones (2010), and Geban and Çam (2010) found chemistry students have sophisticated beliefs in *simplicity/certainty knowledge and source of knowledge* while Mason et al. (2011) carried out a study in online searching which found sophisticated specific beliefs of participants in *simplicity of knowledge, the source of knowledge, and justification of knowing* and Op'tEynde et al. (2006) found sophisticated beliefs in *simple knowledge and source of knowledge* in specific-domain beliefs. Mori (1999) found that specific beliefs about mathematics are more sophisticated in the dimensions of *simplicity/certainty of knowledge* than the dimensions of *simple and certain knowledge* in general beliefs.

The development of the beliefs towards a specific-domain are affected by the learning environment used for introducing the domain to the learners (Franco et al., 2012), the learning content that the learners receive while studying courses in this domain (Bromme et al.,2010) and the way the knowledge about the domain is represented (Mislevy et al., 2010). This can be found through the textbooks, curriculum, teaching methods, integrating technology, and evaluation used during the learning process (Haerle and Bendixen, 2008). According to the findings of this study, the level of the learners' specific-domain beliefs after studying a course are certainly influenced because learners are involved in the subject domain and receive information in-depth and experiences through assignments and projects, dealing with experts in the field, help with integration of facts in the same subject (or even in other subjects) so as to build new knowledge. In other words, learners at some point can raise questions that may not yet have answers or they may discover (for themselves) new ways to reach the right answers.

The findings reflect that learners' knowledge is gradually developed during information literacy courses in such a way as to become more sophisticated. Similarly, there is a clear development in undergraduates' beliefs when they study mathematics (Liu, 2009), physics (Ogan-Bekiroglu and Sengul-Turgut, 2011), or information systems (Tolhurst, 2007) showing that the more sophisticated levels of learners' beliefs result from the learning process and course structures.

After looking at the results of the impact of information literacy on the general and specific-domain epistemological beliefs, it seems that previous knowledge in information literacy has a clear effect on both general and specific-domain beliefs, in other words, undergraduates who study these courses hold more sophisticated belief levels than those who do not. At the same time, the influence of the course is stronger on their specific beliefs than on their general beliefs. This means that the information literacy yes-group show a more developed sophisticated belief level about knowledge and knowing in information literacy than in general knowledge. Furthermore, the range of differences between the epistemological beliefs of the *yes and no group* is larger than in their specific-domain beliefs than in their general beliefs. The undergraduates with previous knowledge of information literacy hold sophisticated beliefs towards the domain of information literacy across all four specific-domain belief dimensions: *certainty/simplicity of knowledge, justification of knowledge, source of knowledge,* and *attainment of truth.*

After discussing each variable independently using the questionnaires SEQ and DFEBQ, the findings of SEQ show that academic level fourth year and major art participants hold more sophisticated general knowledge beliefs than the first year and science participants. The results of DFEBQ also illustrate that academic level fourth year participants have significant specific knowledge beliefs but there was no influence for the major variable. With regard to gender, the findings of both SEQ and DFEBQ demonstrate that there are no significant differences between the epistemological beliefs of male and female participants. The results of both SEQ and DFEBQ determine that the epistemological beliefs of participants who took a course in information literacy have more sophisticated beliefs than those who did not. The DFEBQ, which measures the specific knowledge beliefs of the yes group, shows a stronger significant result than the SEQ which measures the general knowledge beliefs of the yes group. The overall results for all variables means that there is a need to carry out further investigations into the interaction relationships between variables.

5.3 Analysis and Discussion of Variables Interaction

After testing the relationship between each factor and the epistemological beliefs which found some significant results, the next step was to analysis the interaction between the factors looking for significant results to explain how learners' beliefs may be influenced, shaped or developed by interaction between the factors to answer the research question related to interaction between the factors and the participants' beliefs, that is, *does interaction between the independent variables (gender, major, academic level and previous knowledge of information literacy) impact the general-domain and the specific-domain on learners' epistemological beliefs?*

The interaction analysis and discussion are divided into two parts: the first deals with the interactions between variables including gender, major and academic level, answering the research question as to the impact of such interactions on general-domain and specific-domain beliefs. The second focuses on interactions between information literacy and other variables, answering the research question as to the interaction influence of previous knowledge of information literacy and other variables.

Two-way ANOVA and three-way ANOVA analyses were applied next to determine any effective interaction between the independent variables, that is, gender, major and academic level on students' general epistemological beliefs and specific-domain beliefs where the subsets/dimensions of the beliefs are the dependent variables. Further analysis was then carried out to find any significant interaction between information literacy and the other factors. Finally to test the interaction between the four factors together, MANOVA analysis was applied. The analysis provided below will be considered statistically significant interaction when the *p* value is $<.05$ and the effect size partial η^2 is $> .01$.

5.3.1 Interaction between Gender, Major and Academic Level in the Episremological Beliefs

Gender * Major

A 2 (gender) x 2 (major) ANOVA is conducted on the subsets of general epistemological beliefs (see Table 37). The interaction is statistically not significant through all the subsets with the following results: “seek single answers”, $F(1,746) = .082, p = .775$, partial $\eta^2 = .000$, “avoid integration”, $(1,746) = 3.391$, $p = .066$, partial $\eta^2 = .005$, “avoid ambiguity”, $F(1,746) = 2.744$, $p = .098$, partial $\eta^2 = .004$, “knowledge is certain”, $(1,746) = .197$, $p = .658$, partial $\eta^2 = .000$, “don’t criticize authority”, $F(1,746) = 4.232$, $p = .040$, partial $\eta^2 = .006$, “depend on authority“, $F(1,746) = 4.188$, $p = .041$, partial $\eta^2 = .006$, “can't learn how to learn”, $F(1,746) = .686$, $p = .408$, partial $\eta^2 = .001$, “success is unrelated to hard work”, $F(1,746) = .212$, $p = .645$, partial $\eta^2 = .000$, “ability to learn is innate”, $F(1,746) = .920$, $p = .338$, partial $\eta^2 = .001$, “learning is quick”, $F(1,746) = 1.711$, $p = .191$, partial $\eta^2 = .002$, and “learn first time without concentrated effort”, $F(1,746) = .077$, $p = .782$, partial $\eta^2 = .000$

Table 37 Tests of Between-Subjects Effects for interaction gender*major in general beliefs

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1.Seek single answers	Gender * Major	.069	1	.069	.082	.775	.000	.082	.059
	Error	624.974	746	624.974					
2. Avoid integration	Gender * Major	4.851	1	4.851	3.391	.066	.005	3.391	.452
	Error	1067.322	746	1.431					
3. Avoid ambiguity	Gender * Major	3.899	1	3.899	2.744	.098	.004	2.744	.380
	Error	1060.020	746	1.421					
4. Knowledge is certain	Gender * Major	.249	1	.249	.197	.658	.000	.197	.073
	Error	943.659	746	1.265					
5. Don’t criticize authority	Gender * Major	6.171	1	6.171	4.232	.040	.006	4.232	.538
	Error	1087.660	746	1.458					
6. Depend on authority	Gender * Major	6.913	1	6.913	4.188	.041	.006	4.188	.533
	Error	1231.473	746	1.651					
7.Can't learn how to learn	Gender * Major	1.198	1	1.198	.686	.408	.001	.686	.131
	Error	1303.449	746	1.747					
8. Success is unrelated to hard work	Gender * Major	.229	1	.229	.212	.645	.000	.212	.075
	Error	808.149	746	1.083					
9. Ability to learn is innate	Gender * Major	1.183	1	1.183	.920	.338	.001	.920	.160
	Error	959.841	746	1.287					
10. Learning is quick	Gender * Major	1.906	1	1.906	1.711	.191	.002	1.711	.257
	Error	831.008	746	1.114					
11. Learn first time without concentrated effort	Gender * Major	.085	1	.085	.077	.782	.000	.077	.059
	Error	829.521	746	1.112					

Regarding the specific-domain beliefs, a 2 (gender) x 2 (major) ANOVA is conducted on the dimensions (see Table 38). The interaction is statistically not significant in three dimensions, these being *certainty/simplicity of knowledge*, $F(1,746) = .817, p = .366$, partial $\eta^2 = .001$, *justification of knowledge*, $F(1,746) = 1.916, p = .167$, partial $\eta^2 = .003$ and *attainment of truth*, $F(1,746) = .215, p = .643$, partial $\eta^2 = .000$. A statistically significant interaction was found between gender and major in the dimension of *source of knowledge*, F(1,746) = 15.419,p = .000, partial η^2 = .020.

Table 38 Tests of Between-Subjects Effects interaction gender*major/specific-domain beliefs

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1.Certainty/simplicity of knowledge	Gender * major	.645	1	.645	.817	.366	.001	.817	.147
	Error	588.884	746	.789					
2.Justification of knowledge	Gender * major	2.070	1	2.070	1.916	.167	.003	1.916	.282
	Error	805.953	746	1.080					
3. Source of knowledge	Gender * major	17.930	1	17.930	15.419	.000	.020	15.419	.975
	Error	867.473	746	1.163					
4. Attainment of truth	Gender * major	.316	1	.316	.215	.643	.000	.215	.075
	Error	1096.090	746	1.469					

To determine which group scored the higher and the lower mean values in the significant dimension *source of knowledge* a comparison between the mean values (see Table 39) indicate that the highest mean value was scored by males from science majors (N=133, M=3.2763, SD=1.03319) whereas the lowest mean value was scored by females from art majors (N=244, M=2.9437, SD=1.03972).

Table 39 Descriptive Statistics for interaction between gender*major/specific-domain beliefs

Dimension	Gender	Major	Mean	Std. Deviation	N
3. Source of knowledge	Male	Science	3.2763	1.03319	133
		Art	2.6712	1.13397	130
		Total	2.9772	1.12376	263
	Female	Science	2.9008	1.10858	247
		Art	2.9437	1.03972	240
		Total	2.9220	1.07431	487
	Total	Science	3.0322	1.09619	380
		Art	2.8480	1.08014	370
		Total	2.9413	1.09147	750

Gender * Academic level

A 2 (gender) x 2 (academic level) ANOVA is conducted on the subsets of general epistemological beliefs (see Table 40). The interaction was statistically significant on the beliefs of “success is unrelated to hard work “ F(1,746) = 20.694,p = .000, partial η^2 = .027 whereas, the interaction was statistically not significant through all the remaining subsets with the following results: “seek single answers”, $F(1,746) = .347, p = .556$, partial $\eta^2 = .000$, “avoid integration”, $F\ (1,746) = .014$, $p = .907$, partial $\eta^2 = .000$, “avoid ambiguity”, $F(1,746) = .440$, $p = .507$, partial $\eta^2 = .001$, “knowledge is certain”, $(1,746) = .098$, $p = .754$, partial $\eta^2 = .000$, “don’t criticize authority”, $F(1,746) = 6.520$, $p = .011$, partial $\eta^2 = .009$, “depend on authority“, $F(1,746) = .618$, $p = .432$, partial $\eta^2 = .001$, “can't learn how to learn”, $F(1,746) = .003$, $p = .954$, partial $\eta^2 = .000$, “ability to learn is innate”, $F(1,746) = 4.735$, $p = .030$, partial $\eta^2 = .006$, “learning is quick”, $F(1,746) = .776$, $p = .379$, partial $\eta^2 = .001$, and “learn first time without concentrated effort”, $F(1,746) = .016$, $p = .900$, partial $\eta^2 =.000$

Table 40 Tests of Between-Subjects Effects for interaction gender*AL for general beliefs

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1.Seek single answers	gender * Academic Level	.281	1	.281	.347	.556	.000	.347	.090
	Error	605.149	746	.811					
2. Avoid integration	gender * Academic Level	.018	1	.018	.014	.907	.000	.014	.052
	Error	962.596	746	1.290					
3. Avoid ambiguity	gender * Academic Level	.630	1	.630	.440	.507	.001	.440	.102
	Error	1068.469	746	1.432					
4. Knowledge is certain	gender * Academic Level	.112	1	.112	.098	.754	.000	.098	.061
	Error	853.482	746	1.144					
5. Don’t criticize authority	gender * Academic Level	9.296	1	9.296	6.520	.011	.009	6.520	.722
	Error	1063.612	746	1.426					
6. Depend on authority	gender * Academic Level	1.104	1	1.104	.618	.432	.001	.618	.123
	Error	1332.633	746	1.786					
7.Can't learn how to learn	gender * Academic Level	.005	1	.005	.003	.954	.000	.003	.050
	Error	1211.546	746	1.624					
8. Success is unrelated to hard work	gender * Academic Level	18.260	1	18.260	20.694	.000	.027	20.694	.995
	Error	658.283	746	.882					
9. Ability to learn is innate	gender * Academic Level	5.100	1	5.100	4.735	.030	.006	4.735	.584
	Error	5.100	1	5.100					
10. Learning is quick	gender * Academic Level	.762	1	.762	.776	.379	.001	.776	.142
	Error	732.467	746	.982					
11. Learn first time without concentrated effort	gender * Academic Level	.013	1	.013	.016	.900	.000	.016	.052
	Error	619.677	746	.831					

To determine which group scored the higher and the lower mean values in the significant subset “success is unrelated to hard work” a comparison between the mean values (see Table 41) indicate that the highest mean value was scored by males from the first-year (N=130, M=3.3952, SD=.92250) whereas the lowest mean value was scored by females from the fourth-year (N= 227,M= 2.2753,SD=.94493).

Table 41 Descriptive statistics for interaction between gender*AL for general beliefs

Subset	Gender	Academic Level	Mean	Std. Deviation	N
8.Success is unrelated to hard work	Male	First-year	3.3952	.89282	130
		Fourth-year	2.9135	1.03080	133
		Total	3.1435	1.00432	263
	Female	First-year	3.3788	.92250	260
		Fourth-year	2.2753	.94493	227
		Total	2.8732	1.07366	487
	Total	First-year	3.3897	.90167	390
		Fourth-year	2.5111	1.02368	360
		Total	2.9680	1.05710	750

Regarding specific-domain beliefs, a 2 (gender) x 2 (academic level) ANOVA is conducted on the four dimensions (see Table 42). The interaction was statistically not significant across all four dimensions where the results were - *certainty/simplicity of knowledge*, F(1,746) = 1.666, *p* = .197, partial η^2 = .002, *justification of knowledge*, F(1,746) = .343, *p* = .558, partial η^2 = .000, *source of knowledge*, F(1,746) = .517, *p* = .472, partial η^2 = .001 and *attainment of truth*, F(1,746) = .006, *p* = .939, partial η^2 = .000.

Table 42 Tests of Between-Subjects Effects for interaction gender*AL/specific-domain beliefs

Dependent Variable	**Source**	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**	**Noncent. Parameter**	**Observed Power[b]**
1. Certainty/simplicity of knowledge	Gender* Academic Level	1.003	1	1.003	1.666	.197	.002	1.666	.252
	Error	449.070	746	.602					
2.Justification of knowledge	Gender* Academic Level	.317	1	.317	.343	.558	.000	.343	.090
	Error	690.040	746	.925					
3. Source of knowledge	Gender* Academic Level	.539	1	.539	.517	.472	.001	.517	.111
	Error	777.588	746	1.042					
4. Attainment of truth	Gender* Academic Level	.008	1	.008	.006	.939	.000	.006	.051
	Error	1028.547	746	1.379					

Major * Academic level

A 2 (majors) x 2 (academic levels) ANOVA is conducted on the subsets of general epistemological beliefs (see Table 43). The interaction was statistically significant on nine of the general beliefs as follows: "seek single answers", *F*(1,746) = 107.921,*p* = .000, partial η^2 = .126, "avoid integration", (1,746) = 103.669, *p* = .000, partial η^2 = .122, "avoid ambiguity", *F*(1,746) = 90.495, *p* = .000, partial η^2 = .108, "knowledge is certain", (1,746) = 105.062, *p* =

.000, partial η^2 = .123, “can't learn how to learn”, $F(1,746) = 53.164$, $p = .000$, partial η^2 = .067, “success is unrelated to hard work “$F(1,746) = 16.849$,$p = .000$, partial η^2 = .022, “ability to learn is innate”, $F(1,746) = 27.637$, $p = .000$, partial η^2 = .036, “learning is quick”, $F(1,746)$ = 52.979, $p = .000$, partial η^2 = .066 and “learn first time without concentrated effort”, $F(1,746) = 32.409$, $p = .000$, partial η^2 =.042 whereas, the interaction was statistically not significant through the two remaining subsets with the following results: “don’t criticize authority”, $F(1,746) = 6.815$, $p = .009$, partial η^2 = .009, “depend on authority“, $F(1,746)$ = 3.765, $p = .053$, partial η^2 = .005,

Table 43 Tests of Between-Subjects Effects for interaction major * AL for general beliefs

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1.Seek single answers	major * Academic Level	70.533	1	70.533	107.921	.000	.126	107.921	1.000
	Error	487.559	746	.654					
2. Avoid integration	major * Academic Level	105.118	1	105.118	103.669	.000	.122	103.669	1.000
	Error	756.434	746	1.014					
3. Avoid ambiguity	major * Academic Level	100.410	1	100.410	90.495	.000	.108	90.495	1.000
	Error	827.731	746	1.110					
4. Knowledge is certain	major * Academic Level	93.142	1	93.142	105.062	.000	.123	105.062	1.000
	Error	661.362	746	.887					
5. Don’t criticize authority	major * Academic Level	8.476	1	8.476	6.815	.009	.009	6.815	.741
	Error	927.841	746	1.244					
6. Depend on authority	Major * Academic Level	5.092	1	5.092	3.765	.053	.005	3.765	.491
	Error	1008.959	746	1.352					
7.Can't learn how to learn	Major * Academic Level	80.505	1	80.505	53.164	.000	.067	53.164	1.000
	Error	1129.663	746	1.514					
8. Success is unrelated to hard work	Major * Academic Level	14.706	1	14.706	16.849	.000	.022	16.849	.984
	Error	651.106	746	.873					
9. Ability to learn is innate	Major * Academic Level	29.222	1	29.222	27.637	.000	.036	27.637	.999
	Error	788.777	746	1.057					
10. Learning is quick	Major * Academic Level	47.460	1	47.460	52.979	.000	.066	52.979	1.000
	Error	668.277	746	.896					
11. Learn first time without concentrated effort	Major * Academic Level	25.675	1	25.675	32.409	.000	.042	32.409	1.000
	Error	591.002	746	.792					

To determine which group scored the higher and the lower mean values in the significant interaction, a comparison between the mean values (see Table 44) indicated that the highest mean value was scored by first-year students with science majors and the lowest mean value was scored by fourth-year students with art majors, as follows: “seek single answers” first-year/science (N= 180, M= 3.1827, SD= .94349) and fourth-year/art (N= 160, M= 1.9142, SD= .56181), “avoid integration” first-year/science (N= 180, M=3.5618, SD= 1.13250) and fourth-year/art (N= 160, M= 1.7055, SD= .56328), "avoid ambiguity" first-year/science (N= 180, M= 3.6444, SD= 1.00758) and fourth-year/ art (N= 160, M= 1.8662, SD= .75260), "knowledge is certain" first-year/science (N= 180, M= 3.6792, SD= 1.00775), and fourth-year/art (N= 160, M= 1.8922, SD= .64160), "can't learn how to learn" first-year/science (N= 180, M= 3.6590, SD= 1.26891), and fourth-year/art (N= 160, M= 2.2713, SD= 1.29427), "success is unrelated to hard work" first-year/science (N= 180, M= 3.4486, SD= .97658), and fourth-year/art (N= 160, M= 2.1375, SD= .92689), "ability to learn is innate" first-year/science (N= 180, M= 3.4056, SD= 1.05807), and fourth-year/art (N= 160, M= 2.2781, SD= 1.10388), "learning is quick" first-year/science (N= 180, M= 3.4244, SD= 1.08079), and fourth-year/art (N= 160, M= 2.2725, SD= .97451) and "learn first time without concentrated efforts" first-year/science (N= 180, M= 3.5676, SD= 1.05266), and fourth-year/art (N= 160, M= 2.1163, SD= .86946).

Table 44 Descriptive statistics for the interaction between major*AL in general beliefs

subset	Major	Academic Level	Mean	Std. Deviation	N
1.Seek single answers	Science	First-year	3.1827	.94349	180
		Fourth-year	3.1159	.85727	200
		Total	3.1325	.89811	380
	Art	First-year	3.1510	.79407	210
		Fourth-year	1.9142	.56181	160
		Total	2.6342	.94294	370
2. Avoid integration	Science	First-year	3.5618	1.13250	180
		Fourth-year	3.2325	1.15554	200
		Total	3.3885	1.15497	380
	Art	First-year	3.5405	1.00403	210
		Fourth-year	1.7055	.56328	160
		Total	2.7470	1.23950	370
3. Avoid ambiguity	Science	First-year	3.6444	1.00758	180
		Fourth-year	3.5080	1.16254	200
		Total	3.5726	1.09259	380
	Art	First-year	3.4743	1.17184	210
		Fourth-year	1.8662	.75260	160
		Total	2.7789	1.28771	370
4. Knowledge is certain	Science	First-year	3.6792	1.00775	180
		Fourth-year	3.3625	.98505	200
		Total	3.5125	1.00707	380
	Art	First-year	3.6262	1.02838	210
		Fourth-year	1.8922	.64160	160
		Total	2.8764	1.23140	370
7.Can't learn how to learn	Science	First-year	3.6590	1.26891	180
		Fourth-year	3.0710	1.31078	200
		Total	3.1042	1.28990	380
	Art	First-year	3.1411	1.05628	210
		Fourth-year	2.2713	1.29427	160
		Total	3.0589	1.35194	370
8.Success is unrelated to hard work	Science	First-year	3.4486	.97658	180
		Fourth-year	2.8100	1.00102	200
		Total	3.1125	1.03851	380
	Art	First-year	3.3393	.83118	210

		Fourth-year	2.1375	.92689	160
		Total	2.8196	1.05685	370
9. Ability to learn is innate	Science	First-year	3.4056	1.05807	180
		Fourth-year	2.8787	1.01835	200
		Total	3.1283	1.06894	380
	Art	First-year	3.5988	.94909	210
		Fourth-year	2.2781	1.10388	160
		Total	3.0277	1.21017	370
10: Learning is quick	Science	First-year	3.4244	1.08079	180
		Fourth-year	3.1220	.88557	200
		Total	3.2653	.99314	380
	Art	First-year	3.5867	.85315	210
		Fourth-year	2.2725	.97451	160
		Total	3.0184	1.11646	370
11. Learn first time without concentrated effort	Science	First-year	3.5676	1.05266	180
		Fourth-year	2.6450	.78694	200
		Total	2.9800	.98668	380
	Art	First-year	3.3522	.84497	210
		Fourth-year	2.1163	.86946	160
		Total	2.9400	1.11738	370

Regarding the specific-domain beliefs, a 2 (major) x 2 (academic level) ANOVA is conducted on the four dimensions (see Table 45). The interaction was statistically not significant across three dimensions where the results were: *certainty/simplicity of knowledge*, F(1,746) = .065, p = .799, partial η^2 = .000, *justification of knowledge*, F(1,746) = 3.379, p = .066, partial η^2 = .005, *source of knowledge*, F(1,746) = 1.924 and p = .166, partial η^2 = .003 whereas there was a small significant interaction in *attainment of truth*, F(1,746) = 9.821, p = .002, partial η^2 = .013.

Table 45 Tests of Between-Subjects Effects for interaction major*AL/specific-domain beliefs

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1. Certainty/simplicity of knowledge	Major * Academic Level	.039	1	.039	.065	.799	.000	.065	.057
	Error	450.000	746	.603					
2.Justification of knowledge	Major * Academic Level	3.114	1	3.114	3.379	.066	.005	3.379	.451
	Error	687.477	746	.922					
3. Source of knowledge	Major * Academic Level	1.973	1	1.973	1.924	.166	.003	1.924	.283
	Error	764.909	746	1.025					
4. Attainment of truth	Major * Academic Level	13.247	1	13.247	9.821	.002	.013	9.821	.879
	Error	1006.247	746	1.349					

To determine which group scored the higher and the lower mean values in the significant interaction regarding the dimension *attainment of truth*, a comparison between the mean values (see Table 46) indicated that the highest mean value was scored by first-year students with science majors (N= 180, M= 3.4861, SD= 1.04965) whereas the lowest mean value was scored by fourth-year students with art majors (N= 160, M= 2.6187, SD= 1.15536).

Table 46 Descriptive statistics for the interaction between major*AL/specific-domain beliefs

Dimension	Major	Academic Level	Mean	Std. Deviation	N
4. Attainment of truth	Science	First-year	3.4861	1.04965	180
		Fourth-year	2.5775	1.24721	200
		Total	3.0079	1.24237	380
	ART	First-year	2.9929	1.17233	210
		Fourth-year	2.6187	1.15536	160
		Total	2.8311	1.17816	370
	Total	First-year	3.2205	1.14281	390
		Fourth-year	2.5958	1.20577	360
		Total	2.9207	1.21354	750

Gender * Major * Academic level

A three-way ANOVA (2 gender X 2 majors X 2 academic levels) is conducted on the subsets of general epistemological beliefs (see Table 47). The interaction was statistically not significant in the general belief subsets with the following results: “seek single answers”, $F(1,742) = 1.549, p = .214$, partial $\eta^2 = .002$, “avoid integration”, (1,742) = 1.506, $p = .220$, partial $\eta^2 = .002$, “avoid ambiguity”, $F(1,742) = .182$, $p = .670$, partial $\eta^2 = .000$, “knowledge is certain”, (1,742) = .464, $p = .496$, partial $\eta^2 = .001$, “don’t criticize authority”, $F(1,742) = .093$, $p = .760$, partial $\eta^2 = .000$, “depend on authority“, $F(1,742) = 1.568$, $p = .211$, partial $\eta^2 = .002$, “can't learn how to learn”, $F(1,742) = .314$, $p = .575$, partial $\eta^2 = .000$, “success is unrelated to hard work “$F(1,742) = .390, p = .532$, partial $\eta^2 = .001$, “ability to learn is innate”, $F(1,742) = .002$, $p = .964$, partial $\eta^2 = .000$, and “learn first time without concentrated effort”, $F(1,742) = 32.409$, $p = .423$, partial $\eta^2 =.001$. Except for the subset “learning is quick” there is significant interaction between the three factors, i.e. gender, major and academic level, $F(1,742) = 52.979$, $p = .000$, partial $\eta^2 = .066$.

Table 47 Tests of Between-Subjects Effects for interaction gender*major*AL/general beliefs

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1.Seek single answers	Gender*Major *Academic Level	.992	1	.992	1.549	.214	.002	1.549	.237
	Error	475.233	742	.640					

2. Avoid integration	Gender*Major *Academic Level	1.514	1	1.514	1.506	.220	.002	1.506	.232
	Error	746.195	742	1.006					
3. Avoid ambiguity	Gender*Major *Academic Level	.201	1	.201	.182	.670	.000	.182	.071
	Error	819.140	742	1.104					
4. Knowledge is certain	Gender*Major *Academic Level	.413	1	.413	.464	.496	.001	.464	.104
	Error	660.586	742	.890					
5. Don't criticize authority	gender *Major* Academic Level	.114	1	.114	.093	.760	.000	.093	.061
	Error	907.905	742	1.224					
6. Depend on authority	Gender*Major *Academic Level	2.110	1	2.110	1.568	.211	.002	1.568	.240
	Error	998.573	742	1.346					
7.Can't learn how to learn	Gender*Major *Academic Level	.477	1	.477	.314	.575	.000	.314	.087
	Error	1125.886	742	1.517					
8. Success is unrelated to hard work	Gender*Major *Academic Level	.324	1	.324	.390	.532	.001	.390	.096
	Error	615.814	742	.830					
9. Ability to learn is innate	Gender*Major *Academic Level	.002	1	.002	.002	.964	.000	.002	.050
	Error	663.048	742	.894					
10. Learning is quick	Gender*Major *Academic Level	47.460	1	47.460	52.979	.000	.066	52.979	1.000
	Error	668.277	746	.896					
11. Learn first time without concentrated effort	Gender*Major *Academic Level	.511	1	.511	.643	.423	.001	.643	.126
	Error	589.764	742	.795					

To determine which group scored the higher and the lower mean values in the significant interaction regarding the subset "learning is quick", a comparison between the mean values (see Table 48) indicated that the highest mean value was scored by male first-year students with science majors (N= 60, M= 3.4433, SD= 1.26871) whereas the lowest mean value was scored by female fourth-year students with art majors (N=100, M= 2.2060, SD= .94728).

Table 48 Descriptive statistics for the interaction between gender*major*AL/general beliefs

subset	Gender	Major	Academic Level	Mean	Std. Deviation	N
10: Learning is quick	Male	Science	First-year	3.4433	1.26871	60
			Fourth-year	3.0795	.89613	73
			Total	3.2436	1.09110	133
		Art	First-year	3.7771	.73231	70
			Fourth-year	2.3833	1.01667	60
			Total	3.1338	1.11630	130
	Female	Science	First-year	3.4150	.97917	120
			Fourth-year	3.1465	.88208	127
			Total	3.2769	.93830	247
		Art	First-year	3.4914	.89487	140
			Fourth-year	2.2060	.94728	100
			Total	2.9558	1.11388	240

Regarding the specific-domain beliefs, a three-way ANOVA is conducted on the four dimensions (see Table 49). The interaction was statistically significant in one dimension *certainty/simplicity of knowledge*, $F(1,742) = 10.930$, $p = .001$, partial $\eta^2 = .015$, whereas there was no significant interaction in the remaining three dimensions, i.e. *justification of knowledge*, F(1,742) = 1.563, *p* = .212, partial η^2 = .002, *source of knowledge*, F(1,742) = 3.149 and *p* = .076, partial η^2 = .004 and *attainment of truth*, F(1,742) = .755, *p* = .385, partial η^2 = .001.

Table 49 Tests of Between-Subjects Effects interaction gender*major*AL/specific-domain

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1.Certainty/simplicity of knowledge	Gender*Major * Academic Level	6.505	1	6.505	10.930	.001	.015	10.930	.910
	Error	441.603	742	.595					
2.Justification of knowledge	Gender*Major * Academic Level	1.441	1	1.441	1.563	.212	.002	1.563	.239
	Error	683.812	742	.922					
3. Source of knowledge	Gender*Major * Academic Level	3.151	1	3.151	3.149	.076	.004	3.149	.426
	Error	742.385	742	1.001					
4. Attainment of truth	Gender*Major * Academic Level	1.021	1	1.021	.755	.385	.001	.755	.140
	Error	1003.373	742	1.352					

To determine which group scored the highest and the lowest mean values in the significant interaction regarding the dimension *certainty/simplicity of knowledge*, a comparison between the mean values (see Table 50) indicated that the highest mean value was scored by male first-year students with art majors (N= 70, M= 3.6250, SD= .73228) whereas the lowest mean value was scored by female fourth-year students with science majors (N=127, M= 2.5039, SD= .69041).

Table 50 Descriptive statistics for the interaction between gender*major*AL/specific-domain

dimension	Gender	Major	Academic Level	Mean	Std. Deviation	N
1. Certainty/simplicity of knowledge	Male	Science	First-year	3.3688	.84699	60
			Fourth-year	2.8579	.81392	73
			Total	3.0883	.86435	133
		Art	First-year	3.6250	.73228	70
			Fourth-year	2.5792	.84872	60
			Total	3.1423	.94351	130
	Female	Science	First-year	3.5448	.70035	120
			Fourth-year	2.5039	.69041	127
			Total	3.0096	.86784	247
		Art	First-year	3.5161	.72931	140
			Fourth-year	2.7250	.89735	100
			Total	3.1865	.89198	240

5.3.2 Discussion of the impact of Interaction between Gender, Major and Academic Level on Undergraduates' Epistemological Beliefs

This section discusses the findings of the interaction between the independent variables of the study (gender, major, academic level) towards the general-knowledge and the specific knowledge beliefs. Studying interactions between the variables will obtain further explanations as to which variable may affect the development of epistemological beliefs.

Many studies have been carried out investigating interactions between gender, major, academic level and discipline. Some argue that there are interactions between academic level and gender (Neber and Schommer, 2002; Schommer-Aikins and Easter, 2006), and others claim that interactions can be found between academic level and majors (Ren et al., 2009; King et al., 1990).

On the other hand, some have found no sign of interactional impact between such variables. For example between academic level and gender (Ismail et al., 2012), academic level and major (Ren et al., 2009), major and gender (Tűmkaya, 2012; Çam and Geban, 2010; Ren et al., 2009) and between major, gender and academic level (Ren et al., 2009).

After testing the data of this study to measure the interactions of general epistemological beliefs of the undergraduates focusing on gender, major and academic level, the outcomes shows that academic levels always interact with either major, gender or with both whereas no interaction occurred between gender and major (see Table 51).

Table 51 Interaction between general beliefs and gender, major and academic level

Interaction	Dimensions	subset	Sig.	Partial Eta Squared	Highest groups	Lowest groups	Highest means	Lowest means
Gender* academic level	Ability to learn	8. Success is unrelated to hard work	.000	.027	male first year	Female fourth year	3.3952	2.2753
Major* Academic level	Structure of knowledge	1.Seek single answers	.000	.126	science first year	Art fourth year	3.1827	1.9142
		2. Avoid integration	.000	.122	Science first year	Art fourth year	3.5618	1.7055
	Stability of knowledge	3. Avoid ambiguity	.000	.108	Science first year	Art fourth year	3.6444	1.8662

		4. Knowledge is certain	.000	.123	Science first year	Art fourth year	3.6792	1.8922
	Ability to learn	7.Can't learn how to learn	.000	.067	science first year	Art fourth year	3.6590	2.2713
		8. Success is unrelated to hard work	.000	.022	Science first year	Art fourth year	3.4486	2.1375
		9. Ability to learn is innate	.000	.036	Science first year	Art fourth year	3.4056	2.2781
	Speed of learning	10. Learning is quick	.000	.066	Science first year	Art fourth year	3.4244	2.2725
		11. Learn first time without concentrated effort	.000	.042	science first year	Art fourth year	3.5676	2.1163
Gender* major* academic level	Speed of learning	10: Learning is quick	.000	.066	male science first-year	female art fourth-year	3.4433	2.2060

Academic level and major

The academic level interacted differently with major than with gender. The findings of the academic level and major interaction show that there is a critical impact on general epistemological beliefs of undergraduates in all subsets of the *dimensions of structure of knowledge, stability of knowledge, ability to learn,* and *speed of learning.* The more sophisticated level of general beliefs are held by the fourth year art undergraduates and the less sophisticated beliefs are held by the first year science undergraduates. In other words, the fourth-year undergraduates studying art major believe that general knowledge is neither simple nor certain and learning occurs through efforts and several attempts rather than being quick and an innate ability. The interactional effect between the general epistemological beliefs of the first year science and the fourth year art undergraduates varies depending on the dimensions. The values of effect size of the dimensions range between medium (for the dimensions of *ability to learn* and *speed of learning*), to high effect (for the dimensions of *structure of knowledge* and *stability of knowledge*).

Academic level and gender

The impact of the interaction between academic level and gender is almost absent because there is only one subset, that is, the *ability to learn* dimension which was found to be significant with a very modest difference. The fourth year female undergraduates have more sophisticated general beliefs than the first year male students in the subset of *success is unrelated to hard work*. The fourth year female undergraduates believe that *success can happen if they work hard*. The value of effect size of the *success is unrelated to hard work* subset has a small interactional effect between the general beliefs of the first year male and fourth year female undergraduates. This interaction is too weak to be treated as a finding for this study.

Gender* major* academic level

Another modest interaction impact found that the academic level, gender, and major have differences only in *learning is quick* subset which comes under the dimension of *speed of learning*. This means that the fourth year art female undergraduates hold more sophisticated general beliefs because learning has occurred after several attempts whereas the first year science male students have less sophisticated beliefs about the *speed of learning* considering that learning occurs quickly. The findings confirm that there is a medium interaction effect size of the l*earning is quick* subset between the general beliefs of the first year science male and fourth year female art undergraduates.

With regards to specific-domain beliefs, the interactions of the variables gender, major and academic level Table 52 illustrate that the major always interacts with either academic level, gender or with both whereas there is no interaction between gender and academic level.

Table 52 Interaction between specific-domain beliefs and gender, major and academic level

Interaction	**dimensions**	**Sig.**	**Partial Eta Squared**	**Highest groups**	**Lowest groups**	**Highest means**	**Lowest means**
Gender * major	3.Source of knowledge	.000	.020	males science	females art	3.2763	2.9437
Major * Academic level	4. Attainment of truth	.002	.013	first-year science	fourth-year art	3.4861	2.6187
Gender* major* academic level	1.Certainty/simplicity of knowledge	.001	.015	male first-year	female fourth-year	3.6250	2.5039

				art	science		

Gender * major

The influence of the interactions between major and gender shows that there is a small difference in one dimension, that is, *source of knowledge* while for the other dimensions there are no differences. The female art undergraduates have more sophisticated specific beliefs than the science male undergraduates in the dimension of *source of knowledge*. The female art undergraduates think that experts and educators are not the main source of knowledge in the field of information literacy whereas male science undergraduates depend slightly on educators. The effect size value for the dimension of *source of knowledge* has a modest interactional effect for gender and major variables indicating that the difference between the two variables is small.

Major * Academic level

The impact of the interactions between major and academic level demonstrates a little difference which appears only in one dimension, that is, *attainment of truth* while no significant interaction was found in the other dimensions. The art fourth year undergraduates have more sophisticated specific-domain beliefs than the science first years meaning that the art fourth year undergraduates believe less than the science first year undergraduates about *the attainment of truth* in the field of information literacy. The effect size value is weak for the interaction between the variables of major and academic with regards to the undergraduates' specific beliefs.

Gender* major* academic level

Another impact on the interaction found between the three variables major, academic level and gender becomes visible in the dimension of *certainty/simplicity of knowledge*. The findings of the 3-way interactions reflect that the fourth year female undergraduates who were majoring in science hold more sophisticated specific-domain beliefs believing that knowledge in information science is *complex and changing* while the first year male undergraduates who were majoring in art hold less sophisticated beliefs about the *certainty/simplicity of knowledge* in information literacy believing that knowledge is simple and certain. The interaction effect size of the undergraduates' specific-domain beliefs was found to be small between the three variables and the dimension of *certainty/simplicity of knowledge*.

After investigating the interaction between gender, major, and academic level, it is worth noting that academic levels have more interaction influences on the general knowledge beliefs of the undergraduates than other variables. Other studies have also found that academic level interactions with the other variables have more influence in shaping and developing general beliefs across the different dimensions (Neber and Schommer, 2002; Schommer-Aikins and Easter, 2006; Ren et al., 2009). Regardless as to whether there is an influence of gender, major or discipline, it is argued here that the clear influence of the academic level is caused by the knowledge improvement of learners taking place from one academic level to the next because learners receive more knowledge, experience and practice which shows in the way they view the knowledge structure and the knowing process. In other words, learners are gradually building and becoming more familiar more with knowledge year after year.

Regarding the interaction between the variables in the specific-domain beliefs, the major interacts significantly with specific-domain beliefs. Although any significant interaction appeared only in one specific beliefs dimension, that is, the undergraduates' major interacts with gender or academic level or both. Similarly, previous studies have also found that learners' majors interact with other variables (gender, discipline, academic level) confirming that majors play a vital role in the learners' beliefs (Terzi et al., 2012; Erdem, 2007; Pieschl et al., 2008).

To summarise, the academic level shows a clear interaction with the major variable in all general belief dimensions except that of the *source of knowledge* while major interacts with other variables in one specific-domain beliefs dimension for each interaction. The effect size of academic level interactions in the general beliefs range between medium to high value while the effect size of major interactions on specific beliefs are too small and weak. Academic level always interacts with the major regardless of whether the domain is general or specific. Academic level shows stronger interaction with major in general-domain beliefs than with specific-domain beliefs. In brief, significant interaction between the variables of the learners shows that the more developed general knowledge beliefs and specific-domain beliefs will be held by the female art undergraduate learners.

After discussing the interactions between the three factors gender, major and academic level for the undergraduates general knowledge beliefs and specific-domain beliefs they can be described as follows. The factor of academic level plays a vital role in influencing the general beliefs influencing other variables in shaping the learners' beliefs, whereas for the specific-domain beliefs the major has a clear interaction with other variables forming the learners' beliefs regardless of the fact that the size of this effect is small and is shown in only one dimension. Fourth-year, art-major undergraduates who have more sophisticated levels in both general-domain and specific-domain beliefs are the ones who develop their beliefs better than other learners.

5.3.3 Interaction between Previous Knowledge in Information Literacy and the Variables

Information literacy as a discipline falls within the scope of studying epistemological beliefs in this study as shown above. This section aims to look for differences in beliefs held by the participants who had studied information literacy before and those who had not to ascertain how their previous knowledge of information literacy interacted with the other factors. The analysis was carried out to ascertain the answer to the research question regarding the interaction of information literacy with the other factors. Analysis of and interaction between information literacy and the other factors are presented below.

To test the interaction for previous knowledge in information literacy and gender, major and academic level ANOVA analysis will be applied where the factors are the independent variables and the subsets of the general beliefs and the dimensions of the specific-domain beliefs are the dependent variables. The results of the analysis are provided next looking for significant interaction where $p < .05$ and effect size $\eta^2 > .01$.

Information literacy * Gender

The interaction between the two factors information literacy (yes-group and no-group) and gender (male and female) in the general epistemological beliefs questionnaire was tested using ANOVA analysis. The findings of the interaction (see Table 53) is statistically not significant in nine general belief subsets with the following results: “seek single answers”, $F(1,746) = .002$, $p = .964$, partial $\eta^2 = .000$, “avoid integration”, $(1,746) = .726$, $p = .395$, partial $\eta^2 = .001$, “avoid ambiguity”, $F(1,746) = .061$, $p = .804$, partial $\eta^2 = .000$, “knowledge is certain”, $(1,746) = 1.372$, $p = .242$, partial $\eta^2 = .002$, “don’t criticize authority”, $F(1,746) = 1.747$, $p = .187$, partial $\eta^2 = .002$, “depend on authority”, $F(1,746) = .073$, $p = .786$, partial $\eta^2 = .000$, “can't learn how to learn”, $F(1,746) = .120$, $p = .730$, partial $\eta^2 = .000$, “learning is quick”, $F(1,746) = 2.514$, $p = .113$, partial $\eta^2 = .003$ and “learn first time without concentrated effort”, $F(1,746) = 1.337$, $p = .248$, partial $\eta^2 =.001$. Except for two subsets a significant interaction between information literacy and gender was found with the following results: “success is unrelated to hard work “$F(1,746) = 7.382$, $p = .007$, partial $\eta^2 = .010$ and “ability to learn is innate”, $F(1,746) = 11.003$, $p = .001$, partial $\eta^2 = .002$.

Table 53 Tests of Between-Subjects Effects interaction between IL*gender/general beliefs

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[l]
Information literacy * Gender	1.Seek single answers	.002	1	.002	.002	.964	.000	.002	.050
	Error	671.658	746	.900					
	2. Avoid integration	1.100	1	1.100	.726	.395	.001	.726	.136
	Error	1130.829	746	1.516					
	3. Avoid ambiguity	.096	1	.096	.061	.804	.000	.061	.057
	Error	1163.087	746	1.559					
	4. Knowledge is certain	1.787	1	1.787	1.372	.242	.002	1.372	.216
	Error	971.406	746	1.302					
	5. Don’t criticize authority	2.811	1	2.811	1.747	.187	.002	1.747	.262
	Error	1200.613	746	1.609					
	6. Depend on authority	.149	1	.149	.073	.786	.000	.073	.058
	Error	1510.460	746	2.025					
	7.Can't learn how to learn	.208	1	.208	.120	.730	.000	.120	.064
	Error	1294.280	746	1.735					
	8.Success is unrelated to hard work	7.824	1	7.824	7.382	.007	.010	7.382	.774
	Error	790.630	746	1.060					
	9. Ability to learn is innate	13.477	1	13.477	11.003	.001	.015	11.003	.912
	Error	913.760	746	1.225					
	10: Learning is quick	2.799	1	2.799	2.514	.113	.003	2.514	.353

	Error	830.640	746	1.113					
	11 Learn first time without concentrated effort	1.415	1	1.415	1.337	.248	.002	1.337	.211
	Error	789.338	746	1.058					

To determine which group scored the highest and the lowest mean value for significant interaction regarding the two subsets, a comparison between the mean values (see Table 54) indicated that for the subset "success is unrelated to hard work" the highest mean value was scored by the no-group male students (N= 143, M= 3.1871, SD= .86981) whereas the lowest mean value was scored by the yes-group female students (N=220, M= 2.5852, SD= 1.10719); for the subset "ability to learn is innate" the highest mean value was scored by the no-group male students (N= 143, M= 3.2867, SD= 1.13443) whereas the lowest mean value was scored by the yes-group female students (N=220, M= 2.6352, SD= 1.12346).

Table 54 Descriptive Statistics for the interaction IL*gender for general beliefs

Dimension	IS	gender	Mean	Std. Deviation	N
8.Success is unrelated to hard work	yes	Male	3.0917	1.14584	120
		Female	2.5852	1.10719	220
		Total	2.7640	1.14524	340
	no	Male	3.1871	.86981	143
		Female	3.1105	.98578	267
		Total	3.1372	.94658	410
9. Ability to learn is innate	yes	Male	3.2146	1.25075	120
		Female	2.6352	1.12346	220
		Total	2.8397	1.20059	340
	no	Male	3.2867	1.13443	143
		Female	3.2715	1.00457	267
		Total	3.2768	1.05033	410

Regarding the specific-domain beliefs, for the interaction between the yes-group and the no-group and males and females, a 2 (information literacy) X 2 (gender) ANOVA analysis was applied. The findings of the analysis (see Table 55) showed that there was no statistically significant interaction between the two factors across the four dimensions of beliefs, the results were: *certainty/simplicity of knowledge*, $F(1,746) = .079$, $p = .779$, partial $\eta^2 = .000$, *justification of knowledge*, $F(1,746) = 5.375$, $p = .021$, partial $\eta^2 = .007$, *source of knowledge*, $F(1,746) = 2.576$ and $p = .109$, partial $\eta^2 = .003$ and *attainment of truth*, $F(1,746) = .870$, $p = .351$, partial $\eta^2 = .001$.

Table 55 Tests of Between-Subjects Effects for interaction IL*gender/specific-domain beliefs

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1. Certainty/simplicity of knowledge	Information literacy * Gender	.041	1	.041	.079	.779	.000	.079	.059
	Error	387.277	746	.519					
2.Justification of knowledge	Information literacy * Gender	3.110	1	3.110	5.375	.021	.007	5.375	.639
	Error	431.658	746	.579					
3. Source of knowledge	Information literacy * Gender	2.412	1	2.412	2.576	.109	.003	2.576	.361
	Error	698.499	746	.936					
4. Attainment of truth	Information literacy * Gender	1.163	1	1.163	.870	.351	.001	.870	.154
	Error	997.788	746	1.338					

Information literacy * major

To test the interaction between the yes-group and the no-group with science and art majors, a 2 (information literacy) X 2 (major) ANOVA analysis was applied twice, once on general beliefs subsets and then on specific-domain belief dimensions. The findings of the analysis of general beliefs subsets (see Table 56) showed that the interaction was statistically significant in three subsets with the following results: “seek single answers”, $F(1,746) = .002$, $p = .964$, partial $\eta^2 = .000$, “knowledge is certain”, $(1,746) = 1.372$, $p = .242$, partial $\eta^2 = .002$ and “learning is quick”, $F(1,746) = 2.514$, $p = .113$, partial $\eta^2 = .003$ whereas the interaction between information literacy and the major was statistically not significant among the remaining subsets, showing the following results: “avoid integration”, $(1,746) = .810$, $p = .368$, partial $\eta^2 = .001$, “avoid ambiguity”, $F(1,746) = .610$, $p = .435$, partial $\eta^2 = .001$, “don’t criticize authority”, $F(1,746) = 3.547$, $p = .060$, partial $\eta^2 = .005$, “depend on authority”, $F(1,746) = 6.110$, $p = .014$, partial $\eta^2 = .008$, “can't learn how to learn”, $F(1,746) = 4.554$, $p = .033$, partial $\eta^2 = .006$, “success is unrelated to hard work” $F(1,746) = .263$, $p = .609$, partial $\eta^2 = .000$, “ability to learn is innate”, $F(1,746) = 3.225$, $p = .073$, partial $\eta^2 = .004$ and finally, “learn first time without concentrated effort”, $F(1,746) = .872$, $p = .351$, partial $\eta^2 = .001$.

Table 56 Tests of Between-Subjects Effects for interaction between IL*major/general beliefs

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[l]
Information literacy	1.Seek single answers	9.592	1	9.592	11.519	.001	.015	11.519	.924
	Error	621.209	746	.833					

* Major	2. Avoid integration	1.116	1	1.116	.810	.368	.001	.810	.146
	Error	1027.323	746	1.377					
	3. Avoid ambiguity	.825	1	.825	.610	.435	.001	.610	.122
	Error	1009.267	746	1.353					
	4. Knowledge is certain	14.524	1	14.524	12.872	.000	.017	12.872	.948
	Error	841.708	746	1.128					
	5. Don’t criticize authority	5.055	1	5.055	3.547	.060	.005	3.547	.469
	Error	1063.026	746	1.425					
	6. Depend on authority	9.985	1	9.985	6.110	.014	.008	6.110	.695
	Error	1219.081	746	1.634					
	7.Can't learn how to learn	7.843	1	7.843	4.554	.033	.006	4.554	.568
	Error	1284.794	746	1.722					
	8.Success is unrelated to hard work	.275	1	.275	.263	.609	.000	.263	.081
	Error	780.630	746	1.046					
	9. Ability to learn is innate	4.006	1	4.006	3.225	.073	.004	3.225	.434
	Error	926.832	746	1.242					
	10: Learning is quick	10.308	1	10.308	9.553	.002	.013	9.553	.870
	Error	804.920	746	1.079					
	11 Learn first time without concentrated effort	.918	1	.918	.872	.351	.001	.872	.154
	Error	784.986	746	1.052					

To determine which group scored the highest and the lowest mean values of significant interaction regarding the three subsets, a comparison between the mean values (see Table 57) indicated that for the subset “seek single answers” the highest mean value was scored by the no-group science majors (N= 160, M= 3.1698, SD= .95673) whereas the lowest mean value was scored by the yes-group art majors (N=120, M= 2.3758, SD= .88234), for the subset “knowledge is certain” the highest mean value was scored by the no-group science majors (N= 160, M= 3.7672, SD= .93252) whereas the lowest mean value was scored by the yes-group art majors (N=120, M= 2.1875, SD= 1.00641) and for the subset “learning is quick” the highest mean value was scored by the no-group science majors (N= 160, M= 3.3225, SD= 1.05186) whereas the lowest mean value was scored by the yes-group art majors (N=120, M= 2.6217, SD= 1.31999).

Table 57 Descriptive Statistics for the interaction IL* major for general beliefs

Dimension	IS	Major	Mean	Std. Deviation	N
1.Seek single answers	yes	Science	3.0813	.81079	220
		Art	2.3758	.88234	120
		Total	2.8896	1.00450	340
	no	Science	3.1698	.95673	160
		Art	2.7582	.94760	250
		Total	2.8843	.90946	410
4. Knowledge is certain	yes	Science	3.3273	1.02076	220
		Art	2.1875	1.00641	120
		Total	2.9250	1.15161	340
	no	Science	3.7672	.93252	160
		Art	3.2070	1.19357	250
		Total	3.4256	1.13146	410

10: Learning is quick	yes	Science	3.2236	.94844	220
		Art	2.6217	1.31999	120
		Total	3.0112	1.12949	340
	no	Science	3.3225	1.05186	160
		Art	3.2088	.94987	250
		Total	3.2532	.99121	410

Regarding the interaction analysis between information literacy and major for specific-domain beliefs, the findings of the analysis (see Table 58) showed that there is no statistically significant interaction between the two factors across the four dimensions of the beliefs; the results were: *certainty/simplicity of knowledge*, F(1,746) = .586, *p* = .444, partial η^2 = .001, *justification of knowledge*, F(1,746) = 3.717, *p* = .054, partial η^2 = .005, *source of knowledge*, F(1,746) = 4.252 and *p* = .040, partial η^2 = .006 and *attainment of truth*, F(1,746) = .611, *p* = .435, partial η^2 = .001.

Table 58 Tests of Between-Subjects Effects for interaction IL*major/specific-domain beliefs

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1.Certainty/simplicity of knowledge	Information literacy* Major	.301	1	.301	.586	.444	.001	.586	.119
	Error	383.507	746	.514					
2.Justification of knowledge	Information literacy* Major	2.066	1	2.066	3.717	.054	.005	3.717	.486
	Error	414.718	746	.556					
3. Source of knowledge	Information literacy* Major	3.754	1	3.754	4.252	.040	.006	4.252	.540
	Error	658.541	746	.883					
4. Attainment of truth	Information literacy* Major	.796	1	.796	.611	.435	.001	.611	.122
	Error	972.034	746	1.303					

Information literacy * Academic level

For the general beliefs questionnaire interaction between the two factors for information literacy (yes-group and no-group) and academic level (first-year and fourth-year) was tested using ANOVA analysis. The findings (see Table 59) showed that the interaction was statistically significant in four subsets with the following results: “knowledge is certain”, (1,746) = 16.738, *p* = .000, partial η^2 = .022, “don’t criticize authority”, *F*(1,746) = 16.107, *p* = .000, partial η^2 = .021, “depend on authority”, *F*(1,746) = 11.716, *p* = .001, partial η^2 = .015,and “ability to learn is innate”, *F*(1,746) = 19.894, *p* = .000, partial η^2 = .026 whereas the interaction between information literacy and the major was statistically not significant among the remaining subsets with the following results: “seek single answers”, *F*(1,746) = 3.737, *p* = .054, partial η^2 = .005, “avoid integration”, (1,746) = 1.328, p = .249, partial η^2 = .002, “avoid ambiguity”, F(1,746) = 1.001, p = .317, partial η^2 = .001, “can't learn how to learn”, F(1,746) = .985, p = .321, partial η^2 = .001, “success is unrelated to hard work” F(1,746) = 6.289, p = .012, partial η^2 = .008, “learning is quick”, F(1,746) = 4.279, p = .039, partial η^2 = .006 and finally, “learn first time without concentrated effort”, F(1,746) = 3.877, p = .049, partial η^2 =.005.

Table 59 Tests of Between-Subjects Effects for interaction between IL*AL/general beliefs

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[l]
Information literacy * Academic level	1.Seek single answers	3.002	1	3.002	3.737	.054	.005	3.737	.488
	Error	599.303	746	.803					
	2. Avoid integration	1.709	1	1.709	1.328	.249	.002	1.328	.210
	Error	959.534	746	1.286					
	3. Avoid ambiguity	1.434	1	1.434	1.001	.317	.001	1.001	.170
	Error	1068.688	746	1.433					
	4. Knowledge is certain	18.675	1	18.675	16.738	.000	.022	16.738	.983
	Error	832.336	746	1.116					
	5. Don’t criticize authority	22.640	1	22.640	16.107	.000	.021	16.107	.980
	Error	1048.628	746	1.406					
	6. Depend on authority	19.781	1	19.781	11.716	.001	.015	11.716	.928
	Error	1259.561	746	1.688					
	7.Can't learn how to learn	1.598	1	1.598	.985	.321	.001	.985	.168
	Error	1210.288	746	1.622					
	8.Success is unrelated to hard work	5.789	1	5.789	6.289	.012	.008	6.289	.707
	Error	686.652	746	.920					
	9. Ability to learn is innate	21.390	1	21.390	19.894	.000	.026	19.894	.994
	Error	802.094	746	1.075					
	10: Learning is quick	4.184	1	4.184	4.279	.039	.006	4.279	.542
	Error	729.529	746	.978					
	11 Learn first time without concentrated efforts	3.206	1	3.206	3.877	.049	.005	3.877	.503
	Error	617.039	746	.827					

To determine which group scored the highest and the lowest mean values of the significant interaction regarding the four subsets, a comparison between the mean values (see Table 60) indicated that for the subset “knowledge is certain” the highest mean value was scored by the no-group first-year students (N= 290, M= 3.7776, SD= 1.03533) whereas the lowest mean value was scored by the yes-group fourth-year students (N=240, M= 2.5750, SD= .87483). For the subset “don’t criticize authority” the highest mean value was scored by the no-group first-year students (N= 290, M= 3.5621, SD= 1.22758) whereas the lowest mean value was scored by the yes-group fourth-year students (N=240, M= 2.8135, SD= 1.28736), for the subset “depend on authority" the highest mean value was scored by the no-group first-year students (N= 290, M= 4.0467, SD= .83420) whereas the lowest mean value was scored by the yes-group art majors (N=240, M= 2.4347, SD= 1.37467) and for the subset "ability to learn is innate" the highest mean value was scored by the no-group first-year students (N= 290, M= 3.4310, SD= 1.02054) whereas the lowest mean value was scored by the yes-group fourth-year students (N=240, M= 2.4656, SD= 1.10183).

Table 60 Descriptive Statistics for the interaction IL*AL for general beliefs

Dimension	IL	AL	Mean	Std. Deviation	N
4. Knowledge is certain	yes	First-year	3.2825	.87086	100
		Fourth-year	2.5750	.87483	240
		Total	2.9250	1.15161	340
	no	First-year	3.7776	1.03533	290
		Fourth-year	2.7760	1.22115	120
		Total	3.4256	1.13146	410
5. Don't criticize authority	yes	First-year	4.1650	.70462	100
		Fourth-year	2.8135	1.28736	240
		Total	3.2110	1.30143	340
	no	First-year	3.5621	1.22758	290
		Fourth-year	2.9771	1.18773	120
		Total	3.3909	1.24349	410
6. Depend on authority	yes	First-year	3.0816	1.40324	100
		Fourth-year	2.4347	1.37467	240
		Total	2.9088	1.44102	340
	no	First-year	4.0467	.83420	290
		Fourth-year	2.1861	1.19507	120
		Total	2.8195	1.40475	410
9. Ability to learn is innate	yes	First-year	3.7375	.92276	100
		Fourth-year	2.4656	1.10183	240
		Total	2.8397	1.20059	340
	no	First-year	3.4310	1.02054	290
		Fourth-year	2.9042	1.03163	120
		Total	3.2768	1.05033	410

To test the interaction between the yes-group and the no-group and the first-year and four year students, a 2 (information literacy) X 2 (academic level) ANOVA analysis was applied. The findings of the analysis (see Table 61) showed that there was a statistically significant interaction between the two factors across three dimensions with the following results: *certainty/simplicity of knowledge*, $F(1,746) = 13.484$, $p = .000$, partial $\eta^2 = .018$, *source of knowledge*, $F(1,746) = 11.194$, $p = .001$, partial $\eta^2 = .015$ and *attainment of truth*, $F(1,746) = 26.704$, $p = .000$, partial $\eta^2 = .035$. There was no significant interaction found for *justification of knowledge*, $F(1,746) = 4.726$, $p = .030$, partial $\eta^2 = .006$.

Table 61 Tests of Between-Subjects Effects for interaction IL*AL for specific-domain beliefs

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1.Certainty/simplicity of knowledge	Information literacy*Academic level	6.101	1	6.101	13.484	.000	.018	13.484	.956
	Error	337.523	746	.452					
2.Justification of knowledge	Information literacy*Academic level	2.673	1	2.673	4.726	.030	.006	4.726	.584
	Error	421.959	746	.566					
3. Source of knowledge	Information literacy*Academic level	9.937	1	9.937	11.194	.001	.015	11.194	.916
	Error	662.214	746	.888					
4. Attainment of truth	Information literacy*Academic level	33.759	1	33.759	26.704	.000	.035	26.704	.999
	Error	943.100	746	1.264					

To determine which group scored the highest and the lowest mean values of the significant interaction regarding the dimensions, a comparison between the mean values (see Table 62) indicated that for the dimension *certainty/simplicity of knowledge* the highest mean value was scored by the no-group first-year students (N= 290, M= 3.6823, SD= .74247) whereas the lowest mean value was scored by the yes-group fourth-year students (N=240, M= 2.3083, SD= .60915). For the dimension *source of knowledge* the highest mean value was scored by the no-group first-year students (N= 290, M= 3.4603, SD= 1.00396) whereas the lowest mean value was scored by the yes-group fourth-year students (N=240, M= 2.1781, SD= .87491) and for the dimension *attainment of truth* the highest mean value was scored by the no-group fourth-year students (N= 120, M= 3.2875, SD= 1.07231) whereas the lowest mean value was scored by the yes-group fourth-year students (N=240, M= 2.2500, SD= 1.11850).

Table 62 Descriptive Statistics for the interaction IL*AL for specific-domain beliefs

Dimension	Gender	Academic level	Mean	Std. Deviation	N
1.Certainty/simplicity of knowledge	yes	First-year	3.0563	.50639	100
		Fourth-year	2.3083	.60915	240
		Total	2.5283	.67303	340
	no	First-year	3.6823	.74247	290
		Fourth-year	3.3323	.73416	120
		Total	3.5799	.75615	410
3. Source of knowledge	yes	First-year	2.8900	.85378	100
		Fourth-year	2.1781	.87491	240
		Total	2.3875	.92632	340
	no	First-year	3.4603	1.00396	290
		Fourth-year	3.2563	.98650	120

		Total	3.4006	1.00200	410
4. Attainment of truth	yes	First-year	3.1450	1.17914	100
		Fourth-year	2.2500	1.11850	240
		Total	2.5132	1.20617	340
	no	First-year	3.2466	1.13091	290
		Fourth-year	3.2875	1.07231	120
		Total	3.2585	1.11293	410

Information literacy *Gender * Major

The interaction between three factors, a 2 (information literacy) X 2 (gender) X 2 (major) ANOVA analysis was applied. For the general beliefs questionnaire, the findings of the analysis (see Table 63) showed that the interaction was statistically not significant for ten subsets with the following results: "seek single answers", $F(1,742) = .802$, $p = .371$, partial $\eta^2 = .001$, "avoid integration", (1,742) = 3.359, $p = .067$, partial $\eta^2 = .005$, "avoid ambiguity", $F(1,742) = 3.451$, $p = .064$, partial $\eta^2 = .005$, "knowledge is certain", (1,742) = .334, $p = .563$, partial $\eta^2 = .000$, , "depend on authority", $F(1,742) = .381$, $p = .537$, partial $\eta^2 = .001$, "can't learn how to learn", $F(1,742) = 1.700$, $p = .193$, partial $\eta^2 = .002$, "success is unrelated to hard work" $F(1,742) = .518$, $p = .472$, partial, $\eta^2 = .001$, "ability to learn is innate", $F(1,742) = 1.065$, $p = .302$, partial $\eta^2 = .001$., , "learning is quick", $F(1,742) = .309$, $p = .578$, partial $\eta^2 = .000$ and finally, "learn first time without concentrated effort", $F(1,742) = 3.877$, $p = .049$, partial $\eta^2 = .005$ whereas the interaction between information literacy gender and major was statistically significant in only one subset "don't criticize authority", $F(1,742) = 3.866$, $p = .050$, partial $\eta^2 = .005$.

Table 63 Tests of Effects interaction between IL*gender*major/general beliefs

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[l]
Information literacy * Gender * Major	1.Seek single answers	.658	1	.658	.802	.371	.001	.802	.145
	Error	609.476	742	.821					
	2. Avoid integration	4.593	1	4.593	3.359	.067	.005	3.359	.449
	Error	1014.627	742	1.367					
	3. Avoid ambiguity	4.619	1	4.619	3.451	.064	.005	3.451	.458
	Error	993.196	742	1.339					

	4. Knowledge is certain	.379	1	.379	.334	.563	.000	.334	.089
	Error	841.014	742	1.133					
	5. Don't criticize authority	17.654	1	17.654	12.689	.000	.017	12.689	.945
	Error	1032.381	742	1.391					
	6. Depend on authority	.618	1	.618	.381	.537	.001	.381	.095
	Error	1203.548	742	1.622					
	7.Can't learn how to learn	2.930	1	2.930	1.700	.193	.002	1.700	.256
	Error	1279.020	742	1.724					
	8.Success is unrelated to hard work	.527	1	.527	.518	.472	.001	.518	.111
	Error	755.422	742	1.018					
	9. Ability to learn is innate	1.285	1	1.285	1.065	.302	.001	1.065	.178
	Error	895.445	742	1.207					
	10: Learning is quick	.331	1	.331	.309	.578	.000	.309	.086
	Error	793.310	742	1.069					
	11. Learn first time without concentrated effort	4.056	1	4.056	3.866	.050	.005	3.866	.502
	Error	778.449	742	1.049					

The comparison of the mean values for the significant interaction found in the subset "don't criticize authority" (see Table 64) the highest mean value was scored by the no-group, male students from science majors (N=63, M=4.0079, SD=.92563) whereas the lowest mean value was scored by the yes-group female students from art majors (N=70, M=2.1607, SD=1.21735).

Table 64 Descriptive Statistics for interaction of IL *gender * major for general beliefs

Subset	IL	Gender	Major	Mean	Std. Deviation	N
5. Don't criticize authority	yes	Male	Science	3.3536	1.08305	70
			ART	3.0050	1.08267	50
			Total	3.2083	1.09205	120
		Female	Science	3.7033	1.20520	150
			ART	2.1607	1.21735	70
			Total	3.2125	1.40491	220
		Total	Science	3.5920	1.17663	220
			ART	2.5125	1.23152	120
			Total	3.2110	1.30143	340
	no	Male	Science	4.0079	.92563	63
			ART	3.2000	1.17624	80
			Total	3.5559	1.14273	143
		Female	Science	3.7320	1.20289	97
			ART	3.0574	1.27331	170
			Total	3.3024	1.28762	267
		Total	Science	3.8406	1.10725	160
			ART	3.1030	1.24250	250
			Total	3.3909	1.24349	410

Regarding the specific-domain beliefs questionnaire, the findings of the analysis (see Table 65) showed that there was statistically no significant interaction between the three factors across the dimensions of the beliefs, the results were: *certainty/simplicity of knowledge*, F(1,746) = 1.988,

p = .159, partial η^2 = .003, *justification of knowledge*, F(1,746) = 1.177, p = .278, partial η^2 = .002, *source of knowledge*, F(1,746) = 1.000, p = .318, partial η^2 = .001 and *attainment of truth*, F(1,746) = 2.776, p = .096, partial η^2 = .004.

Table 65 Tests of Between-Subjects Effects for interaction IL*gender*major/specific-domain

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1. Certainty/simplicity of knowledge	Information literacy* Gender* Major	1.024	1	1.024	1.988	.159	.003	1.988	.291
	Error	382.024	742	.515					
2.Justification of knowledge	Information literacy* Gender* Major	.654	1	.654	1.177	.278	.002	1.177	.192
	Error	412.075	742	.555					
3. Source of knowledge	Information literacy* Gender* Major	.871	1	.871	1.000	.318	.001	1.000	.170
	Error	646.214	742	.871					
4. Attainment of truth	Information literacy* Gender* Major	3.618	1	3.618	2.776	.096	.004	2.776	.384
	Error	967.198	742	1.304					

Information literacy * Gender * Academic level

To test the interaction between three factors, a 2 (information literacy) X 2 (gender) X 2 (academic level) ANOVA analysis was applied. The findings of the analysis for the general beliefs questionnaire (see Table 66) showed that the interaction was statistically not significant in all the subsets with the following results: “seek single answers”, $F(1,742) = 3.595$, p = .058, partial η^2 = .005, “avoid integration”, (1,742) = 3.888, p = .049, partial η^2 = .005, “avoid ambiguity”, $F(1,742) = 2.142$, p = .144, partial η^2 = .003, “knowledge is certain”, (1,742) = 4.566, p = .033, partial η^2 = .006, “don’t criticize authority”, $F(1,742) = .869$, p = .352, partial η^2 = .001, “depend on authority”, $F(1,742) = 3.938$, p = .048, partial η^2 = .005, “can't learn how to learn”, $F(1,742) = 2.539$, p = .111, partial η^2 = .003, “success is unrelated to hard work” $F(1,742) = 2.018$, p = .156, partial, η^2 = .003, “ability to learn is innate”, $F(1,742)$ = 1.866, p = .172, partial η^2 = .003, , “learning is quick”, $F(1,742) = 2.332$, p = .127, partial η^2 = .003 and finally, “learn first time without concentrated effort”, $F(1,742) = 5.732$, p = .017, partial η^2 =.008.

Table 66 Tests of Effects interaction between IL *gender*AL/general beliefs

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[l]
Information literacy * Gender * Academic level	1.Seek single answers	2.839	1	2.839	3.595	.058	.005	3.595	.474
	Error	585.930	742	.790					
	2. Avoid integration	4.963	1	4.963	3.888	.049	.005	3.888	.504
	Error	947.098	742	1.276					
	3. Avoid ambiguity	3.067	1	3.067	2.142	.144	.003	2.142	.309
	Error	1062.671	742	1.432					
	4. Knowledge is certain	5.047	1	5.047	4.566	.033	.006	4.566	.569
	Error	820.139	742	1.105					
	5. Don't criticize authority	1.209	1	1.209	.869	.352	.001	.869	.154
	Error	1032.846	742	1.392					
	6. Depend on authority	6.644	1	6.644	3.938	.048	.005	3.938	.509
	Error	1251.786	742	1.687					
	7.Can't learn how to learn	4.118	1	4.118	2.539	.111	.003	2.539	.356
	Error	1203.473	742	1.622					
	8.Success is unrelated to hard work	1.774	1	1.774	2.018	.156	.003	2.018	.295
	Error	652.365	742	.879					
	9. Ability to learn is innate	1.958	1	1.958	1.866	.172	.003	1.866	.276
	Error	778.421	742	1.049					
	10: Learning is quick	2.276	1	2.276	2.332	.127	.003	2.332	.332
	Error	724.017	742	.976					
	11. Learn first time without concentrated effort	4.727	1	4.727	5.732	.017	.008	5.732	.667
	Error	611.869	742	.825					

For interaction between the three factors of information literacy, gender and academic level regarding the specific-domain questionnaire, the findings of the analysis for the general beliefs questionnaire (see Table 67) showed that there was statistically no significant interaction between the three factors across the dimensions of the beliefs, the results were: *certainty/simplicity of knowledge*, $F(1,742) = .037$, $p = .847$, partial $\eta^2 = .000$, *justification of knowledge*, $F(1,742) = 6.283$, $p = .012$, partial $\eta^2 = .008$, *source of knowledge*, $F(1,742) = 1.004$, $p = .317$, partial $\eta^2 = .001$ and *attainment of truth*, $F(1,742) = 0.000$, $p = .984$, partial $\eta^2 = .000$.

Table 67 Tests of Effects interaction IL*gender*AL/specific-domain beliefs

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1. Certainty/simplicity of knowledge	Information literacy * Gender*Academic level	.017	1	.017	.037	.847	.000	.037	.054
	Error	337.240	742	.455					
2.Justification of knowledge	Information literacy * Gender*Academic level	3.507	1	3.507	6.283	.012	.008	6.283	.707

	Error	414.196	742	.558					
3. Source of knowledge	Information literacy * Gender*Academic level	.892	1	.892	1.004	.317	.001	1.004	.170
	Error	659.042	742	.888					
4. Attainment of truth	Information literacy * Gender*Academic level	.000	1	.000	.000	.984	.000	.000	.050
	Error	940.775	742	1.268					

Information literacy * Major * Academic level

To test the interaction between three factors, a 2 (information literacy) X 2 (major) X 2 (academic level) ANOVA analysis was applied. The findings of the analysis (see Table 68) showed that there was statistically significant interaction between the three factors across three subsets of general beliefs: “avoid ambiguity”, $F(1,742) = 2.142$, $p = .144$, partial $\eta^2 = .003$, “knowledge is certain”, (1,742) = 4.566, $p = .033$, partial $\eta^2 = .006$ and “learning is quick”, $F(1,742) = 2.332$, $p = .127$, partial $\eta^2 = .003$ whereas interaction between the three factors was statistically not significant in the subsets: “seek single answers”, $F(1,742) = 1.700$, $p = .193$, partial $\eta^2 = .002$, “avoid integration”, (1,742) = 2.531, $p = .112$, partial $\eta^2 = .003$, “don’t criticize authority”, $F(1,742) = .022$, $p = .881$, partial $\eta^2 = .000$, “depend on authority”, $F(1,742) = 4.535$, $p = .034$, partial $\eta^2 = .006$, “can't learn how to learn”, $F(1,742) = 3.205$, $p = .074$, partial $\eta^2 = .004$, “success is unrelated to hard work” $F(1,742) = 1.860$, $p = .173$, partial, $\eta^2 = .003$, “ability to learn is innate”, $F(1,742) = .114$, $p = .736$, partial $\eta^2 = .000$ and finally, “learn first time without concentrated effort”, $F(1,742) = .178$, $p = .673$, partial $\eta^2 = .000$.

Table 68 Tests of Effects interaction between IL*gender*AL/general beliefs

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[l]
Information literacy * Major * Academic level	1.Seek single answers	1.068	1	1.068	1.700	.193	.002	1.700	.256
	Error	466.125	742	.628					
	2. Avoid integration	2.392	1	2.392	2.531	.112	.003	2.531	.355
	Error	701.498	742	.945					
	3. Avoid ambiguity	23.446	1	23.446	22.436	.000	.029	22.436	.997
	Error	775.392	742	1.045					
	4. Knowledge is certain	6.991	1	6.991	8.274	.004	.011	8.274	.819
	Error	626.953	742	.845					
	5. Don’t criticize authority	.027	1	.027	.022	.881	.000	.022	.053
	Error	883.675	742	1.191					
	6. Depend on authority	5.743	1	5.743	4.535	.034	.006	4.535	.566
	Error	939.629	742	1.266					

	7.Can't learn how to learn	4.800	1	4.800	3.205	.074	.004	3.205	.432
	Error	1111.087	742	1.497					
	8.Success is unrelated to hard work	1.581	1	1.581	1.860	.173	.003	1.860	.275
	Error	630.845	742	.850					
	9. Ability to learn is innate	.114	1	.114	.114	.736	.000	.114	.063
	Error	743.420	742	1.002					
	10: Learning is quick	8.326	1	8.326	9.625	.002	.013	9.625	.873
	Error	641.854	742	.865					
	11. Learn first time without concentrated effort	.139	1	.139	.178	.673	.000	.178	.071
	Error	578.121	742	.779					

To determine which group scored the highest and the lowest mean values for the significant interaction regarding the three subsets, a comparison between the mean values (see Table 69) indicated that for the subset "avoid ambiguity" the highest mean value was scored by the no-group science major and first-year students (N= 120, M= 4.5000, SD= .92598) whereas the lowest mean value was scored by the yes-group art major and fourth-year students (N=80, M= 1.8225, SD= .68251). For the subset "knowledge is certain" the highest mean value was scored by the no-group science major and first-year students (N= 120, M= 3.9000, SD= .93844) whereas the lowest mean value was scored by the yes-group art major and fourth-year students (N=80, M= 1.6063, SD= .55229); for the subset "learning is quick" the highest mean value was scored by the no-group science major and first-year students (N= 120, M= 3.5200, SD= .99436) whereas the lowest mean value was scored by the yes-group art major and fourth-year students (N=80, M= 1.9400, SD= 1.02149).

Table 69 Descriptive Statistics for the interaction IL*major*AL for general beliefs

Subset	IL	Major	Major	Mean	Std. Deviation	N
3. Avoid ambiguity	yes	Science	First-year	3.6433	1.01386	60
			Fourth-year	3.2600	1.08246	160
			Total	3.3645	1.07560	220
		Art	First-year	3.2350	.82635	40
			Fourth-year	1.8225	.68251	80
			Total	2.3517	1.03062	120
		Total	First-year	3.4800	.96022	100
			Fourth-year	2.8100	1.18649	240
			Total	3.0071	1.16414	340
	no	Science	First-year	4.5000	.92598	120
			Fourth-year	3.6450	1.00869	40
			Total	3.8588	1.05344	160
		Art	First-year	3.5306	1.23447	170
			Fourth-year	1.9100	.81871	80
			Total	2.9840	1.34889	250

		Total	First-year	3.5779	1.14599	290
			Fourth-year	2.7150	1.48214	120
			Total	3.3254	1.31212	410
4. Knowledge is certain	yes	Science	First-year	3.2375	1.00362	60
			Fourth-year	3.3609	1.02820	160
			Total	3.3273	1.02076	220
		Art	First-year	3.3500	.62737	40
			Fourth-year	1.6063	.55229	80
			Total	2.1875	1.00641	120
		Total	First-year	3.2825	.87086	100
			Fourth-year	2.7760	1.22115	240
			Total	2.9250	1.15161	340
	no	Science	First-year	3.9000	.93844	120
			Fourth-year	3.3688	.80062	40
			Total	3.7672	.93252	160
		Art	First-year	3.6912	1.09304	170
			Fourth-year	2.1781	.59825	80
			Total	3.2070	1.19357	250
		Total	First-year	3.7776	1.03533	290
			Fourth-year	2.5750	.87483	120
			Total	3.4256	1.13146	410
10: Learning is quick	yes	Science	First-year	3.3767	1.12248	60
			Fourth-year	3.1125	.90913	160
			Total	3.2236	.94844	220
		Art	First-year	3.9850	.58597	40
			Fourth-year	1.9400	1.02149	80
			Total	2.6217	1.31999	120
		Total	First-year	3.7060	.88144	100
			Fourth-year	2.7217	1.09615	240
			Total	3.0112	1.12949	340
	no	Science	First-year	3.5200	.99436	120
			Fourth-year	3.1600	.79382	40
			Total	3.3225	1.05186	160
		Art	First-year	3.4929	.88006	170
			Fourth-year	2.6050	.80251	80
			Total	3.2088	.94987	250
		Total	First-year	3.4448	.98742	290
			Fourth-year	2.7900	.83851	120
			Total	3.2532	.99121	410

To test the interaction between three factors, a 2 (information literacy) X 2 (major) X 2 (academic level) regarding the specific-domain beliefs ANOVA analysis was applied and the findings (see Table 70) showed that there was statistically significant interaction between the three factors across two dimensions of the beliefs: *source of knowledge*, $F(1,742) = 17.132$, $p = .000$, partial $\eta^2 = .023$ and *attainment of truth*, $F(1,742) = 7.246$, $p = .007$, partial $\eta^2 = .010$ whereas there was no statistically significant interaction between the three factors in two dimensions: *certainty/simplicity of knowledge*, $F(1,742) = 3.422$, $p = .065$, partial $\eta^2 = .005$, *justification of knowledge*, $F(1,742) = 4.324$, $p = .038$, partial $\eta^2 = .006$.

Table 70 Tests of Between-Subjects Effects interaction IL*major*AL/specific-domain beliefs

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1. Certainty/simplicity of knowledge	Information literacy * Major * Academic level	1.512	1	1.512	3.422	.065	.005	3.422	.455
	Error	327.900	742	.442					
2.Justification of knowledge	Information literacy * Major * Academic level	2.250	1	2.250	4.324	.038	.006	4.324	.546
	Error	386.116	742	.520					
3. Source of knowledge	Information literacy * Major * Academic level	13.921	1	13.921	17.132	.000	.023	17.132	.985
	Error	602.929	742	.813					
4. Attainment of truth	Information literacy * Major * Academic level	8.803	1	8.803	7.246	.007	.010	7.246	.767
	Error	901.424	742	1.215					

The mean values for the significant interaction regarding the dimensions *source of knowledge* and *attainment of truth* were tested to recognize which group scored the highest and the lowest mean value. The comparison between the mean values (see Table 71) indicated that for the dimension *source of knowledge* the highest mean value was scored by the no-group first-year students with science majors (N= 120, M= 3.8667, SD= .88340) whereas the lowest mean value was scored by the yes-group fourth-year students with art majors (N=80, M= 1.7594, SD= .65173) and for the dimension *attainment of truth* the highest mean value was scored by the no-group first-year students with science majors (N= 120, M= 3.6250, SD= 1.02131) whereas the lowest mean value was scored by the yes-group fourth-year students with art majors (N=80, M= 1.9375, SD= .85082).

Table 71 Descriptive Statistics for the interaction IL*major*AL for specific-domain beliefs

Dimension	Information literacy	Major	Academic Level	Mean	Std. Deviation	N
3. Source of knowledge	yes	Science	First-year	2.7875	.78630	60
			Fourth-year	2.3875	.89846	160
			Total	2.4966	.88573	220
		Art	First-year	3.0437	.93522	40
			Fourth-year	1.7594	.65173	80
			Total	2.1875	.96865	120
	no	Science	First-year	3.8667	.88340	120
			Fourth-year	3.4750	.96377	40
			Total	3.7687	.91697	160
		Art	First-year	3.1735	.98699	170
			Fourth-year	3.1469	.98541	80
			Total	3.1650	.98458	250
4. Attainment of truth	yes	Science	First-year	3.2083	1.05883	60
			Fourth-year	2.4062	1.20297	160
			Total	2.6250	1.21691	220
		Art	First-year	3.0500	1.34831	40

			Fourth-year	1.9375	.85082	80
			Total	2.3083	1.16349	120
	no	Science	First-year	3.6250	1.02131	120
			Fourth-year	3.2625	1.19822	40
			Total	3.5344	1.07593	160
		Art	First-year	2.9794	1.13100	170
			Fourth-year	3.3000	1.01133	80
			Total	3.0820	1.10233	250

Information literacy * Gender * Major * Academic level

To test the interaction between four factors, 2 (information literacy) X 2 (gender) X 2 (majors) X 2 (academic levels) MANOVA analyses was applied for both general-domain and specific-domain beliefs. The findings of the analysis for the general beliefs (see Table 72) showed that there was statistically no significant interaction between the four factors across the dimensions of the beliefs, the results were: “seek single answers”, $F(1,734) = 2.847$, $p = .092$, partial $\eta^2 = .004$, “avoid integration”, $(1,734) = .809$, $p = .369$, partial $\eta^2 = .001$, “avoid ambiguity”, $F(1,734) = 4.812$, $p = .029$, partial $\eta^2 = .007$, “knowledge is certain”, $(1,734) = .283$, $p = .595$, partial $\eta^2 = .000$, “depend on authority”, $F(1,734) = 2.139$, $p = .144$, partial $\eta^2 = .003$, “can't learn how to learn”, $F(1,734) = .175$, $p = .676$, partial $\eta^2 = .000$, “success is unrelated to hard work” $F(1,734) = 3.424$, $p = .065$, partial, $\eta^2 = .005$, “ability to learn is innate”, $F(1,734) = .414$, $p = .520$, partial $\eta^2 = .001$, “learning is quick”, $F(1,734) = 1.200$, $p = .274$, partial $\eta^2 = .002$ and finally, “learn first time without concentrated effort”, $F(1,734) = .782$, $p = .377$, partial $\eta^2 = .001$ whereas the interaction between the four factors was statistically significant in only one subset “don’t criticize authority”, $F(1,734) = 12.749$, $p = .000$, partial $\eta^2 = .017$.

Table 72 Effects for interaction between IL*gender*major*AL/general beliefs

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[l]
IL *gender* Major* Academic Level	1.Seek single answers	1.738	1	1.738	2.847	.092	.004	2.847	.392
	Error	448.023	734	.610					
	2. Avoid integration	.761	1	.761	.809	.369	.001	.809	.146
	Error	689.929	734	.940					
	3. Avoid ambiguity	4.950	1	4.950	4.812	.029	.007	4.812	.591
	Error	755.122	734	1.029					
	4. Knowledge is certain	.239	1	.239	.283	.595	.000	.283	.083
	Error	619.917	734	.845					
	5. Don’t criticize authority	14.493	1	14.493	12.749	.000	.017	12.749	.946

	Error	834.403	734	1.137					
	6. Depend on authority	2.697	1	2.697	2.139	.144	.003	2.139	.309
	Error	925.712	734	1.261					
	7.Can't learn how to learn	.263	1	.263	.175	.676	.000	.175	.070
	Error	1105.324	734	1.506					
	8.Success is unrelated to hard work	2.772	1	2.772	3.424	.065	.005	3.424	.455
	Error	594.270	734	.810					
	9. Ability to learn is innate	.404	1	.404	.414	.520	.001	.414	.099
	Error	715.723	734	.975					
	10: Learning is quick	1.036	1	1.036	1.200	.274	.002	1.200	.194
	Error	633.181	734	.863					
	11. Learn first time without concentrated effort	.610	1	.610	.782	.377	.001	.782	.143
	Error	572.969	734	.781					

For the significant interaction in the subset "don't criticize authority", the findings of the comparison between mean values (see Table 73) indicated that the highest mean value was scored by the no-group male students with science major from first-year (N=40, M=4.5000, SD= 1.13870) and the lowest mean value was scored by the yes-group female students with art majors from fourth-year (N=50, M=1.6050, SD=.74760).

Table 73 Descriptive Statistics for interaction of IL*gender* major*AL for general beliefs

subset	Information literacy	Gender	Major	Academic Level	Mean	Std. Deviation	N
5. Don't criticize authority	yes	Male	Science	First-year	4. 0375	.37170	20
				Fourth-year	2.8950	.92042	50
				Total	3.3536	1.08305	70
			Art	First-year	3.8375	.51475	20
				Fourth-year	2.4500	1.00516	30
				Total	3.0050	1.08267	50
			Total	First-year	4.1688	.55582	40
				Fourth-year	2.7281	.97126	80
				Total	3.2083	1.09205	120
		Female	Science	First-year	4.4688	.35890	40
				Fourth-year	3.4250	1.28307	110
				Total	3.7033	1.20520	150
			Art	First-year	3.5500	1.04693	20
				Fourth-year	1.6050	.74760	50
				Total	2.1607	1.21735	70
			Total	First-year	4.1625	.79301	60
				Fourth-year	2.8563	1.42019	160
				Total	3.2125	1.40491	220
	no	Male	Science	First-year	4.5000	1.13870	40
				Fourth-year	3.9565	.33416	23
				Total	4.0079	.92563	63
			Art	First-year	3.7900	.88115	50
				Fourth-year	2.2167	.92553	30

				Total	3.2000	1.17624	80
			Total	First-year	3.9000	1.00546	90
				Fourth-year	2.9717	1.13262	53
				Total	3.5559	1.14273	143
		Female	Science	First-year	3.7937	1.24637	80
				Fourth-year	3.4412	.95004	17
				Total	3.7320	1.20289	97
			Art	First-year	3.1542	1.25783	120
				Fourth-year	2.8250	1.29289	50
				Total	3.0574	1.27331	170
			Total	First-year	3.4100	1.28898	200
				Fourth-year	2.9813	1.23806	67
				Total	3.3024	1.28762	267

The findings of the analysis for the interaction between the four factors regarding specific-domain beliefs (see Table 74) showed that there was statistically no significant interaction between the four factors across the dimensions of the beliefs, the results were: *certainty/simplicity of knowledge*, $F(1,734) = .092$, $p = .761$, partial $\eta^2 = .000$, *justification of knowledge*, $F(1,734) = .070$, $p = .791$, partial $\eta^2 = .000$, *source of knowledge*, $F(1,734) = .004$, $p = .953$, partial $\eta^2 = .000$ and *attainment of truth*, $F(1,734) = 4.423$, $p = .036$, partial $\eta^2 = .006$.

Table 74 Tests Effects for interaction IL*gender*major*AL/specific-domain beliefs

Dependent Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[b]
1. Certainty/simplicity of knowledge	IL*Gender*Major*Academic level	.041	1	.041	.092	.761	.000	.092	.061
	Error	322.668	734	.440					
2.Justification of knowledge	IL*Gender*Major*Academic level	.036	1	.036	.070	.791	.000	.070	.058
	Error	379.434	734	.517					
3. Source of knowledge	IL*Gender*Major*Academic level	.003	1	.003	.004	.953	.000	.004	.050
	Error	586.287	734	.799					
4. Attainment of truth	IL*Gender*Major*Academic level	5.363	1	5.363	4.423	.036	.006	4.423	.556
	Error	890.037	734	1.213					

Interaction for the factor of previous knowledge in information literacy and the other factors related to participants' characteristics, that is, gender, majors and academic levels focusing on the discipline-focused epistemological beliefs questionnaire were analysed, the findings shoed interesting results in that gender had no impact on the specific-domain beliefs toward the discipline of information literacy whereas majors, academic levels and previous knowledge of information literacy had an influence on beliefs about the discipline.

5.3.4 Discussion of the impact of Interaction between Information Literacy and the Variables on Undergraduates' Epistemological Beliefs

This section aims to discuss interaction between information literacy as a discipline and gender, major and academic levels between students' general-knowledge and specific knowledge beliefs.

Table 75 below demonstrates the results of the interaction of general epistemological beliefs of the undergraduates looking at information literacy, gender, major and academic level. Clearly, information literacy interacts with either academic level, major, gender or all three; however, there is no interaction between information literacy, gender and academic level.

Table 75 Interaction between IS and the three factors in general beliefs

Interaction	Dimensions	subsets	Sig.	Partial Eta Squared	Highest groups	Lowest groups	Highest means	Lowest means
IS * gender	Ability to learn	8.Success is unrelated to hard work	.007	.010	no-group male	yes-group female	3.1871	2.5852
		9. Ability to learn is innate	.001	.015	no-group male	yes-group female	3.2867	2.6352
IS * Major	Structure of knowledge	1.Seek single answers	.001	.015	no-group science	yes-group art	3.1698	2.3758
	Stability of knowledge	4. Knowledge is certain	.000	.017	no-group science	yes-group art	3.7672	2.1875
	Speed of learning	10: Learning is quick	.002	.013	no-group science	yes-group art	3.3225	2.6217
IS * Academic level	Stability of knowledge	4. Knowledge is certain	.000	.022	no-group first year	yes-group fourth year	3.7776	2.5750
	Source of knowledge	5. Don't criticize authority	.000	.021	no-group first year	yes-group fourth year	3.5621	2.8135
		6. Depend on authority	.001	.015	no-group first year	yes-group fourth	4.0467	2.4347
	Ability to learn	9. Ability to learn is innate	.000	.026	no-group first year	yes-group fourth year	3.4310	2.4656
IS *Gender* major	Source of knowledge	5. Don't criticize authority	.000	.017	no-group, male science	yes-group female art	4.0079	2.1607

IS *Major * Academic level	Stability of knowledge	3. Avoid ambiguity	.000	.029	no-group science first year	yes-group art fourth year	4.5000	1.8225
		4. Knowledge is certain	.004	.011	no-group science first year	yes-group art fourth year	3.9000	1.6063
	Speed of learning	10: Learning is quick	.002	.013	no-group science first year	yes-group art fourth year	3.5200	1.9400
IS *Gender* major* Academic level	Source of knowledge	5. Don't criticize authority	.000	.017	no-group male science first year	yes-group female art fourth year	4.5000	1.6050

Information literacy * gender

The interaction between information literacy and gender is weak because there is only a small difference in one dimension, that is, *ability to learn* while the other dimensions shows no differences. More clearly, the yes-group female undergraduates have higher sophisticated general beliefs than the no-group male undergraduates in two subsets, that is, "success is unrelated to hard work" and "ability to learn is innate" which come under the *ability to learn* dimension. In other words, yes-group female undergraduates believe learning is not an innate ability but can be acquired and gained by experience and hard work whereas the no-group male undergraduates think they are born with their learning skills. Although the interaction was only found in one dimension, the effect size value of the interaction is still very weak.

Information literacy * Major

The interaction between information literacy and major has been found to be significant in one subset under only three different general belief dimensions, that is, *structure of knowledge, stability of knowledge,* and *speed of learning* while the other two dimensions (*source of knowledge and ability to learn*) show no differences. The yes-group art undergraduates hold more sophisticated general beliefs than the no-group science undergraduates in the three subsets of the dimensions: *seek single answers, knowledge is certain* and *learning is quick.* This means the yes-group art undergraduates with more sophisticated beliefs think that there are several right answers to one question, that knowledge is changing rapidly and that learning may occur after several attempts. The results of the three subsets are considered poor because finding one significant subset only from each dimension is not enough to provide a clear picture for the whole dimension, in addition, the value of the effect size of the interaction is too weak to be considered.

Information literacy * Academic level

The interaction between information literacy and academic level has a modest impact on general epistemological beliefs of undergraduates showing in three dimensions, that is, *stability of knowledge, source of knowledge and ability to learn*. The findings indicate that the more sophisticated level of general beliefs are held by yes-group fourth-year undergraduates whereas the less sophisticated beliefs are held by the no-group first-year undergraduates in four subsets, that is, “knowledge is certain”, “don’t criticize authority’, “depend on authority”, and “ability to learn is innate’. In other words, the yes-group fourth-year undergraduates believe that general knowledge is not certain, authority can be criticized, authority is not always the only source of knowledge and learning is not an innate ability. It is can clearly be seen that the degree of differences between the beliefs of the two groups regarding *don’t criticize authority,* is much higher than the results of the other subsets, indicating that undergraduates respond quite differently. The modest effect size value is also good evidence for the weak interaction between academic level and information literacy.

Information literacy *Gender* major

The interaction between the three variables, information literacy, gender, and major is almost absent because only one subset was found to be significant in the general beliefs dimension *source of knowledge*. With respect to the subset *don’t criticize authority*, the yes-group female art undergraduates hold more sophisticated beliefs than the no-group male science undergraduates believing that the knowledge presented by educators and experts can be questioned and criticized. The significant subset also shows a very small effect size value of the interaction between the three variables.

Information literacy *Major * Academic level

The impact of the interaction between the three variables information literacy, major, and academic level was found only in two general belief dimensions, that is, *stability of knowledge* and *speed of knowledge* while the other three dimensions showed no interaction with the variables. The yes-group fourth year art undergraduates have sophisticated general beliefs whereas the no-group science first year undergraduates have naïve general beliefs in the subsets *avoid ambiguity*, *knowledge is certain*, and *learning is quick*. This means that the yes-group fourth-year art undergraduates think that ambiguity does exist, knowledge is uncertain and learning is a slow process. The effect size value between the three variables is proof of a weak interaction.

Information literacy *Gender* major* Academic level

The impact of the interaction between the variables information literacy, gender, major and academic level found was only in only one, that is, the general beliefs dimension *source of knowledge* while no impact was found in the other dimensions.

The higher level of sophisticated general beliefs was held by the yes-group, female, fourth-year art undergraduates while the male, no-group, science first-year undergraduates hold a lower level of belief. In other words, in the subset *don't criticize authority,* the fourth-year female art undergraduates yes -group, believe that the knowledge handled by authority (for example educators) can be questioned and criticized. That the two groups answer differently about the subset *don't criticize authority* shows a big difference between their mean values. The effect size values for the interaction between the variables on the general beliefs of the undergraduates are too small to be significant.

To sum up, this section has discussed the impact of the interaction between information literacy and the other variables that is gender, major and academic level, to highlight the interactional influence on the general epistemological beliefs of the undergraduates. The interaction between information literacy and the variables has a modest impact since the interaction is only found in a limited number of subsets in addition to which the effect size values were also found to be small. It is worth noting that the interaction between information literacy and the major is stronger than that of information literacy with academic level and major while the interaction between information literacy with academic level is the strongest. The yes-group fourth-year art-major undergraduates always hold more sophisticated general beliefs than the no-group first-year science-major undergraduates.

The following table (Table 76) illustrates the interaction of specific epistemological beliefs of the undergraduates between information literacy with other variables (gender, major and academic level). The findings show that information literacy has an interactional influence on academic level but that on the other hand it has 3-way interactions with the academic level and major.

Table 76 Interaction between IS and the three factors in specific-domain beliefs

Interaction	Dimension	Sig.	Partial Eta Squared	Highest groups	Lowest groups	Highest means	Lowest means
IS * Academic level	1.Certainty/simplicity of knowledge	.000	.018	no-group first year	yes-group fourth year	3.6823	2.3083
	3.Source of knowledge	.001	.015	no-group first year	yes-group fourth year	3.4603	2.1781
	4.Attainment of truth	.000	.035	no-group fourth year	yes-group fourth year	3.2875	2.2500
IS *Major * Academic level	3. Source of knowledge	.000	.023	no-group first-year science	yes-group fourth-year art	3.8667	1.7594
	4. Attainment of truth	.007	.010	no-group first-year science	yes-group fourth-year art	3.6250	1.9375

IS * Academic level

The impact of the interaction between information literacy and academic level demonstrates a noticeable difference which appears in three dimensions, that is, *certainty/simplicity of knowledge*, *source of knowledge*, and *attainment of truth*, while no interaction was found in the dimension *justification of knowing*. The yes-group fourth-year undergraduates have more sophisticated specific beliefs than the no-group first-year undergraduates meaning that the yes-group fourth-year undergraduates believe that information literacy knowledge is uncertain and complex, scholars are not the only source of knowledge and absolute truth is unreachable. The effect size value of the interaction has a medium effect on the specific-domain beliefs.

Information literacy *Major * Academic level

There is 3-way interaction between information literacy, major and academic level showing the interaction impact in two specific-domain beliefs dimensions *source of knowledge* and *attainment of truth* while no impact was found for the two dimensions *certainty/simplicity of knowledge* and *justification of knowing*. The findings of the 3-way interactions reflect that the yes-group art fourth-year undergraduates hold more sophisticated specific beliefs than the no-group science first-year undergraduates. The more sophisticated group thinks that the source of knowledge in information literacy is not only driven by authorities and that truth in information literacy is not always reachable. The effect size value of the interaction impact on the dimensions of *source of knowledge* and *attainment of truth* is small.

To sum up, it is obvious that the influence of information literacy has strongly appeared when it interacts with academic level meaning that the fourth-year students who study a course in information literacy have a more sophisticated level of specific-domain beliefs than first-year students who are not studying an information literacy course. There is also clear interaction between information literacy, academic level and major showing that the yes-group fourth-year art major undergraduates hold higher sophisticated specific-domain beliefs than the no-group first-year science-major undergraduates.

Studying the interaction between information literacy with other variables in order to study their influence on the undergraduates' general and specific epistemological beliefs has shown that the academic level has a stronger interaction influence than the major on the epistemological beliefs while there is no clear influence for gender. Information literacy has a clear interactional impact on the undergraduates' specific epistemological beliefs than on their general epistemological beliefs.

5.4 General-Domain or Specific-Domain Epistemological Beliefs

Schommer and Walker (1995) claim that epistemological beliefs come under general-domain and are developed through similar approaches across academic domains; however, others claim that the beliefs are developed differently at each academic domain (Buehl et al., 2002; Op ’tEynde et al., 2006). Examination of the results of SEQ and DFEBQ show that beliefs under the dimensions of each scale are developed independently and are influenced by the variables which support the multidimensional structure of the epistemological beliefs (see Schommer, 1990). The beliefs are also found to be multilayered where general beliefs and specific-domain beliefs both exist in multilayered sophisticated levels; especially among the fourth year learners who have had experience of information literacy.

Regarding multilayered beliefs in the general and specific-domain, the level of these beliefs in the dimension *structure of knowledge* and *stability of knowledge* (general beliefs) was found to be higher than the level for dimension *simplicity/certainty of knowledge* (specific-domain beliefs). Furthermore, the level of beliefs of fourth year undergraduates in the same dimension *(simplicity/certainty of knowledge* - specific-domain beliefs) is higher than the level of beliefs for first year undergraduates. Another multilayered beliefs’ example was found in undergraduates viewing the dimension of *source of knowledge*, the level of their sophisticated specific-domain beliefs toward *source of knowledge* is higher than for their general beliefs toward the same dimension.

The question thus arises as to whether the epistemological beliefs found in this study are in the general or specific-domain form? It is worth saying that there is a synthesized claim that says epistemological beliefs are in both domains (Muis et al., 2006; Schommer-Aikins et al., 2002). In fact, beliefs about general knowledge and specific-domain knowledge can be similar, for example, depending on how the *structure of knowledge* is viewed but could differ depending on a particular view of the process of knowing based on the nature of the domain in the learner’s mind.

The decision to generalize whether epistemological beliefs are either general or specific-domain without paying regard to the role of the many variables which impact this is to come to a conclusion that is based on too little data (Buehl and Alexander, 2006; Buehl et al., 2002; Hofer, 2006; Richardson, 2013). It is suggested that each study has its own contribution and findings depending on the approach adopted by the study (Limon, 2006).

For the current study, the findings show that epistemological beliefs can be found in both general-domain and specific-domain forms; the beliefs held in the general-domain form because undergraduates hold almost the same thoughts about *general knowledge* and *information literacy knowledge* in their first year. However, when they reach the fourth year, undergraduates' beliefs have developed towards a more sophisticated specific-domain form, as seen in the findings of the four dimensions of the specific beliefs.

The way their beliefs are developed can be seen (in this study) not only because of the years of studying at the university and the gaining of more knowledge and experience but also because of the nature of the discipline of information literacy. Information literacy is an interdisciplinary domain acting as an umbrella for different subjects from ill-structured to well-structured domain classification; therefore, studying information literacy may influence learners' beliefs regarding the different domain types, that is, both forms, general-domain and specific-domain beliefs.

Given this, it can be assumed that if information literacy is the well-structured domain (science major) it will have more influence and epistemological beliefs will be more general. However, if the ill-structured domain (art major) has more influence then the beliefs will be specific (Buehl et al., 2002). This finding supports the synthesized claim regarding domain-generality and domain-specificity of personal epistemological beliefs.

5.5 Summary

In order to answer the research questions related to the impact of the participants' characteristics, including gender, major, academic level and previous knowledge in information literacy, ANOVA analysis was used to find different levels of relationships between the factors and general and specific-domain beliefs. MANOVA analysis was also used to test the interaction between the four factors. The impact of gender was almost absent for the participants' beliefs regarding general knowledge and information literacy, however, there was a modest impact on participants' major of study in their beliefs but for academic level and previous knowledge of information literacy there was a noticeable impact on the participants' beliefs in both forms towards general knowledge and information literacy in particular. Some significant interaction between the factors and undergraduates' epistemological beliefs were also tested. The results of the interaction analysis appeared more between the two factors, that is, previous knowledge of information literacy and academic level.

This study did not find a clear difference between males and females in their beliefs as much as their major did. Art-major undergraduates hold more sophisticated beliefs in general knowledge than the science-major, whereas no impact for major is found for specific domain beliefs. The most influence on the development of epistemological beliefs in both forms, that is, general and specific, is found at the academic fourth year level. Additionally, previous knowledge of information literacy has a clear impact on the development of specific-domain beliefs but its influence on general beliefs was difficult to confirm. Previous knowledge of information literacy interacts very effectively with academic levels in improving specific-domain beliefs. Fourth-year undergraduates who studied information literacy courses are those with the highest sophisticated specific-domain beliefs found in this study. Based on the findings of this study, the undergraduates' epistemological beliefs are considered to be both general and specific-domain. The overall conclusions, contributions and future research are provided in the next chapter.

Chapter 6 CONCLUSIONS, CONTRIBUTIONS, AND FUTURE RESEARCH

Introduction

The epistemological beliefs - which refer to a learner's thoughts and ways of thinking about knowledge and knowing - are critical elements in teaching and learning. In the past four decades researchers and educators have paid great attention to learners' beliefs. Our understanding of how belief systems are structured has culminated in the multidimensional model of epistemological beliefs as developed by Schommer (1990). Based on Schommer's model other similar models have been created, including those by Kuhn et al. (2000), Qian and Alvermann (1995), Hofer and Pintrich (1997), Bendixen et al. (1994), and Paulsen and Wells (1998) all of whom developed Schommer's model and who added new items to the model thus producing new independent dimensions. The new models have helped to provide more understanding of the belief systems of learners.

This interest in studying learners' beliefs has also been directed towards defining the relationship between epistemological beliefs and different issues of learning. Research has proved that there is a positive link between what learners believe and the development of their academic achievement, motivation and performance (Buehl and Alexander, 2005; Richardson, 2013; Lin et al., 2013; Mohamed and El-Habbal, 2013; Muis et al., 2011). Since then tools with which to measure beliefs and to extract them from learners' minds have been designed and translate the findings into readable data that can be analysed and studied further, and the concern of these studies have turned to new directions. Interests have developed into discovering how the beliefs of learners have been created, formulated and developed, particularly looking at the type of variables that affect learners' beliefs and how, by controlling these variables, educators can improve learning outcomes. As a result of investigations into this area many questions and differences of opinions have arisen including whether the beliefs are about knowledge in general or certain knowledge (Buehl and Alexander, 2006; Hofer, 2006; Muis et al., 2006) and whether, if they are in a specific form, will they be similar or different across disciplines.

The epistemological belief system is a complicated psychological educational issue which has been found to be an important element in education especially in higher education and is also related to different aspects of learning such as assessing learners' achievements and learning performances. It is assumed that by providing better understanding of learners' beliefs will help in obtaining better learning. To get the benefits of the learners' beliefs in education it is critical to understand how they are formulated and developed. Peoples' beliefs change over their lifetimes and are affected by different variables.

One of the lines of argument considers that epistemological beliefs come into the *general domain*, are created from the early years of people's lives and are then developed through learning and experience (Schommer and Walker, 1995; Jacobson et al., 1997). Others view learners' beliefs as *specific domain* believing that it starts to develop in each domain independently (Hofer, 2006; Muis et al., 2006; Wheeler and Montgomery, 2009). Additionally, a few claim that what learners believe about *knowledge in general* and *certain knowledge,* for example science, art, mathematics or history, can be in both forms simultaneously (Buehl and Alexander, 2005; Limon, 2006).

Even with the all investigations into this area, there is still a lot to be learned and people's beliefs regarding knowledge and learning is still puzzling (Muis and Gierus, 2014). While previous studies in epistemological beliefs have looked at developing tools to measure the beliefs of learners, the variables affecting the development of beliefs, and whether the beliefs in general domain or specific domain are focused on different disciplines, no studies have yet been found dedicated to exploring the new discipline of information literacy, a discipline that has come into being only since the advent of the internet, and its impact on learners' beliefs looking at both forms of beliefs, that is, the general domain and the specific domain. There is a need to look at this from the culture of the learners in question given that beliefs, whether general or sp

The literature pointed to the argument about whether the beliefs that the learners hold about knowledge and knowing are in domain-generality or domain-specificity forms. In order to examine this argument on the specific-domain of information literacy, it is essential to investigate whether the effect of the information literacy discipline is only found on the general-domain, specific-domain or on both general and specific-domain beliefs. The findings between two different epistemological belief scales are compared to define the relationship (if it exists) between the development of the general-domain and the specific-domain of the epistemological beliefs and how the two forms of beliefs are affected by each other.

As reviewed earlier, previous studies which have investigated learners' epistemological beliefs regarding different disciplines, for example, mathematics, history, psychology and science, using different approaches, were established based on Schommer's (1990) original work on a multidimensional beliefs' system. The results of the studies found different levels of influences on the beliefs for each discipline; however; no study has yet looked at the impact of information literacy as a discipline on learners' beliefs nor have they mentioned testing general and specific beliefs using different instruments. This study adds to the literature in that it shows the impact of studying information literacy on learners' beliefs looking at the differences in the beliefs.

The main aim of this study was to investigate the influence of information literacy as a discipline on the epistemological beliefs of undergraduates comparing their general and specific beliefs. The objectives of this study are summed up as follows. One, the overall profile of the general and specific-domains of undergraduates. Two, the influence of variables (gender, major, academic level, and previous knowledge of information literacy) on the undergraduates' epistemological beliefs. Three, the interaction between the variables themselves and also between the variables within information literacy. Four, whether or not the epistemological beliefs of undergraduates, whether general or specific-domain, have been achieved. Given that these vary from culture to culture, to look at these from a specific region/culture, and one that has received little attention in the literature, namely, the Middle East.

To measure the epistemological beliefs of the participating undergraduates, this study adopted a case study of quantitative methodology using two questionnaires, that is, Schommer's (1990) epistemological beliefs questionnaire (SEQ), and Hofer's (2000) discipline focused epistemological beliefs questionnaire (DFEBQ), applied to 750 undergraduates studying in Colleges of Education at Kuwait University in Kuwait. The Statistical Package for the Social

Sciences software for Windows (SPSS version 19.0) was used to test the internal consistency of the data by applying factor analysis and reliability testing, examination of the epistemological beliefs of undergraduates was also carried out by conducting analyses of the variance tests.

6.1 Key Findings

Clear evidence can be found in this study confirming the impact of the academic level and previous knowledge on learners' epistemological beliefs.

The overall profile of both the general and specific-domain beliefs was found to have a fairly sophisticated level slightly above average. However, the specific domain beliefs were found to be more sophisticated than the general beliefs. In other words, the level of the sophisticated specific beliefs for undergraduates was higher than for their general beliefs. The overview profile of the dimensions is described after the role of the variables and their interactions are defined in detail.

After studying the impact of the variables on the general and the specific-domain epistemological beliefs focusing on gender, major, academic level and previous knowledge of information literacy, the findings of this study show that there are no epistemological belief differences in either questionnaire between male and female undergraduates. According to the major variable, the SEQ clearly distinguished between the epistemological beliefs of science and art undergraduates, however, the DFEBQ could not. The SEQ also showed that the art major has more influence in developing undergraduates' general beliefs than the science major.

The academic level has the strongest impact among the variables on both general and specific-domain epistemological beliefs. The fourth-year undergraduates hold more sophisticated general and specific-domain beliefs than the first-year undergraduates. The DFEBQ clearly measured the differences between the fourth and first-year undergraduates. Previous knowledge in information literacy has a clear influence on both general and specific beliefs; in fact, undergraduates who studied information literacy have more sophisticated beliefs than those who did not. The result of the DFEBQ is clearer than that of the SEQ when differentiating between the yes and the no-group undergraduates. This shows that the range of differences of epistemological beliefs between the yes and no-group is more significant for specific-domain beliefs than for general beliefs.

The results also show the interactions between the independent variables (gender, academic level, major) with the general and specific beliefs of undergraduates. With regard to the general domain, academic levels interact with gender, major or both in influencing the undergraduates' general beliefs. However, in the case of specific domain beliefs, the major interacts with gender, academic level and/or both affecting the specific beliefs of undergraduates. Fourth year art undergraduates hold more sophisticated levels than first-year science undergraduates in both general and specific beliefs.

With regard to interactions between information literacy and the independent variables, information literacy has more interactional effect on academic levels for both general and specific epistemological beliefs than on the major; no clear influence was found for gender. More clearly, information literacy has a significant interactional influence on undergraduates' specific epistemological beliefs but it is not as significant for undergraduates' general epistemological beliefs. The interaction of information literacy with the variables confirms that the yes-group fourth year art undergraduates have higher sophisticated specific-domain beliefs than the no-group first year science undergraduates.

The undergraduates' general beliefs in the dimension of *structure of knowledge* are in the moderate sophisticated level whereas the fourth year art major students hold more developed sophisticated beliefs believing less in seeking single answers and avoiding integration by viewing knowledge as complex,

The dimension of *stability of knowledge* is at a less sophisticated beliefs' level. First year science major undergraduates with no previous knowledge of information literacy are those with a lower development of beliefs, they believe that knowledge is more often certain rather than tentative thus they avoid ambiguity. When the first year students view knowledge as certain and unchanging they may be affected by the way they have been taught at school where teachers present knowledge as certain and stable information.

Regarding the *source of knowledge*, the undergraduates showed different levels of sophisticated beliefs about this dimension. While the fourth year art major undergraduates believe that knowledge has internal and external sources and experts are not the only source of knowledge, they also believe that knowledge presented by experts and authorities cannot be criticized. The beliefs in *source of knowledge* are more sophisticated if fourth year undergraduates have previous experience of information literacy.

The beliefs found in the dimension of *ability to learn* was located in the mid-point average level. The beliefs of the female students appeared, only in this dimension, as greater than those of the male students, that is, they believed that the ability to learn is not innate and hard work is important to success. However, the fourth year art major students were those with the higher level of beliefs, that is, they believe that learning is an acquired skill, success happens through hard work and they can teach themselves how to learn. This shows that the fourth year art major students hold more sophisticated beliefs because the knowledge and experiences obtained in studying their chosen discipline have been extended both and they have become more familiar with their learning abilities as well as the nature of the structure of art domains which allow learners to become independent learners capable of developing and acquiring knowledge and learning skills.

Whether learning happens quickly or over time the undergraduates hold a modest sophisticated beliefs level toward the dimension of *speed of learning*. The fourth year undergraduates hold slightly more sophisticated beliefs, in particular art major undergraduates and if they have had no previous knowledge of information literacy, they believe that learning is a gradual process requiring several attempts and concentrated effort to make learning happen.

The undergraduates' specific-domain beliefs in the dimension of *simplicity/certainty of knowledge* are little above the mid-point towards the naïve level. This means that the majority of the undergraduates believe in the simplicity and certainty of knowledge in the discipline of information literacy whereas the sophisticated beliefs held by the fourth year students with previous knowledge of information literacy were only slightly impacted if their course was an art major.

For the dimension of *justification of knowledge* there are equal levels of naïve and sophisticated beliefs. Where the sophisticated beliefs in this dimension are held by fourth year students and where the students with previous knowledge of information literacy believe that in the discipline of information literacy knowledge can be evaluated by personal experiences rather than by the experts.

The more sophisticated beliefs' level is found in the dimension *of source of knowledge.* Fourth year undergraduates who had studied information literacy have the highest level of belief in the existence of different trusted sources of knowledge rather than the educators and/or textbooks. There is a noticeable impact on the art major students for developing these beliefs.

Finally the dimension of *attainment of truth* has fairly sophisticated beliefs since the fourth year undergraduates with previous knowledge of information literacy believe that absolute truth in information literacy might be unattainable. Once again art major course seem to have an influence on developing undergraduates' beliefs.

The results clearly show that the undergraduates hold general and specific beliefs during their study in the college but that their beliefs become more developed towards more sophisticated specific beliefs over time and after studying advanced specialized courses.

This study contributes to the body of knowledge about the domain-generality and domain-specificity of personal epistemological beliefs with clear evidence that while the first-year undergraduates have more general-beliefs, the fourth year undergraduates hold more specific-domain beliefs. Furthermore, the way the disciplines present their learning material may influence the development of learners' beliefs. This is confirmed by the results that show that those who have already studied information literacy show more developed general and specific beliefs than those undergraduates who have not.

The main contribution of the study has been centred on finding whether epistemological beliefs are general-domain or specific-domain. As discussed in the literature review, there are three basic lines of consideration for the nature of beliefs which claim that epistemological beliefs are either general-domain, specific–domain or both general and specific-domain.

The theoretical contributions of this study have not only confirmed that beliefs are found as both general and specific-domain but has also added to the literature by showing that the first-year undergraduates hold more general than specific-domain beliefs and that the fourth-year undergraduates have more specific-domain than general beliefs; it seems that the epistemological beliefs of undergraduates gradually develop year after year and change from general knowledge to become more specific.

Moreover, art major undergraduates who study information literacy also show more sophisticated general beliefs which might be related to the impact of the arts material presented on the course. As a result, academic level and previous knowledge in information literacy has more influence in developing the specific domain beliefs of the undergraduates whereas the major impact depends on the way the course is presented.

6.2 Contribution

This study contributes to the existing knowledge on the area of individual’s epistemological beliefs in several ways. The main promote of the results to the knowledge can be described by measuring the epistemological beliefs for participants from certain culture using well-known instruments developed three decades ago. As Schommer’s and Hofer’s models are still used in the studies, the outcomes of the two models can be employed to examine and develop the credibility of the instruments from different aspects, for example, by focusing on applying the instrument in different culture, on learners from the new learning environment and the special nature of the discipline examined which is information literacy.

For the similarity of the results across culture, it is worth to mention that although this case study focusing on Kuwait undergraduates the impact of academic level on the epistemological beliefs is similar in studies from other culture. Kuwait first-year students hold simple naïve epistemological beliefs more than the fourth-year students where they hold sophisticated level of epistemological beliefs showing that the differences in their beliefs are regard to their different academic level. The same findings are existed between undergraduates from Iran (Marzooghi et al., 2008) United State of America (King and Magun-Jackson, 2009) Chaina (Ren et. al., 2009) Turkey (Tanriverdi's, 2012) and Singapore (Chai et al., 2010). The students in these studies are affected by the academic level as the same way as the Kuwait undergraduates. It seems that the influence caused by the culture factor is not clearly appeared when it comes to the factor of academic level. The academic level has stronger impact on the development of the students' beliefs that can reduce the impact of any other factor even the culture.

With regards to the contribution to the improvement of base theory and questionnaire, it is true that using a scale provides results depending on the purpose for which the measurement is required. In this study, both SEQ and DFEBQ questionnaires were used to measure the epistemological beliefs of undergraduates who were studying information literacy. While the original multidimensional epistemological beliefs theory proposed in 1990 by Schommer, there are many concepts have been developed and added later to the learning process which may require new additional dimensions of beliefs to be considered.

The findings of the factor analysis in the study support that claim. The results show that five out of 63 items were extracted from the SEQ while all 18 items of the DFEBQ remained, and two subsets "Concentrated effort is a waste of time" and "Learn first time" in the general epistemological beliefs were combined into one subset "Learn first time without concentrated effort". The new modified version of SEQ can be an indicator that the original Schommer model for the epistemological beliefs represented by SEQ is no longer reflect all the learners' beliefs dimensions and cannot measure the changes happened on their beliefs.

In the other hand, DFEBQ found to be more capable to read the learners' beliefs toward information literacy. All the specific-domain dimensions and items measured by DFEBQ are remained as proposed by Hofer (2000).Also, the results of DFEBQ regarding the significant differences and the differences in the mean values between the different groups has high values giving clear and strong readings for the outcomes of the study.

Although Hofer adopted a modified version based on Schommer's multidimensional model, the number of items in Hofer's model has been reduced focusing on more critical aspects related to the beliefs about a certain discipline. The benefit of reducing the items shows by avoiding the redundantly of some questions which may make the questionnaire boring and the participants lose their interests and focus. For that reason, DFEBQ gives clearer and stronger results than SEQ.

With regards to the practical contribution to teaching and learning in higher education in Kuwait, the epistemological beliefs of the Kuwait undergraduates were more superficial, in other words, the curriculum of the information literacy course was more general and not prepared in-depth in such a way as to comply with each major field of study of the Kuwait undergraduates. For this reason, the findings clearly reflect that the majority of Kuwait's undergraduates have very modest development of epistemological beliefs toward information literacy courses since the course is not adding any improvement to their epistemological beliefs compared with those who did not study information literacy.

The insufficiency in the development of the learners' beliefs toward information literacy is related to its multidisciplinary nature. The results of this study participate in directing the educators when they teach information literacy courses for undergraduates to concentrate on the way the content of the course developed. The content of the course should be designed in corresponding with the major of the learners to attract their attention toward information literacy courses and to insure that the course affect positively on developing their beliefs toward more advanced levels.

6.3 Limitations of the Study

This case study was conducted to measure Kuwait undergraduates' beliefs only focusing on their previous knowledge of information literacy; no other disciplines were included. Undergraduates who study information literacy may also have been studying other disciplines; however, the any impact that may have caused is not within the scope of this study.

This study was limited to the use of the case-study approach since all participants were Kuwaiti, no other nationality was included which means that there might have been different findings for non-Kuwaiti students. Furthermore, the study was conducted only on undergraduates from the College of Education at Kuwait University; undergraduates studying in other Colleges were not included. Students were undergraduates, not postgraduates. There is thus the possibility that, as well as the possible effect of the culture/country on the findings, their levels and fields of study may affect their beliefs differently.

Another limitation refers to the programme where the study was conducted. The College of Education is a public teacher preparation programme presented by Kuwait University but there are other teacher preparation programmes in other public institution and also in private universities in Kuwait, none of these were included in the investigation. The influences caused by the different programmes on learners' beliefs were not observed in this study since all participants were from the same programme.

The results show that art major undergraduates who study information literacy hold more sophisticated specific beliefs than science major undergraduates. This may be attributed to the fact that information literacy courses are designed and taught by the College of Social Studies in Kuwait University which has more arts material in its content.

For the demographic information, the study focused only on the impact of gender, major and academic levels on participants' beliefs and excluded studying the impact of other information such as age, GPA and grades. Furthermore, it takes four years to complete the graduation requirements at the College of Education and this study targeted only the students in the first and the fourth years, therefore, second and third year students were not included.

The items in the two questionnaires used in this study, SEQ and DFEBQ, were written in English and since the target sample was Arabic speakers the items were translated by the researcher who tried to use clear, understandable sentences keeping the true meaning for each item as it was originally written. However, the Arabic version was revised by other colleagues so as to be sure it was well-structured; nevertheless, there is still some doubt that some of the original notions may not have been reflected appropriately in the Arabic questionnaire.

The SEQ was designed to measure the general beliefs of undergraduates so there were a large number of general questions which were sometimes repeated, meaning that the SEQ was too long having many questions which, perhaps, caused the participants to be more confused and also many items were either repeated or very similar in the context. For this reason, the questions may not have been precise enough to measure the impact of the information literacy course on those undergraduates answering the questions.

6.4 Future Research

This study has investigated the participating undergraduates' epistemological beliefs supporting the theories in the literature as explained in chapter two. The general and specific domain beliefs have been studied and discussed in this study so as to explore how undergraduates develop their thoughts about knowledge and knowing, however much is still to be learned.

Epistemological beliefs for learners are affected by many variables; however, the variables tested for their impact on undergraduates' beliefs in this study were limited to gender, major, academic level and previous knowledge of information literacy. Studying other variables and their effects on learners' beliefs is needed.

The participants in this study were undergraduates studying in the College of Education at Kuwait University; the results have shown that their beliefs are at a fairly sophisticated level. More levels of beliefs with other groups of learners should be included in further studies, for example, people from different age groups, school students and postgraduates. It is also recommended that learners from different schools be included rather than students from the same school (as in this study) to compare their beliefs based on their field of study such as engineering, social studies and business etcetera.

Regarding the research approach, this study used questionnaires. It would be useful to extend the findings of this study by including direct expressions from the participants themselves so as to better understand what their private thoughts are about knowledge and knowing. It is also suggested that interviews be included so as to obtain a more in-depth investigation which should help to gain personal contact with the participants allowing them to record learners' thoughts using their own words.

The SEQ questionnaire might not precisely measure the epistemological beliefs of university undergraduates, in particular those studying information literacy, because the SEQ questionnaire was developed in 1990 prior to the founding of the internet. For this reason, it is argued that the SEQ questionnaire needs updating and further modification to include information literacy as a main factor, in other words, to include consideration of the rapid and continuous development of undergraduates' epistemological beliefs; in other words it should be updated using the latest technology of internet and the IT revolution.

Information literacy as a discipline was the scope of this research. The investigation into information literacy was carried out broadly through asking participants whether or not they were studying the course. Therefore after this first step, the suggested next step of investigation would focus more on the impact of information literacy on the learners' beliefs whilst studying the course using pre-tests and post-tests. The results of the pre-tests and post-tests would determine the direct influences of the course on the learners' beliefs reducing the impact of other factors.

It would be useful to compare the information literacy learners' beliefs with other disciplines, for example mathematics, science, history, computer science etcetera.

Ultimately, it is true that the initial work of epistemological belief measurements was established in Western countries, however, culture did not come under the scope of this study although there were some signs of cultural impact on students' beliefs which were evident in their responses. For example, the different ways the participants responded to the dimension of *source of* *knowledge* can be seen as a cultural impact. While the freedom to search for the truth is ensured in Kuwait where this study took place, this freedom is restricted with regard to religion and social values relating to showing respect and accepting scholars' and parents' authority. As well the naïve belief level regarding depending on authority found in first year students can be attributed to their dependence on their teachers at school. It is, therefore, critical to investigate the cultural influences on the epistemological beliefs so as to compare how those beliefs are developed across countries as this would shed more light on epistemological beliefs.

The findings of this study support the multidimensional belief system proposed by Schommer (1990). Her system consists of five dimensions outlining the sum of beliefs in the learners' minds towards the structure of knowledge and the process of knowing where the existence and the development of each dimension occurs independently. More understanding about how each dimension acts in the learning process and how it is formulated in the learners' minds raises the need to conduct new lines of epistemological belief studies focusing on the nature of each dimension separately and exploring its relationship with learners' performances and their learning achievements.

Three areas need further research. One, belief regarding the *structure and the stability of knowledge* in which investigations focus on the nature of the learning content and how it is presented. Two, the sources of information and how learners interact with educators and experts as the presenters of knowledge. Three, concern about how learning happens by exploring the learners' abilities and skills. Focusing research on these three lines of epistemological beliefs will add value by providing more understanding of multidimensional belief systems and how they can be applied to the learning process.

It is recognised, however, that further research is required if we are to better understand the epistemological beliefs for each specific learner, and that this work will need to look not only at the different levels/years of study but also, crucially, to look at the cultural and societal aspects of how such belief systems impact their thinking and behaviours.

6.5 Concluding Comments

This study is considered as a pioneer study focusing on the influence of information literacy on the epistemological beliefs of learners towards their academic levels, major, and gender. This study has added to our knowledge about the epistemological general and specific beliefs that learners who study information literacy have, and how epistemological beliefs are influenced by academic level and change over time. The work described in this study makes its contribution as a vital first step towards that goal.

This study has addressed the general knowledge and the specific knowledge in information literacy for undergraduates. The importance of the discipline of information literacy in higher education lies in its relationship to learners' academic and professional success. As an interdisciplinary domain, information literacy is presented to learners in all fields of study from all sorts of schools, however, sometimes there is only one course structure presented to all students. To ensure the effectiveness of information literacy courses on developing learners' beliefs this study related the content material of the course to learners' majors. It is recommended that the course in information literacy should be structured to fulfill the requirements and interests of every field of study. In other words, the course of information literacy designed for learners studying engineering should focus on information related to engineering including teaching how knowledge about engineering is organized, how to access the databases for engineering material, teaching the related keywords and terms in addition to general information. It is also recommended, based on the results of this study, that information literacy becomes a compulsory course not an elective one for first-year students since the findings show that there are some undergraduates who have no experience of the course and hold less developed beliefs.

Educators should pay attention to the development of learners' thoughts regarding knowledge and knowing in order to employ developing belief strategies into the learning process. Educators in higher education must understand that learners join the university with a level of beliefs influenced by the way they have studied in school; usually they will enter with naive levels of belief. The goal of enhancing their belief levels must be added to a university's mission and should be reflected within their academic courses and their extra- curricular activities.

It is assumed that if the disciplines are aware of the epistemological beliefs' development of their learners when designing and presenting courses the disciplines would gain greatly making improvements to the way learners interact with *the* knowledge and knowing in each subject.

The findings of epistemological belief studies can provide guidelines as to how to improve the way the courses are presented. For example the results of this study claim that the course contents of information literacy may affect the development of art major undergraduates' beliefs if the course is influenced by art materials. Therefore designing a course for information literacy that fits with learners' majors and relates it to their epistemological beliefs will add to the literature. Establishing a new course structure for information literacy and watching its impact on the development of students' epistemological beliefs, course grades, academic performances, GPAs, and their academic achievements is recommended.

Whilst it is recognised that more needs to be done in order to better understand belief regarding the structure and stability of knowledge, the sources of information and how learners interact with educators and experts as the presenters of knowledge and concern about how learning happens and how these impact and can be applied to the learning process, including looking at the cultural and societal aspects of how such belief systems impact their thinking and behaviours, this study is a vital step in helping to better understand learners and their learning.

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APPENDICES

Appendix 1 Pilot study

Details of Participants

IL course			Academic Level fourth year	Total
yes	Gender	Male	7	7
		Female	7	7
	Total		14	14
no	Gender	Male	7	7
		Female	7	7
	Total		14	14
Total	Gender	Male	14	14
		Female	14	14
	Total		28	28

Gender MALE
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Q2-1	14	1	5	3.36	1.550
Q2-2	14	1	5	2.43	1.284
Q2-3	14	1	4	1.86	1.099
Q2-4	14	1	5	2.29	1.267
Q2-5	14	1	4	2.00	1.177
Q2-6	14	1	4	2.43	1.158
Q2-7	14	1	3	2.14	.535
Q2-8	14	1	5	2.50	1.345
Q2-9	14	1	4	1.71	.825
Q2-10	14	1	4	2.71	1.326
Q2-11	14	1	4	2.14	.949
Q2-12	14	1	4	2.43	1.089
Q2-13	14	1	5	3.07	1.385
Q2-14	14	1	5	2.29	1.326
Q2-15	14	1	4	1.93	.917
Q2-16	14	3	5	4.00	.555
Q2-17	14	2	5	3.79	.975
Q2-18	14	1	5	3.14	1.406
Valid N (listwise)	14				

Gender FEMALE
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation

Q2-1	14	1	5	3.00	1.710
Q2-2	14	1	4	2.00	.961
Q2-3	14	1	4	2.29	1.267
Q2-4	14	1	2	1.79	.426
Q2-5	14	1	5	2.21	1.311
Q2-6	14	1	5	2.29	1.267
Q2-7	14	1	4	1.57	.852
Q2-8	14	1	5	2.29	1.267
Q2-9	14	1	5	2.07	1.207
Q2-10	14	2	5	3.21	1.188
Q2-11	14	1	4	3.00	.961
Q2-12	14	1	4	2.57	.938
Q2-13	14	1	5	2.79	1.122
Q2-14	14	1	4	2.00	.679
Q2-15	14	1	4	2.00	.784
Q2-16	14	2	5	3.86	1.027
Q2-17	14	2	5	4.21	.802
Q2-18	14	1	5	3.36	1.082
Valid N (listwise)	14				

IL course = yes-group
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Q2-1	14	4	5	4.64	.497
Q2-2	14	1	2	1.57	.514
Q2-3	14	1	2	1.14	.363
Q2-4	14	1	2	1.57	.514
Q2-5	14	1	2	1.36	.497
Q2-6	14	1	2	1.50	.519
Q2-7	14	1	4	1.93	.829
Q2-8	14	1	2	1.43	.514
Q2-9	14	1	4	1.86	.864
Q2-10	14	1	5	3.36	1.151
Q2-11	14	1	4	2.79	.893
Q2-12	14	1	4	2.50	1.019
Q2-13	14	1	5	2.79	1.251
Q2-14	14	1	2	1.50	.519
Q2-15	14	1	2	1.50	.519
Q2-16	14	2	5	4.00	.877
Q2-17	14	4	5	4.50	.519
Q2-18	14	2	5	3.50	1.019
Valid N (listwise)	14				

a. IL course = yes

IL course = no-group
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Q2-1	14	1	3	1.71	.726
Q2-2	14	2	5	2.86	1.231
Q2-3	14	2	4	3.00	.961
Q2-4	14	1	5	2.50	1.092
Q2-5	14	1	5	2.86	1.292

Q2-6	14	2	5	3.21	1.051
Q2-7	14	1	3	1.79	.699
Q2-8	14	2	5	3.36	1.082
Q2-9	14	1	5	1.93	1.207
Q2-10	14	1	5	2.57	1.284
Q2-11	14	1	4	2.36	1.151
Q2-12	14	1	4	2.50	1.019
Q2-13	14	1	5	3.07	1.269
Q2-14	14	2	5	2.79	1.051
Q2-15	14	1	4	2.43	.852
Q2-16	14	2	5	3.86	.770
Q2-17	14	2	5	3.50	.941
Q2-18	14	1	5	3.00	1.414
Valid N (listwise)	14				

a. IL course = no

The influence of GENDER on the DEPQ

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
gender	Q2-1	.893	1	.893	2.419	.133
	Q2-2	1.286	1	1.286	1.421	.245
	Q2-3	1.286	1	1.286	2.512	.126
	Q2-4	1.750	1	1.750	3.267	.083
	Q2-5	.321	1	.321	.314	.580
	Q2-6	.143	1	.143	.194	.664
	Q2-7	2.286	1	2.286	4.267	.050
	Q2-8	.321	1	.321	.429	.519
	Q2-9	.893	1	.893	.781	.386
	Q2-10	1.750	1	1.750	1.167	.291
	Q2-11	5.143	1	5.143	5.838	.024
	Q2-12	.143	1	.143	.158	.695
	Q2-13	.571	1	.571	.348	.561
	Q2-14	.571	1	.571	1.000	.327
	Q2-15	.036	1	.036	.067	.798
	Q2-16	.143	1	.143	.197	.661
	Q2-17	1.286	1	1.286	2.348	.139
	Q2-18	.321	1	.321	.199	.660

The influence of IL on the DEPQ

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
IL	Q2-1	60.036	1	60.036	162.677	.000
	Q2-2	11.571	1	11.571	12.789	.002
	Q2-3	24.143	1	24.143	47.163	.000
	Q2-4	6.036	1	6.036	11.267	.003
	Q2-5	15.750	1	15.750	15.384	.001
	Q2-6	20.571	1	20.571	27.871	.000
	Q2-7	.143	1	.143	.267	.610

	Q2-8	26.036	1	26.036	34.714	.000
	Q2-9	.036	1	.036	.031	.861
	Q2-10	4.321	1	4.321	2.881	.103
	Q2-11	1.286	1	1.286	1.459	.239
	Q2-12	.000	1	.000	.000	1.000
	Q2-13	.571	1	.571	.348	.561
	Q2-14	11.571	1	11.571	20.250	.000
	Q2-15	6.036	1	6.036	11.267	.003
	Q2-16	.143	1	.143	.197	.661
	Q2-17	7.000	1	7.000	12.783	.002
	Q2-18	1.750	1	1.750	1.081	.309

The Interaction between IL and Gender

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
IL * gender	Q2-1	.321	1	.321	.871	.360
	Q2-2	.143	1	.143	.158	.695
	Q2-3	.143	1	.143	.279	.602
	Q2-4	4.321	1	4.321	8.067	.009
	Q2-5	.036	1	.036	.035	.853
	Q2-6	.000	1	.000	.000	1.000
	Q2-7	.143	1	.143	.267	.610
	Q2-8	.321	1	.321	.429	.519
	Q2-9	.321	1	.321	.281	.601
	Q2-10	.893	1	.893	.595	.448
	Q2-11	1.286	1	1.286	1.459	.239
	Q2-12	5.143	1	5.143	5.684	.025
	Q2-13	1.286	1	1.286	.783	.385
	Q2-14	3.571	1	3.571	6.250	.020
	Q2-15	.036	1	.036	.067	.798
	Q2-16	.143	1	.143	.197	.661
	Q2-17	.571	1	.571	1.043	.317
	Q2-18	.321	1	.321	.199	.660

Appendix 2 Courses selected for Data Collections

		Academic level	Course number & title	# of classes		# of participants		Duration
				male	female	male	female	
1.	Pilot study	Fourth-year	235 Computer in education	1	1	14	14	20-30 Minutes
2.	Main study	First-year	080 Introduction to college of education programmes	8	13	130	260	20-30 Minutes at the end of the lecture time
3.		Fourth-year	235 Computer in education	1	7	19	67	
4.			358 Educational technology tools	1	4	20	56	
5.			370 Teaching Islamic studies 2	1	1	6	8	
6.			371 Teaching Arabic language 2		1		9	
7.			372 Teaching English language 2	2		16		
8.			373 Teaching social studies 2	2	1	12	7	
9.			374 Teaching science 2	2		27		
10.			375 Teaching Mathematics 2		1		10	
11.			421 Development of educational thought	1	1	33	26	
12.			440 Seminar kindergarten		1		8	
13.			442 Seminar Arabic language		1		4	
14.			446 Seminar English language		1		5	
15.			352 Educational communication tools		2		27	

Appendix 3 Research instruments

عزيزي الطالب... عزيزتي الطالبة...

تحية طيبة،،

أتقدم بالشكر مقدما على تفضلكم بالموافقة على المشاركة في حل أسئلة هذا الاستبيان الذي وضع لإغراض بحثية بحتة تخدم الباحثة في إجراء دراستها في برنامج الدكتوراه بتخصص علم المكتبات والمعلومات، ولن تستخدم نتائج هذا الاستبيان في غير أغراض البحث كما انه لن تكشف هوية من قام على حله بأي حال من الأحوال.

إن تفضلكم بالإجابة بكل دقة وأمانة على أسئلة الاستبيان سيعزز من مصداقية هذه الأداة ومن ثم مصداقية ودقة البحث.

مع خالص شكري وتقديري،،

الباحثة

دلال السميط

6 -1

1. البيانات العامة:

الاسم (اختياري) ....

البريد الالكتروني (اختياري) ....

النوع: ☐ذكر ☐ أنثى

العمر: .... سنة

الجنسية: ☐كويتي ☐ غير كويتي

التخصص في الثانوية العامة : ☐ علمي ☐أدبي

التخصص في كلية التربية: ....

المعدل في الثانوية العامة: .... %

المعدل الجامعي: ....

عدد المقررات المجتازة: ....

المعدل المتوقع في المقرر الحالي:

☐ Pass ☐ Fail ☐......

هل سبق أن درست مقررا في تخصص علم المعلومات ومصادرها؟

☐ نعم ☐ لا

هل تم قبولك بكلية التربية بناء على رغبتك:

☐ نعم ☐ لا

6 -2

2. استبيان قياس المعتقدات المعرفية العامة لدى الطالب

المقصود بالمعتقدات المعرفية العامة لدى الطالب:

هو ما يملكه الطالب من معتقدات و اقتناعات حول كيف تتم عملية التعلم والتعليم للمعرفة بشكل عام (دون تحديد تخصص معين)، من حيث كيف يتم بناء المعرفة و كيف يحدث التعلم وكيف يمكن أن نعرف إننا تعلمنا واكتسبنا المعرفة و كيف يمكن أن نقييم التعلم.

م.	بند الاستبيان	الاستجابة				
		أوافق بشدة	أوافق	لا أعرف	لا أوافق	لا أوافق بشدة
1.	الأمور أبسط مما يحاول اغلب الأساتذة أن يجعلوك تعتقد.					
2.	القدرة على التعلم هي موهبة فطرية.					
3.	الشيء الوحيد الأكيد انه لا يوجد شي مؤكد.					
4.	العبقرية هي 10% موهبة و 90% اجتهاد.					
5.	يتمتع الأشخاص الذين يتحدون السلطة بثقة الزائدة بالنفس.					
6.	أبذل قصارى جهدي لربط المعلومات التي أتعلمها بين فصول المقرر الواحد أو حتى بين المقررات التي أدرسها.					
7.	إذا بذل العلماء جهدا كافيا فأنهم سيتوصلون للحقائق عن كل شيء تقريبا.					
8.	عندما أدرس فإنني أركز على حقائق محددة لدراستها.					
9.	في أغلب الأحيان كفاءة المدرس هي التي تحدد مدى الاستفادة من الدرس.					
10.	أغلب الكلمات في اللغة ليس لديها إلا معنى واحد.					
11.	الحقيقة ثابتة لا يمكن أن تتغير.					
12.	الطالب الناجح هو الذي يستطيع فهم الأشياء بسرعة.					
13.	العلماء يمكنهم دائما التوصل إلى الحقيقة.					
14.	إذا أتيحت لي الفرصة لقراءة فصل من المقرر مرة أخرى فإني سأفهمه أكثر في المرة الثانية.					
15.	أكثر الأجزاء أهمية في البحث العلمي هو الابتكار في طريقة التفكير ولذلك المعرفة تتغير دائما.					
16.	الطلبة الأذكياء فقط هم الذين يجتهدون في المسائل الصعبة والتي تستغرق وقتا طويلا لحلها.					
17.	من المزعج الاستماع إلى محاضر من الواضح عليه انه لا يتخذ قراراته بناء على ما يؤمن به.					
18.	يمكنك أن تصدق كل ما تقرأه تقريبا.					

م.	بند الاستبيان	الاستجابة				
		أوافق بشدة	أوافق	لا أعرف	لا أوافق	لا أوافق بشدة
19.	إذا كنت قادرا على فهم موضوع ما، فمن المنطقي أن يكون ذا معنى لك عند سماعه من المرة الأولى.					
20.	عادة دراسة فصل صعب من المقرر لأكثر من مرة لا يساعدك على أن تفهمه.					
21.	أكثر الأشخاص الناجحين هم الذين عرفوا كيف يحسنون قدرتهم على التعلم. 6 -3					
22.	لضمان النجاح في دراستي من الأفضل أن لا اطرح أسئلة كثيرة.					
23.	الالتحاق بدورة في مهارات الدراسة قد تكون ذات قيمة.					
24.	أتساءل في كثير من الأحيان عن مدى المعلومات التي يعرفها المدرسون فعلا.					
25.	وظيفة المعلم الجيد هي الحفاظ على طلبته من الانحراف عن المسار الصحيح.					
26.	أهم جوانب البحث العلمي هي الدقة في القياس والإتقان في العمل.					
27.	الدراسة بالنسبة لي هي الحصول على الأفكار الرئيسية من الدرس وليس البحث عن التفاصيل.					
28.	على التربويين الآن أن يكونوا على علم بالأسلوب الأفضل في التدريس إن كان أسلوب المحاضرات أو حلقات النقاش للمجاميع الصغيرة.					
29.	لا يمكنك أبدا أن تعرف معنى الكتاب إلا إذا تمكنت من معرفة قصد المؤلف.					
30.	يمتلك الطلبة القدرة الكافية التي تمكنهم من معرفة مدى الاستفادة المرجوة من المقرر.					
31.	من الممتع بالنسبة لي التفكير في القضايا الممنوعة من قبل السلطات.					
32.	الكل بحاجة أن يتعلم كيف يتعلم.					
33.	عندما تواجهك فكره صعبة في مقرر دراسي ما ، فمن الأفضل أن تحاول حلها بنفسك.					
34.	لا تمتلك الجملة معنى واضحا إلا إذا تم معرفة الموقف الذي قيلت فيه.					
35.	الطالب الجيد هو الطالب القادر على حفظ المعلومات.					
36.	الحكمة هي ليست معرفة الإجابات الصحيحة ولكن هي معرفة كيفية التوصل إليها.					
37.	الشخص الذي لا يتذكر تفاصيل نص قرأه ولكنه يستطيع أن يأتي بأفكار جديدة منه فأنني أعتبره شخصاً ذكياً.					
38.	كلما واجهتني مشكلة صعبة في حياتي فإنني أستشير والديّ.					
39.	حفظ التعريفات حرفيا غالباً ما يكون ضرورياً للحصول على أداء جيد بالاختبارات.					
40.	عندما لا يتمكن شخص من فهم موضوع ما في وقت قصير ، فأن عليه أن يستمر بالمحاولة لوقت أطول.					
41.	يجب عليك أحياناً قبول إجابة المدرس حتى لو لم تستطيع فهمها.					
42.	لا أحب الأفلام التي ليست لها نهاية.					
43.	التفوق يتطلب الكثير من العمل.					
44.	من المضيعة للوقت محاولة حل مسألة من المستحيل إيجاد إجابة واضحة لا لبس فيها لها.					

م.	بند الاستبيان	الاستجابة				
		أوافق بشدة	أوافق	لا أعرف	لا أوافق	لا أوافق بشدة
45.	إذا كنت ملما بموضوع الكتاب فعليك أن تقييم دقة المعلومات التي فيه.					
46.	غالباً ، حتى نصائح الخبراء قابله للنقاش.					
47.	بعض الأشخاص مولودين بموهبة جيدة للتعلم، والبعض الآخر لديهم إمكانيات تعلم محدودة.					
48.	لاشيء مؤكد غير الموت والضرائب.					
49.	الطلبة الأذكياء حقا لا يجب عليهم أن يبذلوا جهدا في دراستهم. 6 -4					
50.	إذا بذل شخص جهدا كبيرا لفهم مسألة ما فإنه في أكثر الاحتمالات سيصبح بالنهاية مشوشاً.					
51.	إنك ستحصل على أغلب المعلومات التي تستطيع أن تتعلمها من المقرر من المرة الأولى التي تقرأ بها الكتاب.					
52.	تستطيع عادة أن تفهم الأفكار الصعبة إذا ركزت على الموضوع وابتعدت عن المؤثرات الخارجية التي تشتت تفكيرك.					
53.	أفضل طريقة لفهم المقرر هي التعرف على المعلومات وفق خطة خاصة بي.					
54.	الطلبة الذين مستواهم متوسط بالمدرسة سيبقى مستواهم متوسط حتى في بقية حياتهم.					
55.	العقل النظيف هو العقل الفارغ.					
56.	الخبير هو الشخص الذي يمتلك موهبة خاصة في تخصص ما.					
57.	إنني أحترم المحاضرين الذين ينظمون محاضراتهم بشكل دقيق ومن ثم يلتزمون بخطتهم الدراسية.					
58.	أفضل شيء في المقررات العلمية إن أغلب مسائلها لها إجابة صحيحة واحدة.					
59.	التعلم هو عمليه بطيئة لبناء المعرفة.					
60.	حقائق اليوم قد تكون خيال الغد.					
61.	كتب "درس نفسك بنفسك" لا تساعد كثيراً.					
62.	تصاب بالتشويش إذا حاولت دمج الأفكار الجديدة في مقرر مع ما تعرفه مسبقا عن الموضوع.					
63.	إذا قل اعتماد الدكاترة على النظريات والحقائق يمكن التخرج من الكلية بفائدة اكبر .					

3. استبيان لقياس المعتقدات المعرفية لدى الطالب في تخصص علم المعلومات

المقصود بتخصص علم المعلومات هو: معرفة كيف تنظم المعرفة والمعلومات وكيف يتم العثور على المعلومات من خلال التعرف على مواقف الحاجة إلى معلومات والقدرة على البحث وتحديد المعلومات من مصادرها المختلفة والقدرة على تقييم المعلومات و الاستخدام الفعال لها في اتخاذ القرارات المناسبة ومعرفة كيف تحفظ المعلومات وكيف يمكن استرجاعها عند الحاجة إليها.

م.	بند الاستبيان	الاستجابة				
		أوافق بشدة	أوافق	لا أعرف	لا أوافق	لا أوافق بشدة
1.	تتغير الحلول في هذا التخصص كلما جمع المختصون فيه معلومات أكثر.					
2.	جميع الخبراء في هذا التخصص يفهمون تخصصهم بنفس الطريقة.					
3.	الحقيقة في هذا التخصص لا تتغير أبدا.					
4.	في هذا المقرر كل المسائل لها إجابة واحدة فقط صحيحة.					
5.	المبادئ الأساسية في هذا التخصص غير قابلة للتغيير.					
6.	قد يتوصل جميع الأساتذة في هذا التخصص إلى نفس الإجابات للأسئلة المتعلقة بهذا التخصص.					
7.	من الجيد أن تناقش الأفكار المعروضة في المقرر.					
8.	معظم الحقائق في المقرر معروفة مسبقا.					
9.	التجربة الأولى هي أفضل طريقة للتعلم في هذا المجال.					
10.	أجد نفسي أكثر تقبلا لأفكار الأشخاص حديثي التجربة من الباحثين المتخصصين في هذا المجال.					
11.	الإجابات الصحيحة في هذا التخصص هي رأي شخصي أكثر من كونها حقيقة مسلم بها.					
12.	في الحقيقة لا توجد هناك طريقة تستطيع أن تحدد ما إذا كان بعض الأشخاص لديهم الإجابة الصحيحة في هذا التخصص.					
13.	في بعض الأحيان علينا أن نتقبل إجابات الخبراء في هذا التخصص حتى لو لم نستطيع فهمها.					
14.	من المؤكد أن المعلومات المتضمنة في كتاب المقرر هي معلومات صحيحة.					
15.	إذا تعارض رأيي الشخصي مع أفكار الكتاب المقرر، فمن المرجح أن أفكار الكتاب هي الصحيحة.					
16.	أنا على ثقة كبيرة بأني قادر على تعلم شيء حين أعرف ماذا يفكر به الخبراء.					
17.	يستطيع الخبراء في هذا المجال التوصل في النهاية إلى الحقيقة.					
18.	إذا عمل الباحثون بجدية كافية، فأنهم سيتوصلون إلى الإجابات لكل شيء تقريباً.					

شكري وتقديري،،

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Appendix 4 The original items of SEQ and DFEBQ

Questionnaire for the General Domain of the Epistemological Beliefs

Schommer (1990)

items		Strongly agree	Agree	Don't Know	Strongly Disagree	Disagree
1.	Things are simpler than most professors would have you believe.					
2.	The ability to learn is innate.					
3.	The only thing that is certain is uncertainty itself.					
4.	Genius is 10% ability and 90% hard work.					
5.	People who challenge the authority are overconfident.					
6.	I try my best to combine information across chapters or even across classes.					
7.	If scientists try hard enough, they can find truth about almost everything.					
8.	When I study, I look for specific facts.					
9.	How much a person gets out of school mostly depends on the quality of the teacher.					
10.	Most words have one meaning.					
11.	Truth is unchanging.					
12.	Successful students understand things quickly.					
13.	Scientists can ultimately get to the truth.					
14.	If I get time to reread a textbook chapter, I get a lot more out of it the second time.					
15.	The most important part of scientific work is original thinking; thus knowledge is always changing.					
16.	Working hard on a difficult problem for an extended period of time only pays off for really smart students.					
17.	It is annoying to listen to a lecturer who cannot seem to make up his mind as to what he believes.					
18.	You can believe almost everything you read.					
19.	If you are going to be able to understand something, it will make sense to you the first time you hear it.					
20.	Going a difficult textbook chapter, usually will not help you understand it.					
21.	The most successful people have discovered how to improve their ability to learn.					
22.	For success in school, it is best not to ask too many questions.					
23.	A course in study skills would probably be valuable.					
24.	I often wonder how much my teachers really know.					
25.	A good teacher's job is to keep his or her students from wandering off the right track.					

items		Strongly agree	Agree	Don't Know	Strongly Disagree	Disagree
26.	The most important aspect of scientific research is precise measurement and careful work.					
27.	To me, studying means getting the big ideas from the text rather than details.					
28.	Educators should know by now which is the best method, lectures or small group discussions.					
29.	You never know what a book means unless you know the intent of the author.					
30.	Students have a lot of control over how much they can get out of a textbook.					
31.	I find it refreshing to think about issues that authorities cannot agree on.					
32.	Everyone needs to learn how to learn.					
33.	When you first encounter a difficult concept in a textbook, it is best to work it out on your own.					
34.	A sentence has little meaning unless you know the situation in which it is spoken.					
35.	Being a good student generally involves memorizing facts.					
36.	Wisdom is not knowing the answers, but knowing how to find the answers.					
37.	If a person forgot details but was able to come up with new ideas from a text, I would think they were bright.					
38.	Whenever I encounter a difficult problem in life, I consult my parents.					
39.	Learning definitions word-for-word is often necessary to do well on tests.					
40.	If a person cannot understand something in a short time, he or she should keep trying.					
41.	Sometimes you have to accept teachers' answers although you do not understand them.					
42.	I do not like movies that do not have an ending.					
43.	Getting ahead takes a lot of work.					
44.	It is a waste of time to work on problems that have no possibility of coming out with a clear-cut and unambiguous answer.					
45.	You should evaluate the accuracy of information in a textbook if you are familiar with the topic.					
46.	Often, even advice from experts should be questioned.					
47.	Some people are born good learners; others are stuck with limited ability.					
48.	Nothing is certain but death and taxes.					
49.	The really smart students do not have to work hard to do well in school.					
50.	If a person tries too hard to understand a problem, he or she will most likely just end up being confused.					

items		Strongly agree	Agree	Don't Know	Strongly Disagree	Disagree
51.	You will get almost all the information you can learn from a textbook during the first reading.					
52.	Usually you can figure out difficult concepts if you eliminate all outside distractions and really concentrate.					
53.	A really good way to understand a textbook is to reorganize the information according to your own personal scheme.					
54.	Students who are average in school will remain average for the rest of their lives.					
55.	A tidy mind is an empty mind.					
56.	An expert is someone who has a special gift in some area.					
57.	I appreciate instructors who organize their lectures meticulously and then stick to their plan.					
58.	The best thing about science courses is that most problems have only one right answer.					
59.	Learning is a slow process of building knowledge.					
60.	Today's facts may be tomorrow's fiction.					
61.	Self-help books are not much help.					
62.	You will just get confused if you try to integrate new ideas in a textbook with knowledge you already have about a topic.					
63.	If professors would stick to the facts and theorize less, one could get more out of college.					

Questionnaire for the Specific Domain of the Epistemological Beliefs

Hofer (2000)

Note: The field mentioned below refers to Information literacy

items		Strongly agree	Agree	Don't Know	Strongly Disagree	Disagree
1.	Answers to questions in this field change as experts gather more information.					
2.	All experts in this field understand the field in the same way.					
3.	Truth is unchanging in this subject.					
4.	In this subject, most work has only one right answer.					
5.	Principles in this field are unchanging.					
6.	All professors in this field would probably come up with the same answers to questions in this field.					
7.	In this subject, it is good to question the ideas presented.					
8.	Most of what is true in this subject is already known.					
9.	First-hand experience is the best way of knowing something in this field.					
10.	I am more likely to accept the ideas of someone with firsthand experience than the ideas of researchers in this field.					
11.	Correct answers in this field are more a matter of opinion than fact.					
12.	There is really no way to determine whether someone has the right answer in this field.					
13.	Sometimes you just have to accept answers from the experts in this field, even if you don't understand them.					
14.	If you read something in a textbook for this subject, you can be sure it's true.					
15.	If my personal experience conflicts with ideas in the textbook, the book is probably right.					
16.	I am most confident that I know something when I know what the experts think.					
17.	Experts in this field can ultimately get to the truth.					
18.	If scholars try hard enough, they can find the answers to almost anything.					

Appendix 5 Statement of ethics approval

School of Information Systems, Computing and Mathematics
David Gilbert, Head of School, Professor of Computing
Jasna Kuljis, Head of Information Systems and Computing, Professor of Computing
Tony Rawlins, Head of Mathematical Science, Professor of Mathematics

Brunel University West London

Brunel University, Uxbridge,
Middlesex UB8 3PH, UK
Telephone: +44(0) 1895 274000
Fax: +44(0) 1895 251686
Emails:
Yongmin.Li@brunel.ac.uk
Annette.Payne@brunel.ac.uk
Lampros.Stergioulas@brunel.ac.uk
Zidong.Wang@brunel.ac.uk

Date: 03 November 2011

STATEMENT OF ETHICS APPROVAL

Proposer: Dalal Alsumait

Title: The Relationship between the General and Specific Epistemological Beliefs of the First Year Kuwait University Students in Information Literacy Program

The school's research ethics committee has considered the proposal recently submitted by you. Acting under delegated authority, the committee is satisfied that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that you will adhere to the terms agreed with participants and to inform the committee of any change of plans in relations to the information provided in the application form.

Yours sincerely,

Zidong Wang

Professor Zidong Wang

Chair of the Research Ethics Committee

SISCM

Appendix 6 Frequency Distribution

Frequency Distribution for SEQ

Variables			Results (percent)				
Dimension	Subset	Item	S. Agree	Agree	Don't know	Disagree	S. disagree
Dimension one: structure of knowledge	Subset one: Seek singles answers	1. Things are simpler than most professors would have you believe.	9.9	23.9	6.3	29.7	30.3
		2. Most words have one meaning.	10.1	23.7	6.4	28.4	31.3
		3. he most important part of scientific work is original thinking; thus knowledge is always changing.	9.7	22.9	6.5	29.6	31.2
		4. A good teacher's job is to keep his or her students from wandering off the right track.	11.1	23.3	6.1	28.9	30.5
		5. The most important aspect of scientific research is precise measurement and careful work.	11.1	22.8	6.4	30.3	29.5
		6. Educators should know by now which is the best method, lectures or small group discussions.	9.7	24.5	6.1	29.7	29.9
		7. You never know what a book means unless you know the intent of the author.	9.9	24.0	6.7	31.7	27.7
		8. A sentence has little meaning unless you know the situation in which it is spoken.	11.3	22.9	5.3	31.3	29.1
		9. A tidy mind is an empty mind.	5.7	16.5	5.3	29.7	42.7
		10. I appreciate instructors who organize their lectures meticulously and then stick to their plan.	12.5	23.2	6.3	29.5	28.5
		11. The best thing about science courses is that most problems have only one right answer.	10.1	23.5	6.4	31.3	28.7
	Subset two: Avoid integration	12. I try my best to combine information across chapters or even across classes.	13.7	20.5	6.9	29.2	29.6
		13. When I study, I look for specific facts.	13.2	21.3	6.3	30.7	28.5
		14. To me, studying means getting the big ideas from the text rather than details.	14.3	20.9	5.5	33.5	25.9
		15. Being a good student generally involves memorizing facts.	12.4	21.6	7.1	32.0	26.9
		16. If a person forgot details but was able to come up with new ideas from a text, I would think they were bright.	14.4	20.9	6	30.9	27.7
		17. Learning definitions word-for-word is often necessary to do well on tests.	11.3	22.4	6.7	29.7	29.9
		18. A really good way to understand a textbook is to reorganize the information according to your own personal scheme.	12.3	22	5.9	34.1	25.7
		19. You will just get confused if you try to integrate new ideas in a textbook with knowledge you already have about a topic.	15.2	19.1	5.7	28.5	31.5
Dimension two: Stability of knowledge	Subset three: Avoid ambiguity	20. It is annoying to listen to a lecturer who cannot seem to make up his mind as to what he believes.	22.5	28.3	14.3	15.9	19.1
		21. I find it refreshing to think about issues that authorities cannot agree on.	22	29.2	14	17.1	17.7
		22. I do not like movies that do not have an ending.	22.5	29.5	13.9	15.5	18.7

		23. It is a waste of time to work on problems that have no possibility of coming out with a clear-cut and unambiguous answer.	22	29.3	13.5	16.9	18.3
		24. If professors would stick to the facts and theorize less, one could get more out of college.	22.7	29.5	10.9	18.8	18.1
	Subset four: knowledge is certain	25. The only thing that is certain is uncertainty itself.	15.3	24.8	15.3	24.7	19.9
		26. If scientists try hard enough, they can find the truth about almost everything.	21.6	37.6	10.3	13.7	16.8
		27. Truth is unchanging.	21.6	37.9	9.2	14.3	17.1
		28. Scientists can ultimately get to the truth.	22.3	36.9	9.6	14	17.2
		29. Nothing is certain but death and taxes.	20.8	33.6	18.5	15.7	11.3
		30. Today's facts may be tomorrow's fiction.	13.9	18.1	23.9	27.7	16.4
Dimension three: source of knowledge	Subset five: don't criticize authority	31. People who challenge the authority are overconfident.	18.8	40.5	6.4	22.5	11.7
		32. You can believe almost everything you read.	21.7	36.8	5.6	23.7	12.1
		33. For success in school, it is best not to ask too many questions.	19.7	40.1	4.1	24.1	11.9
		34. I often wonder how much my teachers really know.	16	18.7	11.9	30.9	22.5
		35. You should evaluate the accuracy of information in a textbook if you are familiar with the topic.	21.7	36.8	5.6	24	11.9
		36. Often, even advice from experts should be questioned.	21.2	35.1	5.5	24.7	13.6
	Subset six: depend on authority	37. How much a person gets out of school mostly depends on the quality of the teacher.	14.9	24.4	15.1	27.9	17.7
		38. When you first encounter a difficult concept in a textbook, it is best to work it out on your own.	13.6	22.4	13.7	27.5	22.8
		39. Whenever I encounter a difficult problem in life, I consult my parents.	18	24.9	11.9	30	15.2
		40. Sometimes you have to accept teachers' answers although you do not understand them.	18.3	30	11.6	25.6	14.5
Dimension four: Ability to learn	Subset seven: can't learn how to learn	41. Students have a lot of control over how much they can get out of a textbook.	20.2	25.2	2.1	29.0	23.1
		42. The most successful people have discovered how to improve their ability to learn.	20.9	25.3	2.7	32.8	18.3
		43. A course in study skills would probably be valuable.	18.5	29.7	10.7	22.4	18.7
		44. Everyone needs to learn how to learn.	21.1	29.2	4.7	23.9	21.2
		45. Self-help books are not much help.	21.9	29.5	4.4	23.5	20.8
	Subset eight: success is unrelated to hard work	46. Genius is 10% ability and 90% hard work.	10.7	34.5	6.3	28.3	20.3
		47. Wisdom is not knowing the answers, but knowing how to find the answers.	20.7	22.4	8.1	28.3	20.5
		48. Getting ahead takes a lot of work.	14.9	22.7	9.7	28.7	24
		49. The really smart students do not have to work hard to do well in school.	14	33.2	8.3	29.5	15.1
	Subset nine: Ability to learn is innate	50. The ability to learn is innate.	17.3	29.1	4.7	32.9	16
		51. Some people are born good learners; others are stuck with limited ability.	24.3	25.9	8.7	25.9	15.3
		52. Students who are average in school will remain average for the rest of their lives.	15.9	32	9.2	27.7	15.2
		53. An expert is someone who has a special gift in some area.	17.2	24.5	10	31.5	16.8

Dimension Five: Speed of learning	Subset ten: Learning is quick	1. Successful students understand things quickly.	7.1	22.9	4.4	45.6	20.0
		2. Working hard on a difficult problem for an extended period of time only pays off for really smart students.	8.8	21.1	6.7	39.2	24.3
		3. If you are going to be able to understand something, it will make sense to you the first time you hear it.	3.2	26.3	33.2	33.5	3.9
		4. If a person cannot understand something in a short time, he or she should keep trying.	8.1	19.3	9.7	40.4	22.4
		5. Learning is a slow process of building knowledge.	12.8	35.6	21.1	24.1	6.4
	Subset eleven: Learn first time	6. If I get time to reread a textbook chapter, I get a lot more out of it the second time.	23.9	28.5	4.9	27.6	15.1
		7. Going over a difficult textbook chapter, usually will not help you understand it.	31.3	35.5	7.1	17.3	8.8
		8. You will get almost all the information you can learn from a textbook during the first reading.	20.5	23.3	13.2	20.7	22.3
	Subset twelve: Concentrated effort is a waste of time	9. Usually you can figure out difficult concepts if you eliminate all outside distractions and really concentrate.	19.5	35.2	13.9	19.3	11.7
		10. If a person tries too hard to understand a problem, he or she will most likely just end up being confused.	20.2	25.0	10.9	27.5	16.1

variables		Results (percent)				
Subset	Item	S. Agree	Agree	Don't know	Disagree	S. disagree
Dimension one: Certainty/simplicity 0f knowledge	**1. Answers to questions in this field change as experts gather more information**	9.1	23.7	6.3	35.5	25.5
	2. **All experts in this field understand the field in the same way.**	13.6	22.7	9.6	27.6	26.5
	3. **Truth is unchanging in this subject.**	15.7	20.3	13.3	26.8	23.9
	4. **In this subject, most work has only one right answer.**	21.9	20	12	23.1	23.1
	5. **Principles in this field are unchanging.**	18	22.3	8	24.1	27.6
	6. **All professors in this field would probably come up with the same answers to questions in this field.**	16.1	24.3	10.4	29.9	19.3
	7. **In this subject, it is good to question the ideas presented.**	22.9	26.8	13.2	21.5	15.6
	8. **Most of what is true in this subject is already known.**	17.3	23.7	10.8	20	28.1
Dimension two: Justification of knowledge	9. **First-hand experience is the best way of knowing something in this field.**	13.1	28.7	4.7	32.1	21.5
	10. **I am more likely to accept the ideas of someone with firsthand experience than the ideas of researchers in this field.**	17.9	28.1	8.5	28.8	16.7
	11. **Correct answers in this field are more a matter of opinion than fact.**	13.3	24.9	9.1	24	28.7
	12. **There is really no way to determine whether someone has the right answer in this field.**	11.7	22.4	16.3	29.7	19.9
Dimension three: Source of knowledge	13. **Sometimes you just have to accept answers from the experts in this field, even if you don't understand them.**	7.2	21.7	7.3	38.9	24.8
	14. **If you read something in a textbook for this subject, you can be sure it's true.**	10.1	24	6.4	36.3	23.2
	15. **If my personal experience conflicts with ideas in the textbook, the book is probably right.**	13.1	20.3	9.3	33.2	24.1
	16. **I am most confident that I know something when I know what the experts think.**	11.5	19.7	12.4	34.7	21.7
Dimension four: Attainment of truth	17. **Experts in this field can ultimately get to the truth.**	12.9	17.1	13.3	33.5	23.2
	18. **If scholars try hard enough, they can find the answers to almost anything.**	16.4	18.5	12	31.1	22

Frequency Distribution for DFEBQ

Appendix 7 Factor analysis and scree plots

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.947
Bartlett's Test of Sphericity	Approx. Chi-Square	3105.227
	df	55
	Sig.	.000

Anti-image Matrices

		Q1-s1-1- Things are simpler than most professors would have you believe	Q1-s1-2- Most words have one meaning	Q1-s1-3- The most important part of scientific work is original thinking; thus knowledge is always changing	Q1-s1-4- A good teacher's job is to keep his or her students from wandering off the right track	Q1-s1-5- The most important aspect of scientific research is precise measurement and careful work	Q1-s1-6- Educators should know by now which is the best method, lectures or small group discussions	Q1-s1-7- You never know what a book means unless you know the intent of the author	Q1-s1-8- A sentence has little meaning unless you know the situation in which it is spoken	Q1-s1-9- I appreciate instructors who organize their lectures meticulously and then stick to their plan	Q1-s1-10- The best thing about science courses is that most problems have only one right answer	Q1-s1-11- A tidy mind is an empty mind
Anti-image Correlation	Q1-s1-1- Things are simpler than most professors would have you believe	.954[a]	-.037-	-.160-	-.093-	-.076-	-.065-	-.151-	-.095-	-.065-	-.097-	-.047-
	Q1-s1-2- Most words have one meaning	-.037-	.947[a]	.009	-.110-	-.006-	-.066-	-.065-	-.023-	-.059-	-.043-	.050
	Q1-s1-3- The most important part of scientific work is original thinking; thus knowledge is always changing	-.160-	.009	.950[a]	-.118-	-.109-	-.133-	-.090-	-.105-	-.014-	-.003-	-.075-
	Q1-s1-4- A good teacher's job is to keep his or her students from wandering off the right track	-.093-	-.110-	-.118-	.938[a]	-.177-	-.152-	.008	-.042-	.003	-.143-	-.143-
	Q1-s1-5- The most important aspect of scientific research is precise measurement and careful work	-.076-	-.006-	-.109-	-.177-	.944[a]	-.095-	-.105-	-.049-	-.211-	-.066-	-.084-

Q1-s1-6- Educators should know by now which is the best method, lectures or small group discussions	-.065-	-.066-	-.133-	-.152-	-.095-	.949[a]	-.091-	-.136-	-.017-	-.150-	-.070-
Q1-s1-7- You never know what a book means unless you know the intent of the author	-.151-	-.065-	-.090-	.008	-.105-	-.091-	.951[a]	-.095-	-.120-	-.128-	-.102-
Q1-s1-8- A sentence has little meaning unless you know the situation in which it is spoken	-.095-	-.023-	-.105-	-.042-	-.049-	-.136-	-.095-	.948[a]	-.206-	-.113-	-.056-
Q1-s1-9- I appreciate instructors who organize their lectures meticulously and then stick to their plan	-.065-	-.059-	-.014-	.003	-.211-	-.017-	-.120-	-.206-	.935[a]	-.140-	-.110-
Q1-s1-10- The best thing about science courses is that most problems have only one right answer	-.097-	-.043-	-.003-	-.143-	-.066-	-.150-	-.128-	-.113-	-.140-	.949[a]	-.079-
Q1-s1-11- A tidy mind is an empty mind	-.047-	.050	-.075-	-.143-	-.084-	-.070-	-.102-	-.056-	-.110-	-.079-	.957[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

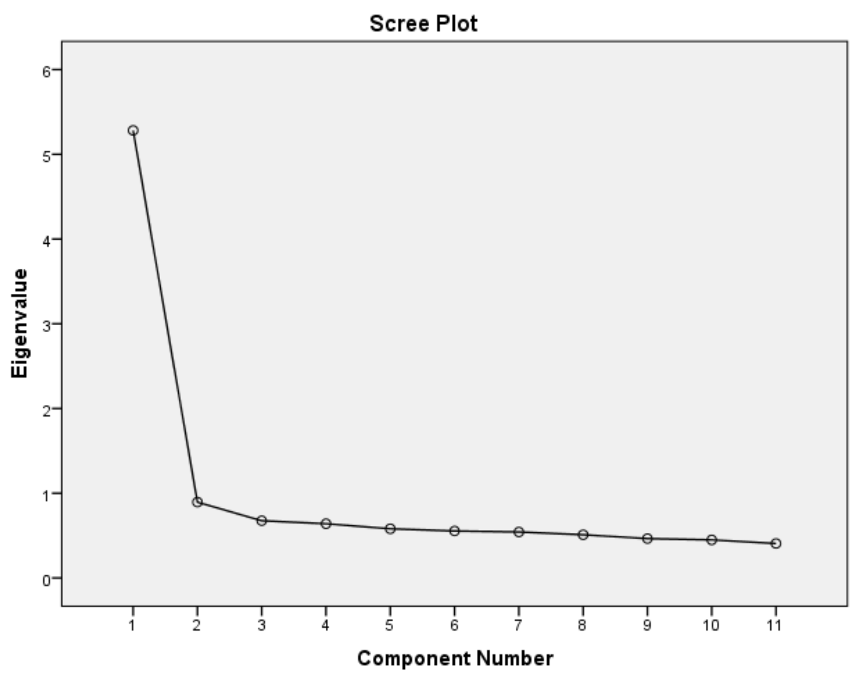
	Initial	Extraction
Q1-s1-1- Things are simpler than most professors would have you believe	1.000	.504
Q1-s1-2- Most words have one meaning	1.000	.151
Q1-s1-3- The most important part of scientific work is original thinking; thus knowledge is always changing	1.000	.464
Q1-s1-4- A good teacher's job is to keep his or her students from wandering off the right track	1.000	.516
Q1-s1-5- The most important aspect of scientific research is precise measurement and careful work	1.000	.556
Q1-s1-6- Educators should know by which is the best method, lectures or small group discussions	1.000	.541
Q1-s1-7- You never know what a book means unless you know the intent of the author	1.000	.523
Q1-s1-8- A sentence has little meaning unless you know the situation in which it is spoken	1.000	.526
Q1-s1-9- I appreciate instructors who organize their lectures meticulously and then stick to their plan	1.000	.521
Q1-s1-10- The best thing about science courses is that most problems have only one right answer	1.000	.545
Q1-s1-11- A tidy mind is an empty mind	1.000	.434

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.282	48.018	48.018	5.282	48.018	48.018
2	.895	8.136	56.154			
3	.675	6.139	62.293			
4	.640	5.820	68.112			
5	.580	5.274	73.387			
6	.554	5.041	78.427			
7	.542	4.929	83.357			
8	.510	4.638	87.994			
9	.465	4.225	92.220			
10	.449	4.081	96.301			
11	.407	3.699	100.000			

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.955
Bartlett's Test of Sphericity	Approx. Chi-Square	4356.370
	df	28
	Sig.	.000

Anti-image Matrices

		Q1-s2-1- I try my best to combine information across chapters or even across classes	Q1-s2-2- When I study, I look for specific facts	Q1-s2-3- To me, studying means getting the big ideas from the text rather than details	Q1-s2-4- Being a good student generally involves memorizing facts	Q1-s2-5- If a person forgot details but was able to come up with new ideas from a text, I would think they were bright	Q1-s2-6- Learning definitions word-for-word is often necessary to do well on tests	Q1-s2-7- A really good way to understand a textbook is to reorganize the information according to your own personal scheme	Q1-s2-8- You will just get confused if you try to integrate new ideas in a textbook with knowledge you already have about a topic
Anti-image Correlation	Q1-s2-1- I try my best to combine information across chapters or even across classes	.948[a]	-.022-	-.174-	-.142-	-.217-	-.162-	-.086-	-.196-
	Q1-s2-2- When I study, I look for specific facts	-.022-	.951[a]	-.209-	-.135-	-.172-	-.169-	-.180-	-.096-
	Q1-s2-3- To me, studying means getting the big ideas from the text rather than details	-.174-	-.209-	.951[a]	-.165-	-.100-	-.163-	-.106-	-.133-
	Q1-s2-4- Being a good student generally involves memorizing facts	-.142-	-.135-	-.165-	.955[a]	-.207-	-.109-	-.104-	-.129-
	Q1-s2-5- If a person forgot details but was able to come up with new ideas from a text, I would think they were bright	-.217-	-.172-	-.100-	-.207-	.954[a]	-.078-	-.066-	-.016-
	Q1-s2-6- Learning definitions word-for-word is often necessary to do well on tests	-.162-	-.169-	-.163-	-.109-	-.078-	.959[a]	-.161-	-.073-
	Q1-s2-7- A really good way to understand a textbook is to reorganize the information according to your own personal scheme	-.086-	-.180-	-.106-	-.104-	-.066-	-.161-	.963[a]	-.130-
	Q1-s2-8- You will just get confused if you try to integrate new ideas in a textbook with knowledge you already have about a topic	-.196-	-.096-	-.133-	-.129-	-.016-	-.073-	-.130-	.963[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

	Initial	Extraction
Q1-s2-1- I try my best to combine information across chapters or even across classes	1.000	.722
Q1-s2-2- When I study, I look for specific facts	1.000	.720
Q1-s2-3- To me, studying means getting the big ideas from the text rather than details	1.000	.749
Q1-s2-4- Being a good student generally involves memorizing facts	1.000	.727
Q1-s2-5- If a person forgot details but was able to come up with new ideas from a text, I would think they were bright	1.000	.677
Q1-s2-6- Learning definitions word-for-word is often necessary to do well on tests	1.000	.702

Q1-s2-7- A really good way to understand a textbook is to reorganize the information according to your own personal scheme	1.000	.659
Q1-s2-8- You will just get confused if you try to integrate new ideas in a textbook with knowledge you already have about a topic	1.000	.632

Extraction Method: Principal Component Analysis.

Total Variance Explained

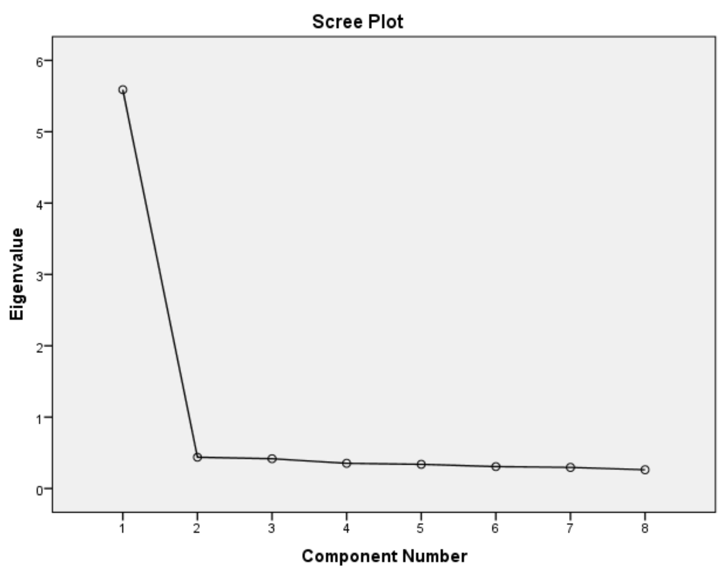
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.589	69.867	69.867	5.589	69.867	69.867
2	.438	5.475	75.341			
3	.417	5.211	80.552			
4	.353	4.406	84.959			
5	.338	4.228	89.187			
6	.307	3.838	93.025			
7	.295	3.690	96.715			
8	.263	3.285	100.000			

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.700	44.999	44.999	2.700	44.999	44.999	2.700	44.997	44.997
2	1.723	28.718	73.717	1.723	28.718	73.717	1.723	28.720	73.717
3	.513	8.555	82.271						
4	.400	6.659	88.931						
5	.385	6.420	95.351						
6	.279	4.649	100.000						

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.893
Bartlett's Test of Sphericity	Approx. Chi-Square	2893.598
	df	10
	Sig.	.000

Anti-image Matrices

		Q1-s3-1- It is annoying to listen to a lecturer who cannot seem to make up his mind as to what he believes	Q1-s3-2- I find it refreshing to think about issues that authorities cannot agree on	Q1-s3-3- I do not like movies that do not have an ending	Q1-s3-4- It is a waste of time to work on problems that have no possibility of coming out with a clear-cut and unambiguous answer	Q1-s3-5- If professors would stick to the facts and theorize less, one could get more out of college
Anti-image Correlation	Q1-s3-1- It is annoying to listen to a lecturer who cannot seem to make up his mind as to what he believes	.904[a]	-.344-	-.250-	-.136-	-.117-
	Q1-s3-2- I find it refreshing to think about issues that authorities cannot agree on	-.344-	.900[a]	-.229-	-.225-	-.100-
	Q1-s3-3- I do not like movies that do not have an ending	-.250-	-.229-	.912[a]	-.215-	-.200-
	Q1-s3-4- It is a waste of time to work on problems that have no possibility of coming out with a clear-cut and unambiguous answer	-.136-	-.225-	-.215-	.869[a]	-.465-
	Q1-s3-5- If professors would stick to the facts and theorize less, one could get more out of college	-.117-	-.100-	-.200-	-.465-	.881[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

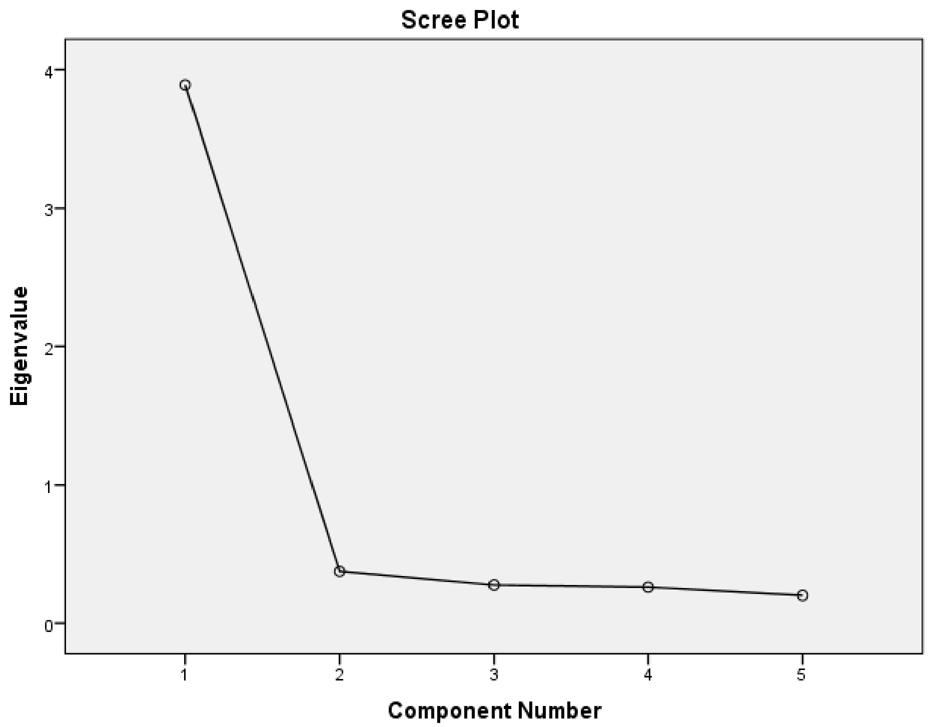
	Initial	Extraction
Q1-s3-1- It is annoying to listen to a lecturer who cannot seem to make up his mind as to what he believes	1.000	.755
Q1-s3-2- I find it refreshing to think about issues that authorities cannot agree on	1.000	.775
Q1-s3-3- I do not like movies that do not have an ending	1.000	.780
Q1-s3-4- It is a waste of time to work on problems that have no possibility of coming out with a clear-cut and unambiguous answer	1.000	.812
Q1-s3-5- If professors would stick to the facts and theorize less, one could get more out of college	1.000	.770

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.892	77.843	77.843	3.892	77.843	77.843
2	.374	7.475	85.318			
3	.275	5.494	90.812			
4	.259	5.190	96.002			
5	.200	3.998	100.000			

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.718
Bartlett's Test of Sphericity	Approx. Chi-Square	1699.542
	df	15
	Sig.	.000

Anti-image Matrices

		Q1-s4-1- The only thing that is certain is uncertainty itself.	Q1-s4-2- If scientists try hard enough, they can find the truth about almost everything	Q1--s4-3- Truth is unchanging	Q1-s4-4- Scientists can ultimately get to the truth	Q1-s4-5- Nothing is certain but death and taxes	Q1-s4-6- Today's facts may be tomorrow's fiction
Anti-image Correlation	Q1-s4-1- The only thing that is certain is uncertainty itself.	.844[a]	-.278-	-.233-	-.152-	-.001-	-.037-
	Q1-s4-2- If scientists try hard enough, they can find the truth about almost everything	-.278-	.801[a]	-.280-	-.307-	.027	.056
	Q1--s4-3- Truth is unchanging	-.233-	-.280-	.801[a]	-.336-	.038	-.079-
	Q1-s4-4- Scientists can ultimately get to the truth	-.152-	-.307-	-.336-	.809[a]	.012	-.025-
	Q1-s4-5- Nothing is certain but death and taxes	-.001-	.027	.038	.012	.502[a]	-.715-
	Q1-s4-6- Today's facts may be tomorrow's fiction	-.037-	.056	-.079-	-.025-	-.715-	.500[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

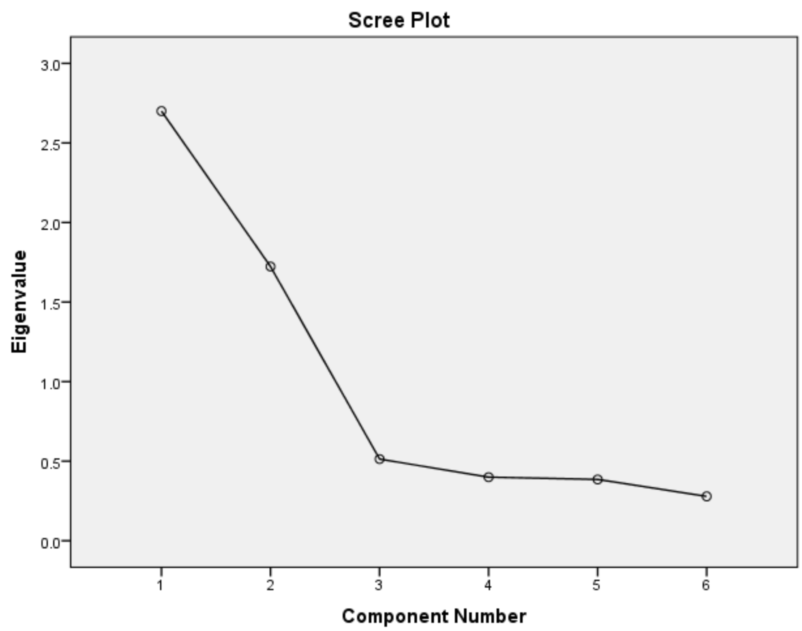
	Initial	Extraction
Q1-s4-1- The only thing that is certain is uncertainty itself.	1.000	.613
Q1-s4-2- If scientists try hard enough, they can find the truth about almost everything	1.000	.709
Q1--s4-3- Truth is unchanging	1.000	.703
Q1-s4-4- Scientists can ultimately get to the truth	1.000	.681
Q1-s4-5- Nothing is certain but death and taxes	1.000	.857
Q1-s4-6- Today's facts may be tomorrow's fiction	1.000	.860

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.700	44.999	44.999	2.700	44.999	44.999	2.700	44.997	44.997
2	1.723	28.718	73.717	1.723	28.718	73.717	1.723	28.720	73.717
3	.513	8.555	82.271						
4	.400	6.659	88.931						
5	.385	6.420	95.351						
6	.279	4.649	100.000						

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.822
Bartlett's Test of Sphericity	Approx. Chi-Square	3182.551
	df	15
	Sig.	.000

Anti-image Matrices

		Q1-s5-1- People who challenge the authority are overconfident	Q1-s5-2- You can believe almost everything you read.	Q1-s5-3- For success in school, it is best not to ask too many questions	Q1-s5-4- You should evaluate the accuracy of information in a textbook if you are familiar with the topic	Q1-s5-5- Often, even advice from experts should be questioned	Q1-s5-6- I often wonder how much my teachers really know
Anti-image Correlation	Q1-s5-1- People who challenge the authority are overconfident	.858[a]	-.347-	-.225-	-.407-	.054	.022
	Q1-s5-2- You can believe almost everything you read.	-.347-	.889[a]	-.251-	-.233-	-.054-	.025

Q1-s5-3- For success in school, it is best not to ask too many questions	-.225-	-.251-	.881[a]	-.380-	-.069-	.024
Q1-s5-4- You should evaluate the accuracy of information in a textbook if you are familiar with the topic	-.407-	-.233-	-.380-	.849[a]	.061	.006
Q1-s5-5- Often, even advice from experts should be questioned	.054	-.054-	-.069-	.061	.530[a]	-.590-
Q1-s5-6- I often wonder how much my teachers really know	.022	.025	.024	.006	-.590-	.574[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

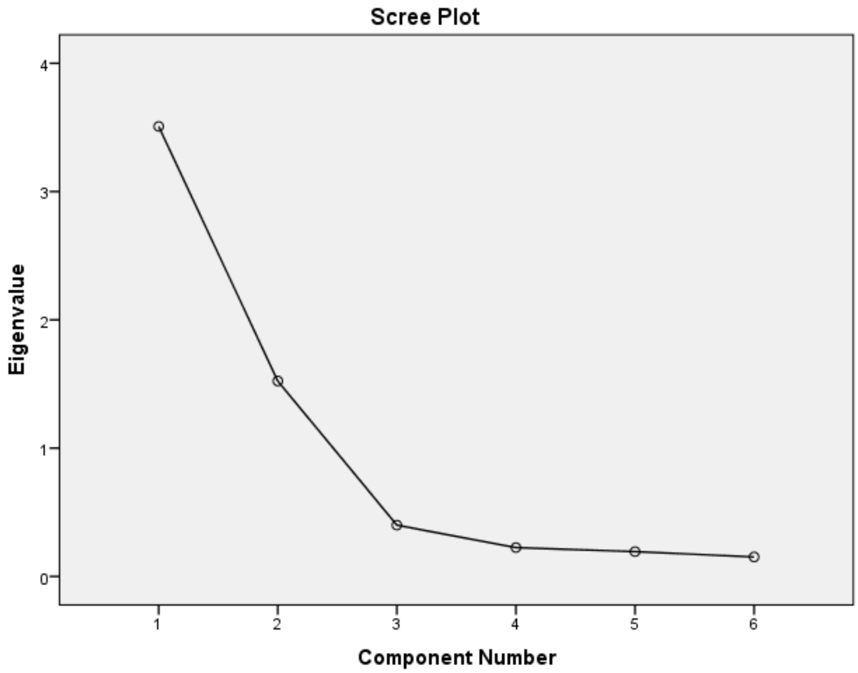
	Initial	Extraction
Q1-s5-1- People who challenge the authority are overconfident	1.000	.870
Q1-s5-2- You can believe almost everything you read.	1.000	.839
Q1-s5-3- For success in school, it is best not to ask too many questions	1.000	.845
Q1-s5-4- You should evaluate the accuracy of information in a textbook if you are familiar with the topic	1.000	.876
Q1-s5-5- Often, even advice from experts should be questioned	1.000	.806
Q1-s5-6- I often wonder how much my teachers really know	1.000	.796

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.508	58.461	58.461	3.508	58.461	58.461	3.416	56.934	56.934
2	1.523	25.388	83.848	1.523	25.388	83.848	1.615	26.914	83.848
3	.400	6.662	90.510						
4	.225	3.744	94.254						
5	.193	3.219	97.473						
6	.152	2.527	100.000						

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.780
Bartlett's Test of Sphericity	Approx. Chi-Square	2744.573
	df	6
	Sig.	.000

Anti-image Matrices

		Q1-s6-1- How much a person gets out of school mostly depends on the quality of the teacher	Q1-s6-2- When you first encounter a difficult concept in a textbook, it is best to work it out on your own	Q1-s6-3 Whenever I encounter a difficult problem in life, I consult my parents.	Q1-s6-4- Sometimes you have to accept teachers' answers although you do not understand them
Anti-image Correlation	Q1-s6-1- How much a person gets out of school mostly depends on the quality of the teacher	.756[a]	-.524-	-.078-	-.503-
	Q1-s6-2- When you first encounter a difficult concept in a textbook, it is best to work it out on your own	-.524-	.790[a]	.038	-.396-
	Q1-s6-3 Whenever I encounter a difficult problem in life, I consult my parents.	-.078-	.038	.076[a]	.043

Q1-s6-4- Sometimes you have to accept teachers' answers although you do not understand them	-.503-	-.396-	.043	.798[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

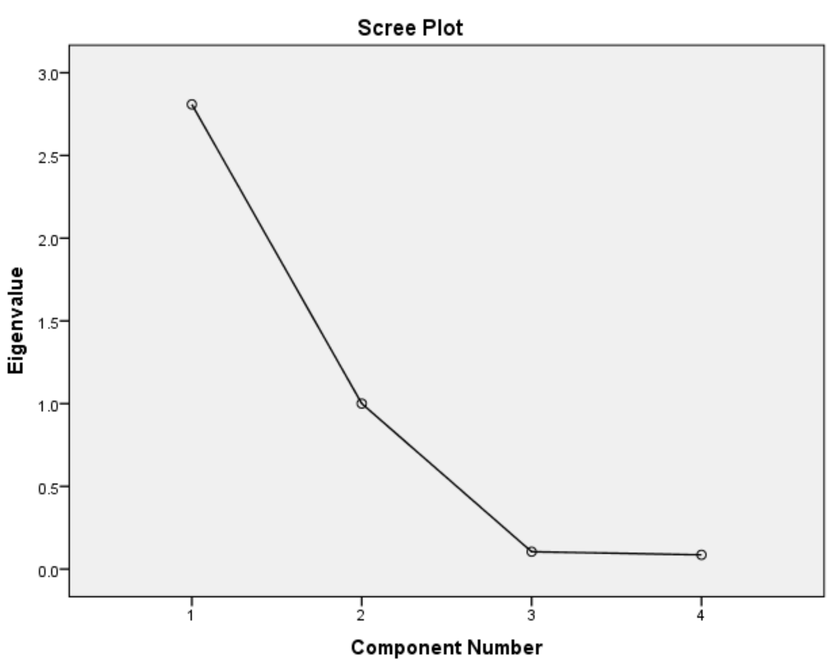
	Initial	Extraction
Q1-s6-1- How much a person gets out of school mostly depends on the quality of the teacher	1.000	.943
Q1-s6-2- When you first encounter a difficult concept in a textbook, it is best to work it out on your own	1.000	.934
Q1-s6-3 Whenever I encounter a difficult problem in life, I consult my parents.	1.000	1.000
Q1-s6-4- Sometimes you have to accept teachers' answers although you do not understand them	1.000	.932

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.809	70.216	70.216	2.809	70.216	70.216	2.808	70.212	70.212
2	1.000	25.011	95.227	1.000	25.011	95.227	1.001	25.015	95.227
3	.105	2.624	97.851						
4	.086	2.149	100.000						

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.888
Bartlett's Test of Sphericity	Approx. Chi-Square	3755.164
	df	10
	Sig.	.000

Anti-image Matrices

		Q1-s7-1- Students have a lot of control over how much they can get out of a textbook	Q1-s7-2- The most successful people have discovered how to improve their ability to learn	Q1--s7-3- A course in study skills would probably be valuable	Q1-s7-4- Everyone needs to learn how to learn	Q1-s7-5- Self-help books are not much help
Anti-image Correlation	Q1-s7-1- Students have a lot of control over how much they can get out of a textbook	.915[a]	-.219-	-.078-	.076	-.337-
	Q1-s7-2- The most successful people have discovered how to improve their ability to learn	-.219-	.889[a]	-.400-	-.327-	-.081-
	Q1--s7-3- A course in study skills would probably be valuable	-.078-	-.400-	.893[a]	-.336-	-.162-
	Q1-s7-4- Everyone needs to learn how to learn	.076	-.327-	-.336-	.866[a]	-.417-
	Q1-s7-5- Self-help books are not much help	-.337-	-.081-	-.162-	-.417-	.887[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

	Initial	Extraction
Q1-s7-1- Students have a lot of control over how much they can get out of a textbook	1.000	.667
Q1-s7-2- The most successful people have discovered how to improve their ability to learn	1.000	.864
Q1--s7-3- A course in study skills would probably be valuable	1.000	.860
Q1-s7-4- Everyone needs to learn how to learn	1.000	.865
Q1-s7-5- Self-help books are not much help	1.000	.849

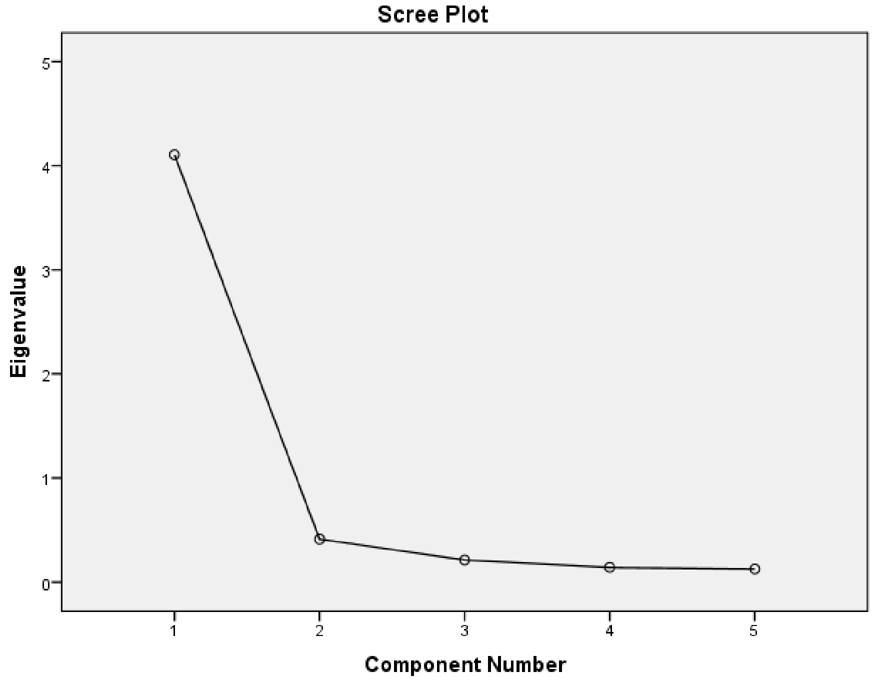
Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.104	82.075	82.075	4.104	82.075	82.075
2	.414	8.276	90.351			
3	.213	4.267	94.618			

4	.142	2.846	97.464			
5	.127	2.536	100.000			

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.782
Bartlett's Test of Sphericity	Approx. Chi-Square	728.926
	df	6
	Sig.	.000

Anti-image Matrices

		Q1-s8-1- Genius is 10% ability and 90% hard work	Q1-s8-2- Wisdom is not knowing the answers, but knowing how to find the answers	Q1-s8-3- Getting ahead takes a lot of work	Q1-s8-4- The really smart students do not have to work hard to do well in school
Anti-image Correlation	Q1-s8-1- Genius is 10% ability and 90% hard work	.773[a]	-.274-	-.240-	-.250-
	Q1-s8-2- Wisdom is not knowing the answers, but knowing how to find the answers	-.274-	.789[a]	-.245-	-.160-
	Q1-s8-3- Getting ahead takes a lot of work	-.240-	-.245-	.777[a]	-.265-

	Q1-s8-4- The really smart students do not have to work hard to do well in school	-.250-	-.160-	-.265-	.790[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

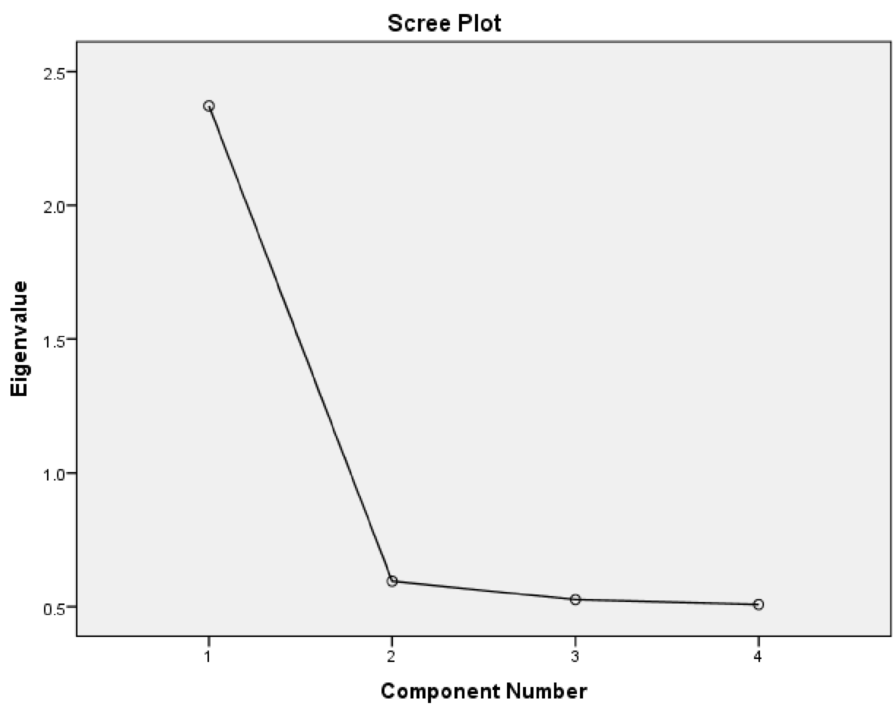
	Initial	Extraction
Q1-s8-1- Genius is 10% ability and 90% hard work	1.000	.618
Q1-s8-2- Wisdom is not knowing the answers, but knowing how to find the answers	1.000	.573
Q1-s8-3- Getting ahead takes a lot of work	1.000	.611
Q1-s8-4- The really smart students do not have to work hard to do well in school	1.000	.570

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.371	59.283	59.283	2.371	59.283	59.283
2	.595	14.870	74.153			
3	.526	13.148	87.301			
4	.508	12.699	100.000			

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.804
Bartlett's Test of Sphericity	Approx. Chi-Square	1223.718
	df	6
	Sig.	.000

Anti-image Matrices

		Q1-s9-1- The ability to learn is innate	Q1-s9-2- Some people are born good learners; others are stuck with limited ability	Q1-s9-3- An expert is someone who has a special gift in some area.	Q1-s9-4- Students who are average in school will remain average for the rest of their lives
Anti-image Correlation	Q1-s9-1- The ability to learn is innate	.791[a]	-.343-	-.094-	-.383-
	Q1-s9-2- Some people are born good learners; others are stuck with limited ability	-.343-	.825[a]	-.210-	-.217-
	Q1-s9-3- An expert is someone who has a special gift in some area.	-.094-	-.210-	.830[a]	-.357-
	Q1-s9-4- Students who are average in school will remain average for the rest of their lives	-.383-	-.217-	-.357-	.778[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

	Initial	Extraction
Q1-s9-1- The ability to learn is innate	1.000	.699
Q1-s9-2- Some people are born good learners; others are stuck with limited ability	1.000	.675
Q1-s9-3- An expert is someone who has a special gift in some area.	1.000	.617
Q1-s9-4- Students who are average in school will remain average for the rest of their lives	1.000	.743

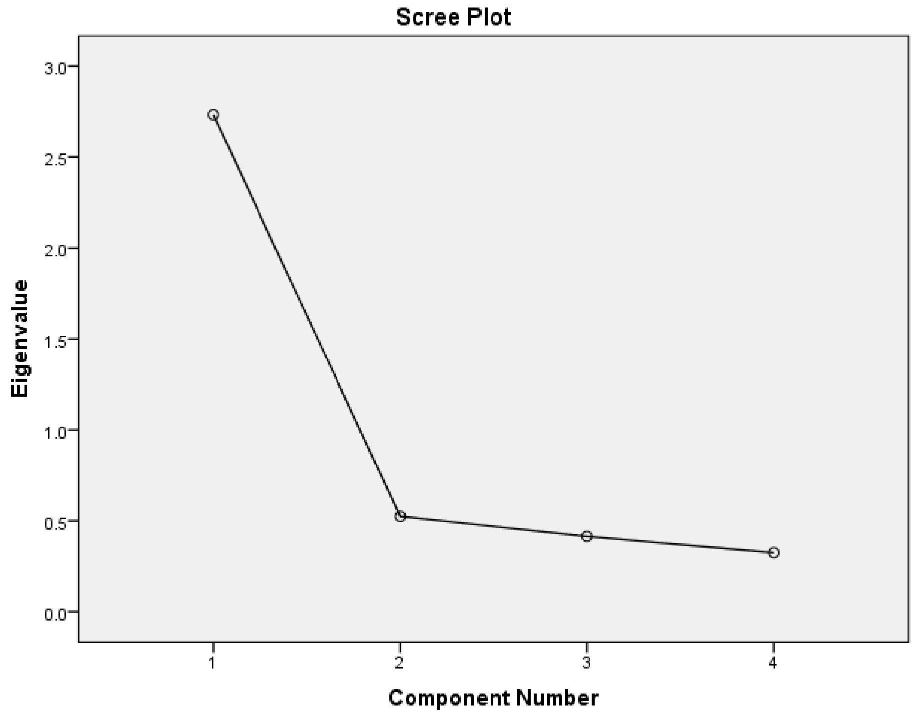
Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.734	68.347	68.347	2.734	68.347	68.347
2	.525	13.118	81.464			
3	.415	10.387	91.852			

4	.326	8.148	100.000			

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.834
Bartlett's Test of Sphericity	Approx. Chi-Square	2015.879
	df	10
	Sig.	.000

Anti-image Matrices

		Q1-s10-1- Successful students understand things quickly	Q1-s10-2- Working hard on a difficult problem for an extended period of time only pays off for really smart students	Q1-s10-3- If you are going to be able to understand something, it will make sense to you the first time you hear it	Q1-s10-4- If a person cannot understand something in a short time, he or she should keep trying	Q1-s10-5- Learning is a slow process of building knowledge
Anti-image Correlation	Q1-s10-1- Successful students understand things quickly	.815[a]	-.546-	-.129-	-.223-	-.085-

	Q1-s10-2- Working hard on a difficult problem for an extended period of time only pays off for really smart students	-.546-	.785[a]	-.255-	-.308-	.049
	Q1-s10-3- If you are going to be able to understand something, it will make sense to you the first time you hear it	-.129-	-.255-	.902[a]	-.034-	-.210-
	Q1-s10-4- If a person cannot understand something in a short time, he or she should keep trying	-.223-	-.308-	-.034-	.855[a]	-.338-
	Q1-s10-5- Learning is a slow process of building knowledge	-.085-	.049	-.210-	-.338-	.851[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

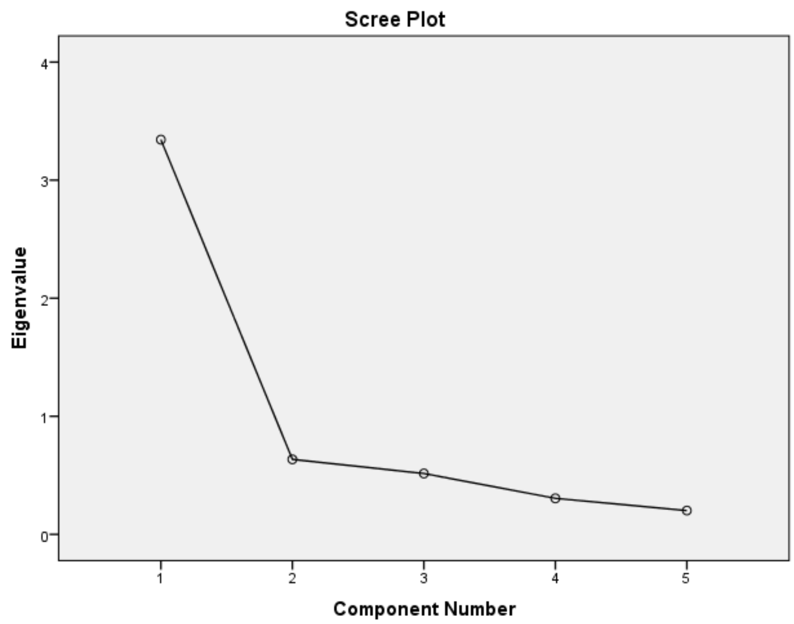
	Initial	Extraction
Q1-s10-1- Successful students understand things quickly	1.000	.764
Q1-s10-2- Working hard on a difficult problem for an extended period of time only pays off for really smart students	1.000	.776
Q1-s10-3- If you are going to be able to understand something, it will make sense to you the first time you hear it	1.000	.586
Q1-s10-4- If a person cannot understand something in a short time, he or she should keep trying	1.000	.726
Q1-s10-5- Learning is a slow process of building knowledge	1.000	.492

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.343	66.864	66.864	3.343	66.864	66.864
2	.635	12.704	79.569			
3	.515	10.305	89.874			
4	.305	6.102	95.976			
5	.201	4.024	100.000			

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.827
Bartlett's Test of Sphericity	Approx. Chi-Square	1231.864
	df	10
	Sig.	.000

Anti-image Matrices

		Q1-s11-1- If I get time to reread a textbook chapter, I get a lot more out of it the second time	Q1-s11-2- Going over a difficult textbook chapter, usually will not help you understand it	Q1-s11-3- You will get almost all the information you can learn from a textbook during the first reading	Q1-s12-1- Usually you can figure out difficult concepts if you eliminate all outside distractions and really concentrate.	Q1-s12-2- If a person tries too hard to understand a problem, he or she will most likely just end up being confused
Anti-image Correlation	Q1-s11-1- If I get time to reread a textbook chapter, I get a lot more out of it the second time	.806[a]	-.312-	-.303-	-.264-	-.099-
	Q1-s11-2- Going over a difficult textbook chapter, usually will not help you understand it	-.312-	.828[a]	-.295-	-.137-	-.125-
	Q1-s11-3- You will get almost all the information you can learn from a textbook during the first reading	-.303-	-.295-	.809[a]	.019	-.248-
	Q1-s12-1- Usually you can figure out difficult concepts if you eliminate all outside distractions and really concentrate.	-.264-	-.137-	.019	.846[a]	-.173-

	Q1-s12-2- If a person tries too hard to understand a problem, he or she will most likely just end up being confused	-.099-	-.125-	-.248-	-.173-	.868[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

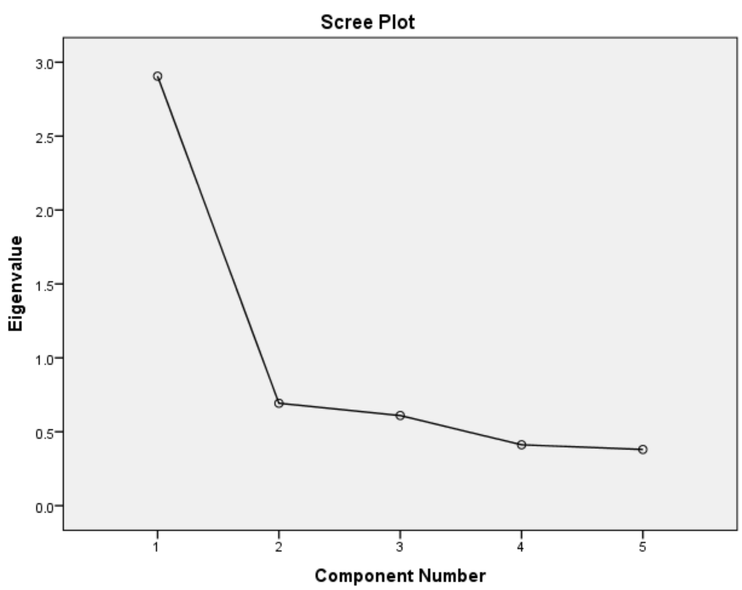
	Initial	Extraction
Q1-s11-1- If I get time to reread a textbook chapter, I get a lot more out of it the second time	1.000	.682
Q1-s11-2- Going over a difficult textbook chapter, usually will not help you understand it	1.000	.650
Q1-s11-3- You will get almost all the information you can learn from a textbook during the first reading	1.000	.630
Q1-s12-1- Usually you can figure out difficult concepts if you eliminate all outside distractions and really concentrate.	1.000	.440
Q1-s12-2- If a person tries too hard to understand a problem, he or she will most likely just end up being confused	1.000	.504

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.906	58.119	58.119	2.906	58.119	58.119
2	.692	13.849	71.968			
3	.610	12.196	84.164			
4	.412	8.234	92.398			
5	.380	7.602	100.000			

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.886
Bartlett's Test of Sphericity	Approx. Chi-Square	1341.735
	df	28
	Sig.	.000

Anti-image Matrices

		Q2-d1-1- Answers to questions in this field change as experts gather more information	Q2-d1-2- All experts in this field understand the field in the same way.	Q2-d1-3- Truth is unchanging in this subject	Q2-d1-4- In this subject, most work has only one right answer.	Q2-d1-5- In this subject, it is good to question the ideas presented	Q2-d1-6- Most of what is true in this subject is already known	Q2-d1-7- Principles in this field are unchanging	Q2-d1-8- All professors in this field would probably come up with the same answers to questions in this field.
Anti-image Correlation	Q2-d1-1- Answers to questions in this field change as experts gather more information	.886[a]	-.217-	-.152-	-.103-	-.066-	-.097-	-.102-	-.032-
	Q2-d1-2- All experts in this field understand the field in the same way.	-.217-	.884[a]	-.106-	-.155-	-.057-	-.080-	-.048-	-.135-
	Q2-d1-3- Truth is unchanging in this subject	-.152-	-.106-	.877[a]	-.225-	-.146-	-.157-	-.051-	-.086-
	Q2-d1-4- In this subject, most work has only one right answer.	-.103-	-.155-	-.225-	.878[a]	-.176-	-.059-	-.064-	-.036-
	Q2-d1-5- In this subject, it is good to question the ideas presented	-.066-	-.057-	-.146-	-.176-	.895[a]	-.102-	-.127-	-.106-
	Q2-d1-6- Most of what is true in this subject is already known	-.097-	-.080-	-.157-	-.059-	-.102-	.901[a]	-.109-	-.142-
	Q2-d1-7- Principles in this field are unchanging	-.102-	-.048-	-.051-	-.064-	-.127-	-.109-	.887[a]	-.207-
	Q2-d1-8- All professors in this field would probably come up with the same answers to questions in this field.	-.032-	-.135-	-.086-	-.036-	-.106-	-.142-	-.207-	.881[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

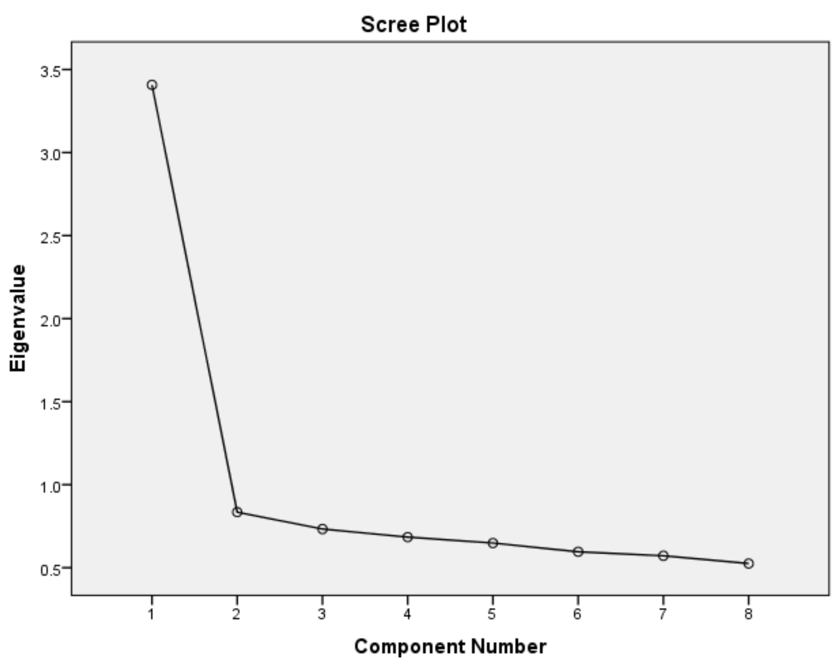
	Initial	Extraction
Q2-d1-1- Answers to questions in this field change as experts gather more information	1.000	.423
Q2-d1-2- All experts in this field understand the field in the same way.	1.000	.435
Q2-d1-3- Truth is unchanging in this subject	1.000	.503
Q2-d1-4- In this subject, most work has only one right answer.	1.000	.454
Q2-d1-5- In this subject, it is good to question the ideas presented	1.000	.428
Q2-d1-6- Most of what is true in this subject is already known	1.000	.407
Q2-d1-7- Principles in this field are unchanging	1.000	.369
Q2-d1-8- All professors in this field would probably come up with the same answers to questions in this field.	1.000	.389

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.408	42.594	42.594	3.408	42.594	42.594
2	.834	10.431	53.025			
3	.733	9.158	62.183			
4	.684	8.553	70.737			
5	.649	8.106	78.843			
6	.596	7.449	86.292			
7	.572	7.146	93.438			
8	.525	6.562	100.000			

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.776
Bartlett's Test of Sphericity	Approx. Chi-Square	767.242
	df	6
	Sig.	.000

Anti-image Matrices

		Q2-d2-1- First-hand experience is the best way of knowing something in this field	Q2-d2-2- I am more likely to accept the ideas of someone with firsthand experience than the ideas of researchers in this field	Q2-d2-3- Correct answers in this field are more a matter of opinion than fact.	Q2-d2-4- There is really no way to determine whether someone has the right answer in this field
Anti-image Correlation	Q2-d2-1- First-hand experience is the best way of knowing something in this field	.754[a]	-.254-	-.339-	-.250-
	Q2-d2-2- I am more likely to accept the ideas of someone with firsthand experience than the ideas of researchers in this field	-.254-	.794[a]	-.283-	-.104-
	Q2-d2-3- Correct answers in this field are more a matter of opinion than fact.	-.339-	-.283-	.756[a]	-.199-
	Q2-d2-4- There is really no way to determine whether someone has the right answer in this field	-.250-	-.104-	-.199-	.819[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

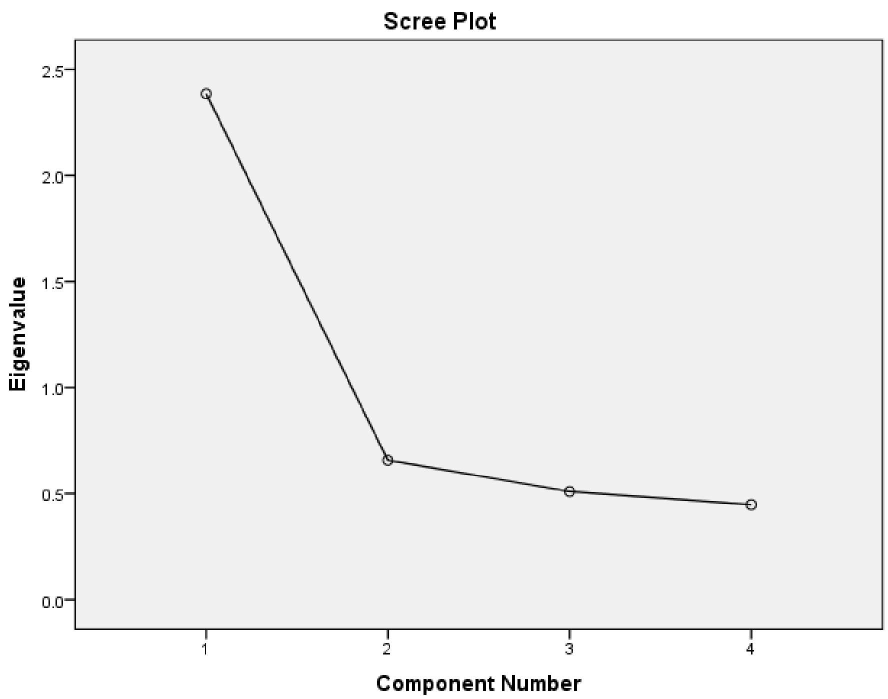
	Initial	Extraction
Q2-d2-1- First-hand experience is the best way of knowing something in this field	1.000	.664
Q2-d2-2- I am more likely to accept the ideas of someone with firsthand experience than the ideas of researchers in this field	1.000	.566
Q2-d2-3- Correct answers in this field are more a matter of opinion than fact.	1.000	.656
Q2-d2-4- There is really no way to determine whether someone has the right answer in this field	1.000	.499

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.385	59.625	59.625	2.385	59.625	59.625
2	.657	16.430	76.055			
3	.510	12.750	88.805			
4	.448	11.195	100.000			

Extraction Method: Principal Component Analysis.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.821
Bartlett's Test of Sphericity	Approx. Chi-Square	1543.741
	df	15
	Sig.	.000

Anti-image Matrices

		Q2-d3-1- Sometimes you just have to accept answers from the experts in this field, even if you don't understand them	Q2-d3-2- If you read something in a textbook for this subject, you can be sure it's true	Q2-d3-3- If my personal experience conflicts with ideas in the textbook, the book is probably right	Q2-d3-4- I am most confident that I know something when I know what the experts think	Q2-d4-1- Experts in this field can ultimately get to the truth.	Q2-d4-2- If scholars try hard enough, they can find the answers to almost anything
Anti-image Correlation	Q2-d3-1- Sometimes you just have to accept answers from the experts in this field, even if you don't understand them	.853[a]	-.305-	-.233-	-.206-	-.101-	-.058-
	Q2-d3-2- If you read something in a textbook for this subject, you can be sure it's true	-.305-	.844[a]	-.248-	-.232-	-.081-	-.004-
	Q2-d3-3- If my personal experience conflicts with ideas in the textbook, the book is probably right	-.233-	-.248-	.845[a]	-.305-	-.021-	-.046-
	Q2-d3-4- I am most confident that I know something when I know what the experts think	-.206-	-.232-	-.305-	.850[a]	.002	-.104-
	Q2-d4-1- Experts in this field can ultimately get to the truth.	-.101-	-.081-	-.021-	.002	.731[a]	-.458-
	Q2-d4-2- If scholars try hard enough, they can find the answers to almost anything	-.058-	-.004-	-.046-	-.104-	-.458-	.735[a]

a. Measures of Sampling Adequacy(MSA)

Communalities

	Initial	Extraction
Q2-d3-1- Sometimes you just have to accept answers from the experts in this field, even if you don't understand them	1.000	.672
Q2-d3-2- If you read something in a textbook for this subject, you can be sure it's true	1.000	.688
Q2-d3-3- If my personal experience conflicts with ideas in the textbook, the book is probably right	1.000	.691
Q2-d3-4- I am most confident that I know something when I know what the experts think	1.000	.670
Q2-d4-1- Experts in this field can ultimately get to the truth.	1.000	.765
Q2-d4-2- If scholars try hard enough, they can find the answers to almost anything	1.000	.760

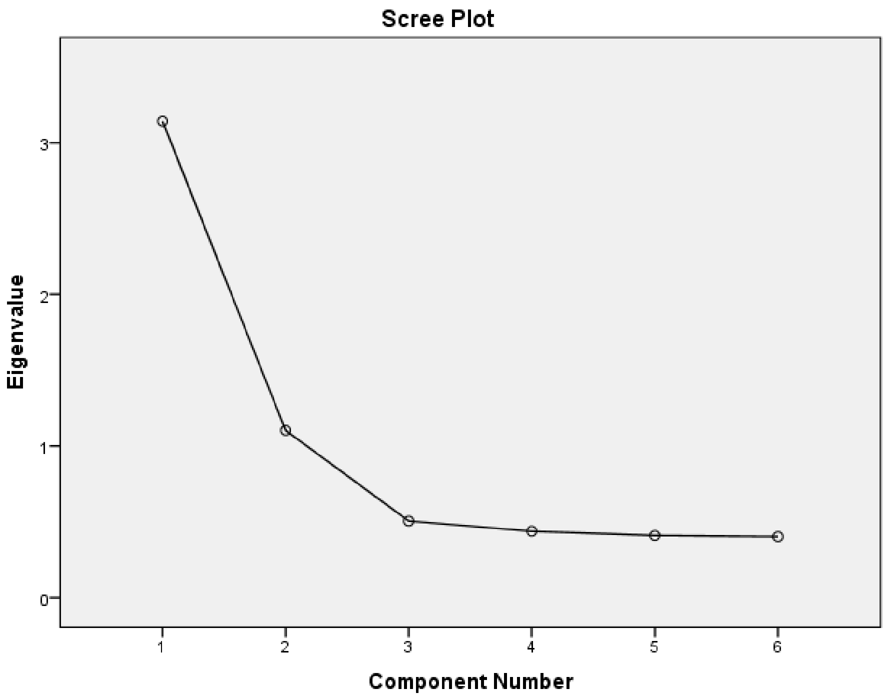
Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues	Extraction Sums of Squared Loadings	Rotation Sums of Squared Loadings

	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.142	52.372	52.372	3.142	52.372	52.372	2.663	44.386	44.386
2	1.103	18.380	70.751	1.103	18.380	70.751	1.582	26.365	70.751
3	.505	8.412	79.163						
4	.438	7.298	86.462						
5	.410	6.834	93.296						
6	.402	6.704	100.000						

Extraction Method: Principal Component Analysis.



Appendix 8 Results for the reliability tests

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.889	.888	11

Item Statistics

	Mean	Std. Deviation	N
Q1-s1-1- Things are simpler than most professors would have you believe	3.03	1.397	750
Q1-s1-2- Most words have one meaning	2.23	1.251	750
Q1-s1-3- The most important part of scientific work is original thinking; thus knowledge is always changing	2.94	1.359	750
Q1-s1-4- A good teacher's job is to keep his or her students from wandering off the right track	3.01	1.391	750
Q1-s1-5- The most important aspect of scientific research is precise measurement and careful work	2.97	1.371	750
Q1-s1-6- Educators should know by now which is the best method, lectures or small group discussions	2.98	1.393	750
Q1-s1-7- You never know what a book means unless you know the intent of the author	2.97	1.387	750
Q1-s1-8- A sentence has little meaning unless you know the situation in which it is spoken	2.91	1.390	750
Q1-s1-9- I appreciate instructors who organize their lectures meticulously and then stick to their plan	3.01	1.408	750
Q1-s1-10- The best thing about science courses is that most problems have only one right answer	2.99	1.377	750
Q1-s1-11- A tidy mind is an empty mind	2.75	1.471	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1-s1-1- Things are simpler than most professors would have you believe	28.75	90.959	.631	.407	.878
Q1-s1-2- Most words have one meaning	29.54	100.069	.323	.119	.895

Q1-s1-3- The most important part of scientific work is original thinking; thus knowledge is always changing	28.84	92.223	.599	.378	.880
Q1-s1-4- A good teacher's job is to keep his or her students from wandering off the right track	28.77	90.754	.642	.433	.878
Q1-s1-5- The most important aspect of scientific research is precise measurement and careful work	28.81	90.391	.669	.464	.876
Q1-s1-6- Educators should know by now which is the best method, lectures or small group discussions	28.80	90.301	.660	.446	.876
Q1-s1-7- You never know what a book means unless you know the intent of the author	28.81	90.716	.646	.427	.877
Q1-s1-8- A sentence has little meaning unless you know the situation in which it is spoken	28.87	90.660	.647	.433	.877
Q1-s1-9- I appreciate instructors who organize their lectures meticulously and then stick to their plan	28.77	90.483	.644	.444	.877
Q1-s1-10- The best thing about science courses is that most problems have only one right answer	28.78	90.467	.662	.450	.876
Q1-s1-11- A tidy mind is an empty mind	29.03	91.395	.575	.346	.882

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.938	.938	8

Item Statistics

	Mean	Std. Deviation	N
Q1-s2-1- I try my best to combine information across chapters or even across classes	3.06	1.504	750
Q1-s2-2- When I study, I look for specific facts	3.07	1.447	750
Q1-s2-3- To me, studying means getting the big ideas from the text rather than details	3.07	1.497	750
Q1-s2-4- Being a good student generally involves memorizing facts	3.09	1.485	750
Q1-s2-5- If a person forgot details but was able to come up with new ideas from a text, I would think they were bright	3.07	1.496	750
Q1-s2-6- Learning definitions word-for-word is often necessary to do well on tests	3.08	1.509	750
Q1-s2-7- A really good way to understand a textbook is to reorganize the information according to your own personal scheme	3.06	1.426	750
Q1-s2-8- You will just get confused if you try to integrate new ideas in a textbook with knowledge you already have about a topic	3.07	1.496	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1-s2-1- I try my best to combine information across chapters or even across classes	21.52	75.150	.798	.645	.929
Q1-s2-2- When I study, I look for specific facts	21.50	76.042	.796	.643	.929
Q1-s2-3- To me, studying means getting the big ideas from the text rather than details	21.51	74.830	.817	.671	.927
Q1-s2-4- Being a good student generally involves memorizing facts	21.49	75.364	.802	.645	.929
Q1-s2-5- If a person forgot details but was able to come up with new ideas from a text, I would think they were bright	21.51	76.034	.765	.599	.931
Q1-s2-6- Learning definitions word-for-word is often necessary to do well on tests	21.50	75.444	.783	.617	.930
Q1-s2-7- A really good way to understand a textbook is to reorganize the information according to your own personal scheme	21.51	77.334	.752	.570	.932
Q1-s2-8- You will just get confused if you try to integrate new ideas in a textbook with knowledge you already have about a topic	21.50	76.795	.732	.544	.933

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.929	.929	5

Item Statistics

	Mean	Std. Deviation	N
Q1-s3-1- It is annoying to listen to a lecturer who cannot seem to make up his mind as to what he believes	3.19	1.421	750
Q1-s3-2- I find it refreshing to think about issues that authorities cannot agree on	3.18	1.427	750
Q1-s3-3- I do not like movies that do not have an ending	3.17	1.402	750
Q1-s3-4- It is a waste of time to work on problems that have no possibility of coming out with a clear-cut and unambiguous answer	3.17	1.443	750
Q1-s3-5- If professors would stick to the facts and theorize less, one could get more out of college	3.19	1.428	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1-s3-1- It is annoying to listen to a lecturer who cannot seem to make up his mind as to what he believes	12.71	25.960	.794	.641	.916
Q1-s3-2- I find it refreshing to think about issues that authorities cannot agree on	12.73	25.710	.810	.664	.913
Q1-s3-3- I do not like movies that do not have an ending	12.73	25.895	.814	.662	.912
Q1-s3-4- It is a waste of time to work on problems that have no possibility of coming out with a clear-cut and unambiguous answer	12.74	25.225	.839	.722	.907
Q1-s3-5- If professors would stick to the facts and theorize less, one could get more out of college	12.71	25.750	.806	.679	.914

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.740	.696	6

Item Statistics

	Mean	Std. Deviation	N
Q1-s4-1- The only thing that is certain is uncertainty itself.	3.13	1.413	750
Q1-s4-2- If scientists try hard enough, they can find the truth about almost everything	3.23	1.417	750
Q1--s4-3- Truth is unchanging	3.19	1.439	750
Q1-s4-4- Scientists can ultimately get to the truth	3.24	1.417	750
Q1-s4-5- Nothing is certain but death and taxes	3.03	.589	750
Q1-s4-6- Today's facts may be tomorrow's fiction	3.05	.758	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1-s4-1- The only thing that is certain is uncertainty itself.	15.76	14.954	.598	.389	.664
Q1-s4-2- If scientists try hard enough, they can find the truth about almost everything	15.65	14.634	.631	.490	.652
Q1--s4-3- Truth is unchanging	15.69	14.177	.668	.488	.639

Q1-s4-4- Scientists can ultimately get to the truth	15.64	14.540	.642	.468	.648
Q1-s4-5- Nothing is certain but death and taxes	15.85	22.662	.084	.516	.772
Q1-s4-6- Today's facts may be tomorrow's fiction	15.83	21.964	.133	.520	.770

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.726	.711	6

Item Statistics

	Mean	Std. Deviation	N
Q1-s5-1- People who challenge the authority are overconfident	3.35	1.394	750
Q1-s5-2- You can believe almost everything you read.	3.28	1.360	750
Q1-s5-3- For success in school, it is best not to ask too many questions	3.28	1.366	750
Q1-s5-4- You should evaluate the accuracy of information in a textbook if you are familiar with the topic	3.33	1.379	750
Q1-s5-5- Often, even advice from experts should be questioned	2.74	1.267	750
Q1-s5-6- I often wonder how much my teachers really know	2.57	1.249	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1-s5-1- People who challenge the authority are overconfident	15.21	17.011	.715	.776	.605
Q1-s5-2- You can believe almost everything you read.	15.27	17.157	.725	.723	.603
Q1-s5-3- For success in school, it is best not to ask too many questions	15.27	17.041	.733	.734	.600
Q1-s5-4- You should evaluate the accuracy of information in a textbook if you are familiar with the topic	15.22	17.039	.724	.785	.603
Q1-s5-5- Often, even advice from experts should be questioned	15.81	25.173	.031	.366	.797
Q1-s5-6- I often wonder how much my teachers really know	15.98	26.010	-.031-	.372	.810

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.839	.771	4

Item Statistics

	Mean	Std. Deviation	N
Q1-s6-1- How much a person gets out of school mostly depends on the quality of the teacher	2.90	1.484	750
Q1-s6-2- When you first encounter a difficult concept in a textbook, it is best to work it out on your own	2.81	1.444	750
Q1-s6-3 Whenever I encounter a difficult problem in life, I consult my parents.	4.75	.673	750
Q1-s6-4- Sometimes you have to accept teachers' answers although you do not understand them	2.87	1.478	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1-s6-1- How much a person gets out of school mostly depends on the quality of the teacher	10.43	8.545	.915	.872	.671
Q1-s6-2- When you first encounter a difficult concept in a textbook, it is best to work it out on your own	10.53	8.872	.898	.856	.682
Q1-s6-3 Whenever I encounter a difficult problem in life, I consult my parents.	8.58	18.174	.009	.006	.966
Q1-s6-4- Sometimes you have to accept teachers' answers although you do not understand them	10.46	8.698	.895	.852	.682

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.944	.945	5

Item Statistics

	Mean	Std. Deviation	N
Q1-s7-1- Students have a lot of control over how much they can get out of a textbook	2.94	1.498	750
Q1-s7-2- The most successful people have discovered how to improve their ability to learn	3.13	1.465	750
Q1--s7-3- A course in study skills would probably be valuable	3.12	1.434	750
Q1-s7-4- Everyone needs to learn how to learn	3.13	1.476	750
Q1-s7-5- Self-help books are not much help	3.09	1.425	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1-s7-1- Students have a lot of control over how much they can get out of a textbook	12.47	29.454	.730	.563	.953
Q1-s7-2- The most successful people have discovered how to improve their ability to learn	12.28	27.781	.883	.799	.925
Q1--s7-3- A course in study skills would probably be valuable	12.29	28.143	.879	.801	.926
Q1-s7-4- Everyone needs to learn how to learn	12.28	27.692	.882	.819	.925
Q1-s7-5- Self-help books are not much help	12.32	28.301	.873	.775	.927

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.771	.771	4

Item Statistics

	Mean	Std. Deviation	N

Q1-s8-1- Genius is 10% ability and 90% hard work	3.00	1.371	750
Q1-s8-2- Wisdom is not knowing the answers, but knowing how to find the answers	2.97	1.425	750
Q1-s8-3- Getting ahead takes a lot of work	2.88	1.369	750
Q1-s8-4- The really smart students do not have to work hard to do well in school	3.02	1.328	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1-s8-1- Genius is 10% ability and 90% hard work	8.87	10.691	.592	.351	.705
Q1-s8-2- Wisdom is not knowing the answers, but knowing how to find the answers	8.90	10.672	.556	.313	.725
Q1-s8-3- Getting ahead takes a lot of work	9.00	10.744	.586	.344	.708
Q1-s8-4- The really smart students do not have to work hard to do well in school	8.85	11.198	.553	.311	.725

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.845	.845	4

Item Statistics

	Mean	Std. Deviation	N
Q1-s9-1- The ability to learn is innate	3.05	1.400	750
Q1-s9-2- Some people are born good learners; others are stuck with limited ability	3.17	1.401	750
Q1-s9-3- An expert is someone who has a special gift in some area.	3.00	1.375	750
Q1-s9-4- Students who are average in school will remain average for the rest of their lives	3.10	1.349	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1-s9-1- The ability to learn is innate	9.26	12.125	.692	.503	.798
Q1-s9-2- Some people are born good learners; others are stuck with limited ability	9.15	12.258	.674	.461	.806
Q1-s9-3- An expert is someone who has a special gift in some area.	9.31	12.792	.626	.409	.827
Q1-s9-4- Students who are average in school will remain average for the rest of their lives	9.22	12.128	.733	.543	.781

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.875	.874	5

Item Statistics

	Mean	Std. Deviation	N
Q1-s10-1- Successful students understand things quickly	3.28	1.343	750
Q1-s10-2- Working hard on a difficult problem for an extended period of time only pays off for really smart students	3.26	1.378	750
Q1-s10-3- If you are going to be able to understand something, it will make sense to you the first time you hear it	3.15	1.168	750
Q1-s10-4- If a person cannot understand something in a short time, he or she should keep trying	3.17	1.328	750
Q1-s10-5- Learning is a slow process of building knowledge	2.86	1.279	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1-s10-1- Successful students understand things quickly	12.43	17.629	.779	.671	.829
Q1-s10-2- Working hard on a difficult problem for an extended period of time only pays off for really smart students	12.46	17.303	.786	.696	.827

Q1-s10-3- If you are going to be able to understand something, it will make sense to you the first time you hear it	12.56	20.137	.640	.423	.863
Q1-s10-4- If a person cannot understand something in a short time, he or she should keep trying	12.55	17.962	.754	.588	.836
Q1-s10-5- Learning is a slow process of building knowledge	12.86	20.067	.568	.363	.880

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.818	.818	5

Item Statistics

	Mean	Std. Deviation	N
Q1-s11-1- If I get time to reread a textbook chapter, I get a lot more out of it the second time	2.82	1.385	750
Q1-s11-2- Going over a difficult textbook chapter, usually will not help you understand it	2.68	1.364	750
Q1-s11-3- You will get almost all the information you can learn from a textbook during the first reading	3.06	1.417	750
Q1-s12-1- Usually you can figure out difficult concepts if you eliminate all outside distractions and really concentrate.	3.11	1.385	750
Q1-s12-2- If a person tries too hard to understand a problem, he or she will most likely just end up being confused	3.13	1.370	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q1-s11-1- If I get time to reread a textbook chapter, I get a lot more out of it the second time	11.98	17.737	.690	.493	.757
Q1-s11-2- Going over a difficult textbook chapter, usually will not help you understand it	12.13	18.150	.662	.459	.766
Q1-s11-3- You will get almost all the information you can learn from a textbook during the first reading	11.74	17.980	.642	.454	.772

Q1-s12-1- Usually you can figure out difficult concepts if you eliminate all outside distractions and really concentrate.	11.69	19.632	.501	.276	.813
Q1-s12-2- If a person tries too hard to understand a problem, he or she will most likely just end up being confused	11.67	19.193	.552	.311	.798

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.807	.807	8

Item Statistics

	Mean	Std. Deviation	N
Q2-d1-1- Answers to questions in this field change as experts gather more information	3.06	1.379	750
Q2-d1-2- All experts in this field understand the field in the same way.	3.15	1.364	750
Q2-d1-3- Truth is unchanging in this subject	3.09	1.359	750
Q2-d1-4- In this subject, most work has only one right answer.	3.20	1.397	750
Q2-d1-5- In this subject, it is good to question the ideas presented	3.07	1.318	750
Q2-d1-6- Most of what is true in this subject is already known	3.09	1.386	750
Q2-d1-7- Principles in this field are unchanging	3.02	1.376	750
Q2-d1-8- All professors in this field would probably come up with the same answers to questions in this field.	3.13	1.335	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q2-d1-1- Answers to questions in this field change as experts gather more information	21.76	39.777	.516	.282	.786
Q2-d1-2- All experts in this field understand the field in the same way.	21.67	39.754	.526	.291	.784
Q2-d1-3- Truth is unchanging in this subject	21.73	39.008	.578	.347	.776
Q2-d1-4- In this subject, most work has only one right answer.	21.63	39.281	.539	.312	.782

Q2-d1-5- In this subject, it is good to question the ideas presented	21.75	40.217	.521	.279	.785
Q2-d1-6- Most of what is true in this subject is already known	21.74	39.906	.505	.260	.787
Q2-d1-7- Principles in this field are unchanging	21.80	40.434	.476	.241	.792
Q2-d1-8- All professors in this field would probably come up with the same answers to questions in this field.	21.69	40.509	.493	.259	.789

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.773	.773	4

Item Statistics

	Mean	Std. Deviation	N
Q2-d2-1- First-hand experience is the best way of knowing something in this field	2.92	1.357	750
Q2-d2-2- I am more likely to accept the ideas of someone with firsthand experience than the ideas of researchers in this field	3.19	1.322	750
Q2-d2-3- Correct answers in this field are more a matter of opinion than fact.	2.99	1.375	750
Q2-d2-4- There is really no way to determine whether someone has the right answer in this field	2.92	1.332	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q2-d2-1- First-hand experience is the best way of knowing something in this field	9.09	10.013	.631	.402	.689
Q2-d2-2- I am more likely to accept the ideas of someone with firsthand experience than the ideas of researchers in this field	8.83	10.762	.549	.315	.732
Q2-d2-3- Correct answers in this field are more a matter of opinion than fact.	9.02	9.970	.624	.396	.693
Q2-d2-4- There is really no way to determine whether someone has the right answer in this field	9.10	11.063	.501	.258	.757

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.811	.813	6

Item Statistics

	Mean	Std. Deviation	N
Q2-d3-1- Sometimes you just have to accept answers from the experts in this field, even if you don't understand them	2.93	1.307	750
Q2-d3-2- If you read something in a textbook for this subject, you can be sure it's true	2.94	1.325	750
Q2-d3-3- If my personal experience conflicts with ideas in the textbook, the book is probably right	2.96	1.338	750
Q2-d3-4- I am most confident that I know something when I know what the experts think	2.93	1.327	750
Q2-d4-1- Experts in this field can ultimately get to the truth.	2.88	1.389	750
Q2-d4-2- If scholars try hard enough, they can find the answers to almost anything	2.96	1.390	750

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Q2-d3-1- Sometimes you just have to accept answers from the experts in this field, even if you don't understand them	14.67	23.612	.650	.470	.765
Q2-d3-2- If you read something in a textbook for this subject, you can be sure it's true	14.67	23.635	.636	.473	.768
Q2-d3-3- If my personal experience conflicts with ideas in the textbook, the book is probably right	14.65	23.618	.628	.469	.769
Q2-d3-4- I am most confident that I know something when I know what the experts think	14.68	23.720	.627	.456	.770
Q2-d4-1- Experts in this field can ultimately get to the truth.	14.72	25.338	.451	.312	.809

Q2-d4-2- If scholars try hard enough, they can find the answers to almost anything	14.65	25.272	.456	.313	.808