Factors affecting students' attitude and performance when using a web-enhanced learning environment

A thesis submitted for the degree of Doctor of Philosophy

By

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Abstract

The purpose of this thesis is to investigate the use of a course management system in a University learning environment and the factors that affect students' attitude and performance in such environments and to study the relationship between these factors. The course management system that was used in the research studies in this thesis was WebCT. Three in-field studies were carried out to achieve the aim of this research thesis. A mixture of qualitative and quantitative approaches was used in the studies. Data from participants were collected via questionnaires, interviews, and numerical data from the WebCT tracking system. First the relationship between the students' attitude towards using WebCT and their module leaders' attitude towards using it was studied. Then, the relationship between students' cognitive styles and their satisfaction, their achievement, and their way of using WebCT was investigated. Finally, a model of the critical factors affecting students' attitudes to WebCT, use of WebCT and achievement was developed and tested. The model is divided into three main dimensions. The three dimensions are 1) The learner dimension: students' interaction with their classmates, students' capability of using the internet, students' capability of using WebCT. 2) The instructor dimension: Instructor's technical competence, instructor's way of presenting materials on WebCT, interaction between students and their instructor. 3) The technology dimension: usefulness, ease of use, flexibility, quality. The results suggested that students have a positive attitude towards using a course management system (WebCT) on their courses. Also, the results indicated that students' use of WebCT is a positive indicator of their academic achievement (in terms of performance on specific modules). It was also found that instructor attitude and way of using WebCT affects students' attitude and performance when using WebCT. The Technology dimension was found to be a positive indicator of students' attitude and use of WebCT. The Instructor dimension was also found to be a positive indicator of students' attitude and achievement in WebCT. Moreover, the Learner dimension was found to be a positive indicator of students' attitude, use of WebCT and achievement.

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This thesis is dedicated to my parents

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The following papers have been published as a result of the research conducted for this thesis.

Hammoud, L., Love, S., Baldwin, L., and Chen, S. Y. (2008) Evaluating WebCT Use In Relation To Students' Attitude and Performance. *International Journal of Information & Communication Technology Education.* 4(2), 26-43.

Hammoud, L., Love, S., & Brinkman, W. (2008). The affect of lecturers' attitude on students' use of an online learning environment. In *Proceedings of the 15th European Conference on Cognitive Ergonomics: the ergonomics of cool interaction* (pp. 1-8). Funchal, Portugal: ACM.

Hammoud, L., Love, S., & Brinkman, W. (2009). Does cognitive style affect student performance on a web-based course? In *European Conference on Cognitive Ergonomics: Designing beyond the Product Understanding Activity and User Experience in Ubiquitous Environments* (pp. 69-72). Helsinki, Finland : VTT Technical Research Centre of Finland.

Hammoud, L., and Love, S. Chapter 11: Evaluating WebCT use in Relation to Students' Attitude and Performance. *ICTs for Modern Educational and Instructional Advancement*. (2010). IGI Global. Pages 120-135

Chapter 1

Introduction

1.1 Introduction

The goal of the research reported in this thesis is to examine factors that affect students' attitude and performance on web-enhanced courses. This chapter begins by discussing the motivation behind the research programme conducted, and presents a brief background to the research. Then the research aim and objectives are identified. The research methodologies employed to investigate the research questions are then introduced. Finally, an outline of the thesis structure is presented, giving a brief description of the contents of the remaining chapters.

1.2 Motivation

The World Wide Web (WWW) provides great opportunities for creating virtual classrooms (Mazza and Dimitrova, 2004) and for building integrated learning and teaching environments (Cheng and Yen, 1998). In addition it helps in supporting traditional educational methods (Kalifa and Lam 2002). As a result of this teaching and learning are no longer limited by place or time (Kalifa and Lam 2002). The WWW is considered to be an important new vehicle for delivering online courses (Jiang and Ting, 2000; Lee and Shih, 2001). The interest in web-based learning and technology to support learning is increasing in higher education and this can be seen

in the large number of publications in higher education journals in this area (Hoskins and Hooff, 2005; Bower, 2001). Large numbers of educational institutions are offering web-based courses (Owston, 2000) or starting to use course management systems such as WebCT or Blackboard (Mazza and Dimitrova, 2004). WebCT (Web Course Tools) was developed by Murray Goldberg, a faculty member at the University of British Columbia (Burgess, 2003; Volery and Lord, 2000). It is an integrated set of educational and management tools which is specifically used for the design and development of teaching and learning materials.

Sun et al. (2008) stated that although the e-learning market has a growth rate of 35.6%, failures exist. They used the term e-learning to define the use of technology to deliver information for education and training. Educational institutes are searching for the means to facilitate learning for a large number of students as there has been a large increase in the number of students seeking entry into higher education. In order to achieve this aim, educational institutes must offer courses supported with systematic technology that the learner can use efficiently (Carbone, 1998).

Educational institutes that use technology to support their courses need to know about the success or failure of their systems. Information system research clearly shows that user satisfaction is one of the most important factors in assessing the success of system implementation (Delon and McLean, 1992). Therefore many studies have been undertaken to assess students' satisfaction with their web-enhanced courses. Web-enhanced courses are traditional face-to-face courses usually adopting a course management system (e.g. WebCT) (Sivo et al., 2007).

There are many factors that may affect student satisfaction with web-enhanced courses such as the use of the discussion boards, a suitable interface, and personal feedback (Hisham et al., 2004). Salomon (1993) stated that it is difficult to judge the 'goodness' of a technology outside of the purpose for which it was created.

Ferdig (2006) stated that future research needs to continue to broaden the relatively new field of educational technology. However, this new research must comprehensively address the people, pedagogy and performance specific to the content and audiences that are involved in the studies. If we are to use online

environments effectively it is important to understand how they can support and enhance learning. Evaluation is the key to achieving understanding and to developing a better insight into factors that affect the embedding process if we are to integrate these new learning technologies into educational processes.

Another factor that been examined in relation to the use of technology in learning is learning styles. Summerville (1999) stated that matching cognitive style to teaching environments may be important because of the potential to enhance learning. However, at this time, the relationship between matching cognitive style and learning has not been researched fully and the implications are inconclusive, especially for hypermedia learning environments. Yang et al. (2007) stated that psychological studies have shown that personal beliefs about learning and environmental preferences affect learning behaviours. However, these learner characteristics have not been widely discussed in the web-based context.

To use computer technology in education does not mean to simply provide the technology and expect the teachers to use it in their courses. It is important to investigate and develop an understanding of the best ways to use technology in teaching and learning (Alavi, 1997). The wide use of course management systems in higher education has highlighted the need for research to address subjects like the users' attitudes and what factors affect the students' performance when using computer mediated communication (CMC). The program of research in this thesis will focus on web-enhanced courses.

Therefore, the aim of the research reported in this thesis is to investigate the use of a course management system in teaching/learning environments and the factors that affect students' attitude and performance in such environments. The course management system that been used in this research work is WebCT. The research objectives driving the research programme reported in this thesis are as follows:

- Investigate the relationship between students' use of WebCT, their performance, and their attitude towards WebCT.

- Investigate the relationship between the students' attitude towards using WebCT and their module leaders' attitude towards it.
- Investigate the relationship between the students' cognitive styles and their satisfaction, their achievement, and their way of using WebCT.
- Develop a model of the critical factors affecting students' attitudes to WebCT and test this model in different courses and compare the results.

1.3 Research methods

Three 'in field' studies were conducted for the research work reported in this thesis. Quantitative and qualitative research approaches were used in these studies. The mixture approach that has been used in the studies benefits from the strength of both quantitative and qualitative methods. Field studies were conducted in order to more accurately reflect the everyday conditions in which WebCT is used, and to subsequently increase the ecological validity of the results.

The data for the research were collected from students, module leaders, and WebCT tracking systems. A number of instruments were used to collect data for the studies reported in this thesis: questionnaires, interviews, a cognitive style analysis test, and numerical data from the WebCT tracking system. In each of the studies, students' attitude toward the use of WebCT was measured by using a questionnaire designed for the purpose. Moreover, the module leaders' opinions and experience using WebCT were investigated by using the interview method. Also, numerical data about students' use of WebCT was collected from the log files of WebCT. Chapter three provides a detailed discussion of the research methods and data collection tools that have been used.

1.4 Thesis overview

Chapter 2 is a discussion of relevant literature. The review purpose is to provide the background to and justification for the research undertaken in this thesis. The chapter starts with definitions of important terms in the area and gives an explanation of WebCT and its tools. The chapter comprises a number of sections which are: the significance of using course management system in higher education; the instructor's role in web-enhanced courses; the role of students' cognitive styles in web-enhanced

courses; students' satisfaction and performance in web-enhanced courses; factors affecting students' achievement in web-enhanced courses; and technology issues.

Chapter three describes the general methodologies and techniques used for the empirical work reported in this thesis. The chapter is divided into four main sections which are: overview of the research problems/questions; an overview of research approaches used in thesis; data collection instruments; data analysis techniques.

Chapter four describes the first study. The study's aim was to investigate the effect of lecturers' attitude on students' use of an online learning environment. The chapter reports the first study in detail. The research methods, participants, data collection instruments, procedure, and data analysis are then explained. Finally, the results are reported and discussed and a conclusion is presented.

Chapter five describes the second in field study, which examines the effects of students' cognitive style on their performance on a web-based course. The research methodology is presented, including the sampling, data collection instruments, procedure, and data analysis. The results are then documented, followed by a discussion section, concluding with a chapter summary.

Chapter six describes the third and final study. In this chapter a framework has been developed and evaluated. The framework helps to investigate and understand the relationships between main variables related to web-enhanced curses. As in chapters four and five, the methodology, results, and discussion are presented, concluding with a chapter summary.

Chapter seven presents a summary of the research findings from chapters four, five, and six. A discussion is then presented of the findings of this thesis, and the contribution to knowledge in this subject that this thesis makes. The chapter also identifies potential limitations of the research work conducted, and possible areas for future research that may extend the current research findings.

1.5 Summary

This chapter presented a brief explanation of the motivation behind the research work of this thesis. A background to the research was mentioned then the research

aim and objectives were presented. The methodological approach that undertakes to achieve the research aim was introduced. Lastly, an outline and brief description of the thesis was presented.

The following chapter is a detailed background of relevant research. This provides a backdrop for the aim and objectives of this research.

Chapter 2

Literature Review

2.1 Introduction

This chapter sets out to review some of the previous research on web-based learning and WebCT in order to help demonstrate the aim of this PhD thesis in relation to previous work in the area. First of all this research aims to examine the use of course management tools in undergraduate courses and to study factors that affect the students use, achievement and attitude towards the course management system used in their courses. The course management system that has been studied in this research is WebCT. This chapter begins with technical definitions in the area then focuses on specific details related to WebCT. Then the significance of using WebCT in higher education is illustrated. Following on from that, factors that should be considered when studying web-based courses are reviewed. Here the focus is on the medium of communication that technology creates rather than the technological products themselves. Finally this chapter concludes by indicating how the author reached the research question for this research thesis based on a perceived gap in the literature.

2.2 Technical Definitions

A learning platform is defined in a publication from the British Educational Communications and Technology Agency (Becta) as a generic term to describe a broad range of Information and Communication Technology (ICT) systems which are used to deliver and support learning. A learning platform usually combines several functions, such as organising, mapping and delivering curriculum activities and the facility for learners and teachers to have a dialogue about the activity, all via ICT. So the term learning platform can be applied to a virtual learning environment (VLE) or to the components of a managed learning environment (MLE), (Becta, 2005). The same report defines virtual learning environment and managed learning environment as follows:

- "A virtual learning environment (VLE) is a software tool which brings together resources for curriculum mapping, delivery, assessment, tutor support, communication and tracking."
- "A managed learning environment (MLE) refers to the whole range of information systems and processes that support learning and the management of learning within an institution. It includes VLEs or other learning platforms, administrative and other support systems." (Becta, 2005)
- Web-enhanced courses are traditional face-to-face courses which include web-related materials. Web-enhanced courses usually adopt a course management system (e.g. WebCT) (Sivo et al., 2007).

Web-based learning is a main subcomponent of the broader term e-learning. There are two general types of e-learning which are technology-enhanced learning and technology-delivered learning. Technology-enhanced learning means that students have regular face-to-face meetings with the teacher. Here the traditional face-to-face class is the basic forum for learning, and the technology may make learning materials available online before they are delivered in the class. Technology-delivered learning means students and teachers are not at the same place; it is also referred to as distance learning.

2.3 Course management systems (WebCT)

WebCT (Web Course Tools) was developed by Murray Goldberg, a faculty member at the University of British Columbia (Burgess, 2003; Volery and Lord, 2000). WebCT is an integrated set of educational and management tools and an important provider of e-learning programs. It is specifically used for the design and development of teaching and learning materials. WebCT is mainly used to create sophisticated World Wide Web-based educational environments either by creating entire online courses, or simply by publishing materials that supplement existing courses. Users of WebCT do not need a lot of technical expertise as all content is accessible via a standard Web browser (Volery and Lord, 2000).

Mazza and Dimitrova (2004) stated that course management systems create large log data which contain students' activities on a web-based course. These systems also contain built-in student monitoring features. The instructor can view statistical data about students' use of course pages such as a student's first and last login, the history of pages visited, the number of messages the student has read and posted in discussions, grades achieved in quizzes and assignments, etc. The instructor can use this information to observe students' progress and to discover potential problems.

Students' activities on Web-based courses can be measured in the following ways:

- *WebCT Hits*: The number of times each student accessed each page such as homepage and content page.
- *Time:* means how much time each student spent exploring a page (such as content page) or using tools (such as quiz or calendar)
- *Communication board use*: This can be measured in two main ways.
    1. Articles Read: The number of articles each student read on the communication board.
    2. Articles Posted: The number of articles each student posted on the communication board.

Course Management Systems (CMS), such as WebCT, are becoming increasingly accepted for delivering and managing web-based courses (Dunn and Lingerfelt,

2004). Disciplines outside computer science are extensively using course management systems (Dunn and Lingerfelt, 2004). They also stated that WebCT can be used in varying degrees in large lecture classes, as well as introductory programming classes. Students with limited computer experience were asked to use WebCT immediately and no main effect has been found on their success rate. Other students with some computer experience seem to adapt well enough to the use of a course management system for handling certain aspects of the course. In other words, students can accommodate quickly with WebCT.

2.4 The significance of using course management systems in higher education

The rapid development of the internet and world wide web (WWW) technologies enables the building of integrated learning and teaching environments (Cheng and Yen, 1998). Examining contemporary learning theories Cheng and Yen found that the educational focus is shifting from being teacher-centred to being student-centred. They believe that communication and collaboration between students and instructors can be enhanced by the internet and WWW. They also state that interactive and collaborative learning should be the main aim of using the internet and WWW technologies in education. Kalifa and Lam (2002) stated that information and communication technologies help in supporting traditional educational methods and facilitate new methods of teaching and learning. In addition, teaching and learning are no longer limited by place or even time. Universities and organizations use new technology to offer on-line training and courses. A large number of web-based courses are available on the worldwide web (Kalifa and Lam, 2002). The rapid development of the internet and WWW provides an important resource for people to easily gain access to various types of information and knowledge. Furthermore the WWW is useful in delivering education because of its use of multi-media, and short response time, etc. (Lee and Shih, 2001). They also stated that learners' performance and interest can be improved by using a well-designed World Wide Web (WWW) learning environment.

The large number of publications in higher education journals about e-learning and technology to enhance learning indicates the importance of web-based learning (Bower, 2001). Traditional institutions of higher education introduced web-based learning systems in several ways (e.g. www.blackboard.com, www.webct.com, and

www.GlobalMinds.com) (Wu et al., 2006). The importance of web-based learning has been illustrated in many studies (Hoskins and Hooff, 2005). There are a growing number of institutions offering web-based courses (Owston, 2000) and there are many reasons why online education is important for institutions. These reasons were summarised by Volery and Lord (2000) into four broad categories:

- *Expanding access*: most institutions need to expand access to educational material to meet the needs of individuals in learning and training.
- *Alleviating capacity constraints*: the number of students is growing more than universities can accommodate. So, online education is seen as a solution to this problem.
- *Capitalizing on emerging market opportunities*: there is a growing acceptance towards lifelong learning among people outside the traditional 18-24 age range. Many institutions are seeking to benefit from the large number of new learners.
- *Serving as a catalyst for institutional transformation*: institutions have a challenge to adapt to a decrease in public funding and increasing competition for students which could be catered for by online education.

2.5 The instructor role in web-enhanced courses

Student motivation has been identified as an important factor in student learning in many studies (McCroskey et al., 2006). Since the beginning of research in the area of instructional communication, scholars have sought to identify the communication behaviours of teachers which can either increase or decrease their effectiveness in attaining learning goals in instruction (McCroskey et al., 2006). Swan (2001) pointed to three factors that have a significant effect on the success of online courses; a clear and consistent course structure, an instructor who interacts frequently and constructively with students, and a valued and dynamic discussion. They believe that these factors are not combined accidently but they jointly support interaction with the course content, interaction with the course instructor, and interaction among students.

Huifen et al. (2002) studied the development of a web-based course which was an electronic copy of an existing course. Students could choose between a face-to-face learning method and a web-based learning method. Face-to-face method is the traditional way in which students have lectures in the classroom and only communicate with each other and with the module leader directly face-to-face. While, web-based learning method is an-online course in which no face-to-face communication was available. The students' results were then compared. In 2000, the web-based group performed better than the face-to-face group. In 2001, although most of the students did not have any previous web-based learning experience, they wanted to have more web-based courses. Huifen et al. (2002) stated that the impact of student-student and student-instructor interaction through a web-based learning environment is an important issue. The instructor's supervision and communication with students can not be replaced completely by communication and interaction tools through the web-based learning environment. Therefore, the new relationship should be enhanced by the instructors. They should talk with students online more actively and encourage students to participate more in these online discussions. For example, they can respond online to every student's questions which may encourage other students to participate.

2.6 The role of students' cognitive styles in web-enhanced course

The term `learning style' is used widely in education and training to refer to a range of constructs from instructional preferences to cognitive style (Riding & Cheema, 1991). Riding and Cheema (1991) argued that learners differ in terms of two fundamental and independent dimensions of cognitive style, the wholist-analytical (WA) dimension and the verbaliser-imager (VI) dimension. The wholist-analytical dimension of cognitive style describes the habitual way in which an individual processes and organises information: some individuals will process and organise information into its component parts (described as analytics); others will retain a global or overall view of information (described as wholistic). The verbal-imagery dimension of cognitive style describes an individual's habitual mode of representing information in memory during thinking. According to Riding (1994) verbalisers consider the information they read, see or listen to, in words or verbal associations. For imagers on the other hand, images flow frequently into their mind to describe the information that they read or listen to.

Graff (2003) investigated the interplay between cognitive learning styles and the effectiveness of online courses in delivering instructional content. Students were categorized on a range from wholistic to analytical. Wholistic learners view ideas as complete wholes and are unable to separate the ideas into discrete parts. In contrast, analytical learners are able to comprehend ideas in parts but have difficulty in seeing the complete picture. Along another axis, learning styles were arranged from verbalizers to imagers. Verbalizers do well with text-based material, whereas imagers deal well with spatial data. Graff (2003) designed two web structures. Web Structure 1 presented content in a "short-page" format, which contained 23 pages of content with little on each page. In contrast, Web Structure 2 consisted of "long-page" material and was only 11 pages long with more content on each page. In each of these conditions, half of the participants received a system overview in the form of a map and half did not. The students were tested on recall through a simple test as well as an essay question on the content of the lesson. The results concerning the effect of Web structure on learning showed that analytics performed better in the long-page format than the wholistics. Analytics, because they were able to learn the content in parts, could integrate the information. Along the other axis, imagers were superior to verbalizers on the recall test in the short-page condition. This result appears consistent in that imagers are better able to keep track of where they are in the website. According to Graff, his study provides clarity for instructional designers and suggests that Web-based learning environments should be matched to the cognitive style of the user.

Jelfs and Colbourn (2002) studied students' learning approaches within a group and how this affected their adoption or rejection of the electronic medium. There study sample involved Second Year Psychology degree level students completing a core module on biological and cognitive psychology. The module included ten seminar sessions, of which five were face-to-face and five used computer-mediated communication through an Intranet Web board. They found weak correlations between deep, strategic and surface approaches to learning and perception of Communication and Information Technology. They said that measures of the deep, strategic and surface approaches to learning indicate potentially interesting relationships. They also suggested that to improve student interest in the use of computer-mediated communication and to motivate students then it has to be

relevant to their course of study and that teaching staff have to also be active in their use of the technology. Students will quickly lose interest if they think that teaching staff are not paying attention to their students' contributions.

Russo and Benson (2005) investigated the relationship between student perception of others in an online class and both affective and cognitive learning outcomes. They demonstrated the significance of student-student as well as teacher-student interaction in online classes. They highlighted the importance of instructor presence and interaction among students to attitudes about the class. They believed that interaction between students is an integrated part of the class and that instructor should encourage and support the interaction, although facilitating interaction is time-consuming and often demanding.

Zapalska et al. (2003) explored cognitive aspects of learning using WebCT technology. They surveyed undergraduate business students based on their level of participation and satisfaction within various WebCT activities including communication, course content, test and quizzes, syllabus and progress tools. Using students' feedback on these activities, they examined whether WebCT enhanced the learning process. They found that effective instruction requires students to become active participants when using various WebCT activities. When these activities are used to their greatest potential, WebCT significantly enhances traditional classroom instruction. The results of their study suggested that students are able to learn equally well on WebCT online courses despite their different learning styles, WebCT learning platform, and background in terms of gender, age, job status, year of admission, previous web-based learning experience, and management information system preparation. Also, they found that most of the students were satisfied with the use of E-mail, bulletin board, syllabus, calendar, and dissatisfied with the use of a progress tool and chat room. They indicated that integrating technology tools such as WebCT into the business curriculum is an inseparable part of good teaching.

WebCT is dynamic and the success of a course is based on its content, development, student interaction with the use of chat room, bulletin, and e-mail, and the course leader's ability to observe and guide the course and make adjustments based on students' needs and interests (Zapalska et al., 2003). They stated that though

students' active engagement with course materials determines the direction of a course, the course leader should act in response to the direction that students provide. The nature of a WebCT course requires a student-centred approach and its goal is student learning. Self-direction and initiative are required on the part of learners to define learning and then systematically explore the WebCT context to meet personal goals. Assessment of students' opinion of the WebCT course is an area where faculty can frame a course to help students reach efficiency.

There are many ways to evaluate students' opinions on a WebCT course such as: the use of an online feedback form that enables students after every lecture to describe what they learned and to give their comments about the class. WebCT can also be used to assess, monitor student progress, control the pace of learning, and evaluate teaching strategies. Using WebCT is a simple but powerful technique to collect student feedback and use it to improve teaching. Data from the students who are taking Web-based courses can be collected by using a variety of forms of assessment tools. Student feedback can be used to provide a formative evaluation of teaching during the semester. As a result, instructors can get immediate feedback on course material, teaching style and student progress in order to make necessary changes and increase the efficiency of the students' learning processes.

2.7 Students' satisfaction and performance in web-enhanced courses

Technology has the possibility to enhance and transform teaching, but it can also be used incorrectly or in ways that may interfere with learning so it is important to know how we can achieve effective learning online (Salter, 2003). Different ways can be used to measure the effectiveness of web-based courses. Therefore studies in distance education differ in what they use as evidence of online course effectiveness. For example, Volery and Lord (2000) collected data from students enrolled on a Global Business course in which WebCT was used to deliver the course materials. They investigated factors that could affect the online course delivery such as: ease of access and navigation, interface, interaction with the instructor, attitudes towards students, instructor technical competence, and classmates' interaction. Volery and Lord (2000) stated that WebCT is easy to use, well designed and structured system which is very important for the students who spend a long time on the site. Moreover, the instructors' personal approach and their ability to motivate the

students in both the classroom and on WebCT are important factors affecting their teaching effectiveness. Furthermore, instructor familiarity with the technology and their ability to use the internet are also considered to be important factors affecting their teaching effectiveness.

In another study, Jurczyk et al. (2004) found that students' attitude can change during a web-based course. Hisham et al. (2004) stated that there are many factors that can affect student satisfaction with asynchronous e-learning systems (they used WebCT in their study). They said that personalised feedback is an important factor for a successful asynchronous e-learning system. Another factor affecting students' satisfaction is a supportive learning community which can be achieved by the use of tools such as discussion boards. A suitable interface was also found to be another factor which may influence students' satisfaction because a well-designed interface gives students the opportunity to easily access the content. Arbaugh and Duray (2002) found that a large class size has a negative relationship with online learning and course satisfaction. Flexibility of delivery positively affected students' learning and satisfaction. Students who have previous experience in using the internet and on-line courses were found to be more satisfied with the course delivery medium.

Yang at al. (2008) stated that the learning behaviour of a student might be affected by their personal opinion about the learning tool. However, these learner characteristics have not been widely discussed in the web-based context. The interaction between students and instructors was found to be the most significant feature about the web-based learning environment.

Previous studies have suggested a variety of factors that affect user satisfaction with web-based learning. Sun et al. (2008) developed an integrated model with six dimensions which are: learners, instructors, courses, technology, design, and environment. They found that there are several critical factors that affect student satisfaction in e-learning. These factors were learner computer anxiety, instructor attitude towards e-learning, e-learning course flexibility, e-learner course quality, perceived usefulness, perceived ease of use, and diversity in assessments. They suggested more research should be carried out on how to improve students' satisfaction toward web-based courses. Sun et al. (2008) also stated that many

studies from psychology and information system fields have identified important variables relating to web-based courses. They presented a six dimensions model; the dimensions are student dimension, instructor dimension, course dimension, technology dimension, design dimension, and environment dimension. These six dimensions were, in turn, made up of thirteen factors.

In the learner dimension the factors were learner attitude toward computers, learner computer anxiety, and learner Internet self-efficacy. In the instructor dimension the factors are instructor response timeliness and instructor attitude toward e-Learning. In the course dimension the factors were e-Learning course flexibility, e-Learning course quality. The technology dimension factors were technology quality and Internet quality. Finally, perceived usefulness and perceived ease of use were identified in the design dimension and diversity in assessment and learner perceived interaction with others in the environmental dimension. Their study concluded that learners' computer anxiety, instructor attitude toward e-Learning, e-Learning course flexibility, e-Learning course quality, perceived usefulness, perceived ease of use, and diversity in assessment are the critical factors affecting learners' perceived satisfaction. They stated that course quality is the most important concern in this e-Learning environment. Course content should be carefully designed and presented. Moreover technological design plays an important role in students' perception of the usefulness and ease of use of a course and it will also have an impact on student satisfaction. Flexibility is an important factor in e-Learning satisfaction. It is one of many advantages of online education. It allows learners to choose the most suitable learning methods to accommodate their needs. Learning system administrators should make sure that all system functionalities are available (e.g communication board, mail tool and chat rooms). This will provide better and uninterrupted effective environments to enhance student satisfaction with e-Learning. In their study Sun et al. (2008) said that students' confidence in using computers is important in making them enjoy e-learning. A basic computer course could be a prerequisite to better prepare students. Finally, the study found that instructors' attitudes toward e-Learning positively influenced students' satisfaction. When instructors are committed to e-Learning and show active and positive attitudes, their enthusiasm will be apparent and further motivate students. In this perspective institute

administrators must be very careful in selecting instructors for e-Learning courses. A training course for instructors might be very helpful (Sun et al., 2008).

In another study, Wells (2000) studied the effect of an on-line computer-mediated communication course, prior computer experience and internet knowledge and learning styles on students' internet attitude. They found that the learning activities and instructional strategies are effective in teaching the necessary enabling skills and allowing students to focus on methods of integration. Prior computer experience was not an issue for graduate students taking an on-line course. Basic computer skills do not need to be taught and advanced computer skills are not necessary for computer-mediated communication participation. The rise in student concern was caused by the course assignment rather than the method of delivery. They indicated that more attention should be focused on how activities such as collaboration and coordination are facilitated because it is a main requirement for teaching via computer-mediated communication. They found that the increase in students' computer skills had a positive effect on student attitudes toward the internet. However, little influence was found on overall student performance which indicates that computer-mediated-communication delivery of information does accommodate a variety of learning styles without negative consequences for learning.

Picciano (2002) indicated that there is a strong relationship between students' perception of the quality and quantity of their interaction and their perceived performance in an online course. However, in comparing student interaction as defined by actual postings on a discussion board to actual performance measures designed specifically to measure course objectives, the results were not consistent. Actual student interaction was measured by the number of postings on the discussion board. They found that there were not any differences among the three (low, moderate, high) interaction groups in terms of performance on the examination. They explained that all students, and especially the low interaction group, studied for the examination. Actual student interaction did have a relationship to the written assignment for students in the high interactive grouping.

In a study based on postgraduate students at a Malaysian university, Hong et al. (2003) explored students' perception of and success in a web-based learning

environment. They chose problem-based learning to implement their study. Problem-based learning is a student-centered instructional approach in which students collaboratively solve problems and reflect on their experiences. In such an approach teachers take on the role as "facilitators" of learning. Hong et al. (2003) compared the differences between the outcomes of a web-based course and a face-to-face version of the same course. They found that most students were satisfied with their web-based learning experience. The students found the web-based course flexible because they could learn at any time and anywhere. A few students felt isolated and needed face-to-face lectures. Developing the students' computer skills was found to be an important aspect supporting students' success and improvement in a problem-based course. Finally the researchers recommended designing clear structures to guide students studying a problem-based module in a web-based environment.

In another study, Nageswaran et al. (2000) set out to investigate students' attitude to modules which were supported by WebCT. WebCT was used to enhance and support the traditional classroom. They said that WebCT is a very good supplementary tool for a traditional classroom, especially for courses with large numbers of students. Students in their study considered that supplementing classroom teaching with WebCT is better than replacing it. The researchers found that students have to work collaboratively in order to achieve good understanding of the information on the web which may be promoted by using emails and chat tools between students.

Storey et al. (2002) evaluated the usability of WebCT and blackboard by collecting data from a survey given to set of students during course time. The results showed students' satisfaction with using web-based tools was related to its perceived convenience and flexibility. Students liked being able to access information any time and any place and the way web-based tools supported their learning styles. Storey et al. stated that Web-based learning tools are developing the learning needs and supporting the traditional way of teaching, as well as offering a new way of delivering education.

2.8 Factors affecting students' achievement in web-enhanced courses

There is a rapid increase in the on-line corporate training which make the potential market for internet-based courses tremendous (Arbaugh, 2000). Moreover Arbaugh argues that more research needs to be undertaken to investigate the effectiveness of using information and communication technology in teaching. In addition, they recommend future research on determining the most appropriate ways of teaching internet-based courses and what type of student and instructor function best in an online environment (Arbaugh. 2000). He also recommends future research to look into determining the most appropriate ways of teaching internet-based courses and what type of student and instructor function best in an online environment. In Arbuagh's study they looked at the effects of gender on students' learning and class participation in an internet-based MBA course. Their results showed that there were no significant differences in learning, and moderately significant differences in class participation between males and females. They used interaction difficulties as a predictor of class participation. Their results showed that males reported more difficulty interacting on the course than females.

Several studies link student characteristics and behaviours to learning experience perceptions and attitude, such as satisfaction, frustration and anxiety. These studies investigate the impact of perception on learning outcomes and performance. For example, Kim and Moore concluded from a 2005 web-based course study that students' interaction with classmates and their instructor may have an impact on their satisfaction with Web–based courses. The study was conducted with eighty-two graduate students enrolled on a web-based course at a Midwest university. Students' who had more interaction with an instructor and other classmates tended to be more satisfied with their Web courses (Kim & Moore, 2005). Interaction is central in teaching and learning; the learning process is based on student interaction with instructors, other students, and with the course content (Lei et al., 2003). At the same time, communication and collaboration between the students and instructors can be enhanced by the internet and WWW (Cheng and Yen, 1998).

Rivera et al. (2002) compared between students achievement and satisfaction in a course delivered in three ways. The students' enrolled voluntarily on the same course but different method of delivering data. First, the traditional method was face-to-face

lectures and the assignments and the exams were undertaken in the traditional way. Second was the web-based section which used the web to deliver the course materials and the assignments. In web-based methods students did the same exam question as in the traditional method but they did them online. The third method was the hybrid section which was a mixture of the first two methods. They used WebCT to deliver the course materials and at the same time the students attended lectures. For all three sections, the exams questions were taken from the same test bank. By comparing the three groups they found that students' performance was not affected by the way the course materials were delivered. However, it had an impact on student satisfaction. They found that the traditional and hybrid student groups were more satisfied with their courses than the web-based students.

In another study focussing on student perception of online learning, Hoskins and Hooff (2005) discussed two important questions in examining online learning: "(1) Which students voluntarily utilise web-based learning; and (2) Does this use influence their academic achievement?" (p. cccs177). They observed 110 undergraduate students of different ages and both genders. The students used WebCT to support their course. The results showed that older students accessed WebCT more, spent longer on it, and used the notice board more frequently than younger students. Males used the chatting dialogue facility more than females. Overall, the results indicated that the age and the gender of the learner had a considerable role in determining students' use of web-based learning. They found that there is a relationship between using the discussion board and the students' achievement. Students who posted messages on the discussion board got better grades than those who did not post or posted fewer messages. They considered this finding to be important and they stated that more research is needed to confirm their result and to find the relationship between using specific aspects of an online environment and students' achievement.

Sayers et al. (2004) compared students' performance with and without the support of WebCT. They studied two different groups of students enrolled in the same module in two different academic years. The authors thought that an on-line assessment could have unfavourable affect on the students' end of semester examination grades; however their results indicated that on-line assessments do not necessarily have a

detrimental effect on students' end of semester examination results. In this study students had the traditional end of semester exam and two on-line multiple choice tests delivered by WebCT. The comparison showed that the students who used WebCT achieve slightly better results than the previous year students who did not have WebCT.

2.9 Technology aspects

There is general acceptance that new technologies generally, and the Web specifically, will continue to have important influence on the ways that information is retrieved, stored and shared in educational environments (Jones and Jones, 2005). A lot of the empirical research in this field has investigated the effectiveness of the strictly traditional classroom versus the strictly virtual classroom (Jones and Jones, 2005).

Large numbers of web-based learning environments have been created with the development of the internet, such as web-enhanced learning. However Dillon (2000) found that web-based instructional environments had not produced desired learning results. In classroom environments a large body of hypermedia research emphasizes that successful learning depends on learner characteristics such as cognitive styles/preferences, and learning styles (Dillon, 2000).

Large classrooms with more than 50 students are increasing. Lectures are the usual instructional strategy; students and lecturers complain about large classrooms (Smith and Kampf, 2004). Carbone (1998) indicated a general dissatisfaction with the quality of large-class learning experiences because of:

- Lack of interaction with faculty members (in and out of the class)
- Lack of structure in the lectures
- Lack of or poor discussion sections
- Inadequate contact with teaching assistants
- Inadequacy of classroom facilities and environment
- Lack of frequent testing or graded assignments

Smith and Kampf (2004) tried to develop writing assignments and feedback strategies for maximum effectiveness in large classroom environments. They used WebCT for peer review techniques and for feedback techniques. They stated that using WebCT allowed them to give feedback to both groups and individuals. Also they said that WebCT offered the students a virtual space in which to reflect on their writing outside of class which they found to improve the quality of the students' writing.

Tian (2001) described the World Wide Web as a vehicle to develop interactive learning and teaching applications. He said that the web is an important tool to facilitate education. Interactive web pages are essential in the learning and teaching process. Therefore, a script language must be used in designing such web pages. Based on his experience and the feedback from multi-choice questions from students, Tian identified six main issues to be considered in designing a computer based course: teachers, students, knowledge, evaluations, communications and the enabling technology.

2.10 Summary

The use of course management systems to support face-to-face courses is clear in the literature. Large numbers of institutes are offering courses supported by WebCT to reach large number of students to meet their educational needs. This chapter discussed the background research that this thesis is based on in order to help form the research question. The review showed the significance of using course management systems to support face-to-face courses. Students' use of these systems and their achievement is an indicator of their learning, therefore it is important to investigate factors that influence student learning. As is shown in the literature, student attitude towards a system is an important factor that influences their use of the system. The instructor plays a main role in motivating the students on such courses. On the other hand, there is no agreement in the literature relating to the affect students' cognitive styles has on learning and is a factor to be considered when studying web-based courses.

The next chapter will describe the research methods which were used to undertake the studies reported in this thesis.

Chapter 3

Research Methodology

3.1 Introduction

The following chapter consists of four main parts. The first part is a review of the questions that this thesis is attempting to answer. Then a general definition of the approach used in conducting the research is provided. After that, a thorough description of the data collection approaches used in this research work is described. Finally, the analytical procedures used on the data collected are presented.

3.2 Overview of the research questions

The aim of the work reported in this thesis is to examine students' use of the course management system (WebCT) in undergraduate courses. Specifically, this thesis will investigate the relationship between the main variables in the success of web-based courses. The first study reported in this thesis investigated the relationship between students' attitudes towards using WebCT and their module leader's attitude towards it. The second study investigates the relationship between students' cognitive styles and their satisfaction with the system, their achievement, and their way of using WebCT. Finally, in the third study, a model that clarifies the relationships between the main variables in web-based courses was developed and tested.

This research benefits from experience at a UK university (Brunel University) in implementing a course management system (WebCT) to support the courses offered to students. The university started using WebCT in 2004. It was important to assess users' satisfaction with the new system. Also, it was important to investigate factors that affect student achievement and use of the system. These factors can come from the system itself, student characteristics and module leader characteristics.

The first study started by investigating the relationship between students' attitudes and the lecturers' attitudes towards using the system. Moreover this first study investigated the influence of module leaders' attitudes on students' attitudes toward the system. It showed general student satisfaction towards the new system and various attitudes from the module leaders toward the new system. The second study reported in chapter 5 of this thesis looked at the relationship between student cognitive styles and their attitudes, performance and achievement. The second study showed that students with different cognitive styles (wholistic-analytical and verbal-imagery dimensions) used WebCT as effectively as each other. Based on the first two studies, a framework was designed to assess the critical factors affecting learners' satisfaction, performance and achievement in courses supported by the course management system. The framework was tested on three different courses in study three which is reported in chapter 6 of this thesis.

3.3 Overview of research approaches used in thesis

Three studies were conducted for the research work reported in this thesis. A mixture of qualitative and quantitative methods was used in these studies. The mixed approach was applied in the studies in order to take the strength of both quantitative and qualitative methods. Owston (2000) used mixed-method evaluation strategies to evaluate web-based learning environments; he stated that the richness and complexity of a web-based learning environment can be captured and understood to greater potential by mixing methods rather than using a single approach. In addition, Creswell (2003) said that there are three methodological research approaches: a quantitative approach, a qualitative approach, and a mixed method approach. Quantitative research refers to studies which produce research findings that are concluded by statistical summary and analyses. The researcher in this approach tries to gather the data by employing different strategies such as surveys and experiments.

On the other hand, qualitative research refers to studies whose findings are not concluded by statistical summary. The data obtained from qualitative research are most commonly gathered from interviews, case studies and observation. Qualitative data can be used to describe individuals groups and social behaviour. In the mixed method approach the researcher collects both quantitative and qualitative data aiming to provide the best understanding of a research problem. This kind of approach begins with collecting statistical data by using quantitative methods such as surveys and then focuses on qualitative data by using qualitative methods such as open-ended interviews. This method is useful in capturing the best of quantitative and qualitative approaches.

Hypotheses are formal statements of predictions derived from evidence from earlier research and theory or simply the result of a hunch (Breakwell et al., 1995). Hypotheses are tested by manipulating one, or some, of the variables (Preece et al. 2002). According to Robson (2002), an experiment involves: the assignment of participants to different conditions; manipulation of one or more of the independent variables; the measurement of the effects of this manipulation on one or more of the dependent variables; and the control of all other variables.

There are two types of experiment: those that are performed in the laboratory and those that are conducted in the work environment, or 'in the field'. When an experiment is conducted in a laboratory the participant must be taken out of the environment in which they would normally use the system and situated in the controlled environment of, for example, the usability laboratory. An advantage of the laboratory is that it allows the isolation and control of variables in order to accurately measure cause and effect (Coolican 1994), thus allowing different designs to be compared. In addition, the laboratory can be stocked with the technology and apparatus to allow extensive data recordings, and offers the participant an environment free from everyday distractions.

Coolican (1994) has isolated another two potential weaknesses of the laboratory setting: artificiality and the inability to generalise. Artificiality refers to the way in which the contrived situation created by the laboratory setting affects the participant. They may feel anxious or overawed by the laboratory setting, feelings which can be

compounded if the experimenter sticks too rigidly to standardised protocol, and neglects the normal human interaction norms, leading to a negative impact on performance. Bias may also occur as a result of the demand characteristics of the experimental situation, which means that the participants may alter their behaviour according to their interpretation of what the experiment is testing and what the experimenter requires of them, an effect that has been shown to be most pronounced amongst participants who have volunteered for an experiment (Rosenthal and Rosnow, 1975). Although such biases may be mediated by keeping experimenter-participant interactions to a minimum, which is often the case with human-computer interaction experiments, many have argued that these weaknesses lead to results which cannot be generalised to the real world beyond the laboratory.

The alternative to laboratory studies is the use of field studies, which situates the participant in their natural real world environment, and allows the experimenter to capture interactions between systems, and other people, that would not have occurred in the laboratory (Coolican 1994). In field studies, the participant interacts in real world conditions of ambient noise, movement, interruptions, and distractions, which are hard to replicate in the laboratory and which enables results to be generalized to the real world, thus promoting external validity. The natural situation of the field experiment reduces the demand characteristics of the experiment through the use of both experimental and mundane realism, and therefore reduces the tendency for participant biases to affect performance. Robson (2002) states that, if an ethical means of random allocation of participants to experimental conditions can be achieved, then a field study is preferable to a laboratory study.

For the previous reasons, the three mixed method studies reported in chapters four, five, and six in this thesis were conducted as field studies rather than laboratory studies. The studies were related to students' use of a course management system, WebCT. It is more reliable to carry out the studies when the students are actually using WebCT on their course rather than asking them to use the system temporarily in a laboratory study.

3.4 Data collection

A number of instruments were used to collect necessary data for the research

reported in this thesis. Data was gathered by using questionnaires, interviews, a cognitive style analysis test, and numerical data from the WebCT tracking system. Each of these instruments is explained in the following section.

3.4.1 Questionnaire

A questionnaire is one of the basic research techniques for gathering structured information from individuals (Coolican, 2004). Usually questionnaires are constructed for a specific research topic and tend to gather various kinds of data such as current opinion or patterns of behaviour. There are some principles that a researcher has to bear in mind while designing a questionnaire. Firstly, asking for the minimum of information required for the research purpose because the respondents' time is precious and the time they spend answering questions has a bearing on their mood (which may affect their answers). A questionnaire should not contain questions that will not be used or can be obtained from elsewhere. Secondly, the researcher should make sure that the questions can be answered. A question like "how many times have you used the internet this year?" is difficult to answer accurately for most people. Thirdly, the researcher should make sure that questions will be answered truthfully. Difficult questions are unlikely to be answered truthfully. Difficult and wide-ranging questions are likely to receive answers based more on well-known public opinion rather than the individual's real beliefs. For example, if a question on child rearing is not phrased very clearly it will produce answers more agreed with general 'expert' views on good practice than with the parent's actual practice. Finally, the researcher should make sure questions will be answered and not rejected. People may refuse to answer questions about a sensitive topic (Coolican, 2004).

A questionnaire was specifically designed for each study in this research. Details about each questionnaire will be presented in the related study later in chapters four, five, and six. However, generally the three questionnaires measured students' attitudes towards using WebCT on their courses and gathered information from students about their experience of using WebCT. Two types of questions were used in the questionnaires which are closed and open-ended questions. Closed questions have many forms such as:

- Yes or no questions: e.g." Do you use the internet at home?"

- One true answer: e.g. "How many modules do you have this term?"
- Choosing from different available answers: e.g. "My age is:

1. Under 16
2. Between 16-21
3. Between 22-25
4. Over 25

Open-ended questions such as: "Can you please tell me what kind of things you use the PC you have at home for?"

Coolican (2004) said that open-ended questions have several advantages. They deliver richer information and encourage the respondents to answer in their own way, not stick with a fixed choice answer. Open-ended questions are more realistic because respondents usually give reasons or explanations for why they agree or disagree with a statement.

Also, a 5-point Likert scale was used to measure students' attitude. Coolican (2004) stated that attitude scales are highly structured measures which usually contain statements to which respondents provide the most appropriate response. The researcher should be aware that each attitude scale attempts to be a unitary measuring instrument, not an opinion questionnaire. There are several popular types of scales that are explained in Coolican (2004) as follows:

- Equal appearing intervals (Thurstone, 1931): on this scale a score equivalent to the strength of every statement that a person agrees with is given. The researcher needs the following steps in order to structure this scale:

1. Present a large number of both positive and negative statements toward the attitude object.
2. Ask group of judges to rate the statements ranging from 1 (highly negative) to 11 (highly positive).
3. Find the scale values by taking the mean value of all the ratings for each

statement.

4. Reject the statements which judges rated very differently.
5. The overall attitude score is the total of all scale values on items respondents agreed with.

This scale has difficulties. The judges cannot be completely neutral. It is difficult to select the most discriminating statements from items that have the same scale value.

- The semantic differential (Osgood, Suci and Tannenbaum, 1957): this scale can be used to measure the connotative meaning of an object for an individual. In the following question, the respondent is asked to mark a scale between bi-polar adjectives according to their feeling where the object holds on the scale. As an example:

  "Nurse"
  good _ _ _ _ _ _ _ bad
  weak _ _ _ _ _ _ _ strong
  active _ _ _ _ _ _ _ passive

  All bi-polar pairs could be attached to the next three general meaning factors:
  - 'active' (along with 'slow-fast', 'hot-cold') is an example of the activity factor
  - 'strong' (along with 'rugged-delicate', 'thick-thin') is an example of potency factor
  - 'good' (along with 'clean-dirty', 'pleasant-unpleasant') is an example of the evaluative factor.

  Adapted to attitude measurement, the semantic differential apparently produces good reliability values and correlates well with other attitude scales. There is a weakness that respondents may have a tendency toward a 'position response bias' where they usually mark at the extreme end of the scale (or won't use the extreme at all) without considering possible weaker or stronger responses.

- Summated rating (Likert, 1932): The researcher needs the following steps in order to structure this scale:

1. Similar to Thurstone scale, present a set of favourable and unfavourable statements about an attitude.
2. Ask respondents to give their response to each statement using a scale ranging between strongly disagree to strongly agree. For example:

"WWW is a good provider of learning"

5	4	3	2	1
Strongly agree	Agree	Neutral	Disagree	Strongly disagree

Scales usually range from 1 to 3 points, to a maximum of 1 to 9 points, but it is generally agreed that taking the middle ground, by using scales of 1 to 5, or 1 to 7, is the most effective method (Dix et al. 2003). For the work reported in this thesis, it was therefore decided to use a scale of 1 to 5 as the previous example shows. Each value in this scale can be used as a score for each respondent on each item. 'Five' will be the score for strongly agree with a favourable item, while it will be 'one' for strongly agree with an unfavourable item. Overall attitude score will be given by adding the scores together for each item.

There is, however, a difficulty in using the Likert scale. The score 3 which is "undecided" is not clear because it is not known whether it corresponds to no opinion or an on-the-fence opinion and therefore the central value in an overall score distribution is quite unclear. 30 out of 60 could be 'undecided' or it could contain a collection of 'strongly for' and ‘strongly against' responses.

A Likert scale was used in this research because of its advantages that have been mentioned by Coolican (1994); he stated that it is more natural to complete and maintain the respondents’ direct involvement; it has been shown to have a high degree of validity and reliability; and it has been shown to be effective at measuring changes over time.

3.4.2 Interview

In the first study reported in chapter four the researcher used interviews to collect

information from the participants. An interview is considered to be a good method for collecting qualitative data. The interview may contain both open-ended questions and closed questions. There are many types of face-to-face interview techniques ranging from fully structured to unstructured. Coolican (2004) described various types of interviews as follows:

- *Non-directive interview:* in this type of interview the interviewee can talk about anything they like and the interviewer does not give any directions to affect the topic under discussion. Helping the interviewee to deal with personal problems and to increase self-awareness are the aims of this type of interview which is used by psychotherapists and counsellors. This type of interview is not suitable for academic research gathering data.

- *Informal interview:* in this type of interview the interviewee can talk on any aspect of a topic because they do not have to answer pre-set questions. The interviewer may just direct the interviewee to keep them to a topic and sometimes prompt them. An interviewee should know what the topic is and what is really expected from them and how their information will help.

- *Semi-structured interview (informal but guided):* this is very popular type of interview because it has the advantage of keeping the procedure informal. In this type of interview, the interviewer does not ask the questions in the same order each time.

- *Structured but open-ended interview:* The interviewer asks a pre-set of open-ended questions in a predetermined order. This keeps the interviewer focused on gathering data and avoiding a two-way conversation. In this type of interview the interviewer can avoid the looseness and inconsistency that may occur in other types of interviews. However, the respondents can still respond in any way they choose. This type is used in the study reported in chapter four.

- *Fully structured interview:* this type of interview consists of a pre-set of fixed

questions asked in a predetermined order. Examples of this format are: yes-no questions, statements with multi-choice responses such as agree, neutral, disagree, strongly disagree, or questions with several possible answers (multiple choice). It can be used as a part of gathering data from respondents in the street. Responses can be counted and analysed numerically.

3.4.3 Cognitive style analysis test (CSA) to measure cognitive style

In the second study presented in this thesis, information about students' cognitive styles was needed. Cognitive style is an individual's preferred and habitual approach to organising and representing information (Riding, 1991). There are a number of instruments that measure cognitive styles such as the Group Embedded Figures Test (GEFT) (Witkin et al., 1977) and cognitive style analysis CSA (Riding, 1991). The Cognitive Styles Analysis (CSA) (Riding, 1991) is a computer-presented test used to determine an individual's position on the Wholist-Analytic and Verbal-Imagery style dimensions. Riding and his co-workers (Riding and Cheema 1991; Riding and Rayner, 1998) have argued that that the various cognitive style labels can most probably be accommodated in a two-dimensional model of style. These may be summarised as follows.

- The *Wholist-Analytic* dimension determines whether or not an individual tends to *organise* information in wholes or parts.
- The *Verbal-Imagery* dimension determines whether or not an individual is inclined to *represent* information during thinking verbally or in mental pictures.

The computerised test consists of three subtests. The first contains items relating to the verbaliser-imager style, the second set of items relates to the wholist dimension of cognitive style and the third set of items relates to the analytic dimension of cognitive style. The test taker is required to react by simply pressing either a 'true' or 'false' button in response to each question item. The computer then calculates an individual's position on each style dimension by comparing response times between the verbal and imagery items and the wholist and analytic items on the test (Graff, 2003).

A Cognitive Styles Analysis (CSA) test was chosen for the work reported in this thesis. Different from many other measures of cognitive style, the CSA has been under considerable empirical investigation. After investigating several cognitive style inventories several authors found the structure and the theoretical support of CSA to be more powerful than that of others (Rezaei and Katz, 2004; Graff, 2003) Riding and Rayner (1998) stated that there is now considerable evidence for the validity of CSA.

When a participant completes the CSA, a screen shows two numbers and the name of the cognitive style that has been measured in the test. The numbers represent WA, which is the measure of *Wholist-Analytic* dimension, and VI which is the measure of the *Verbal-Imagery* dimension. Figure 3.1 shows the possible scores as a result of the CSA test and the cognitive style matching each score.

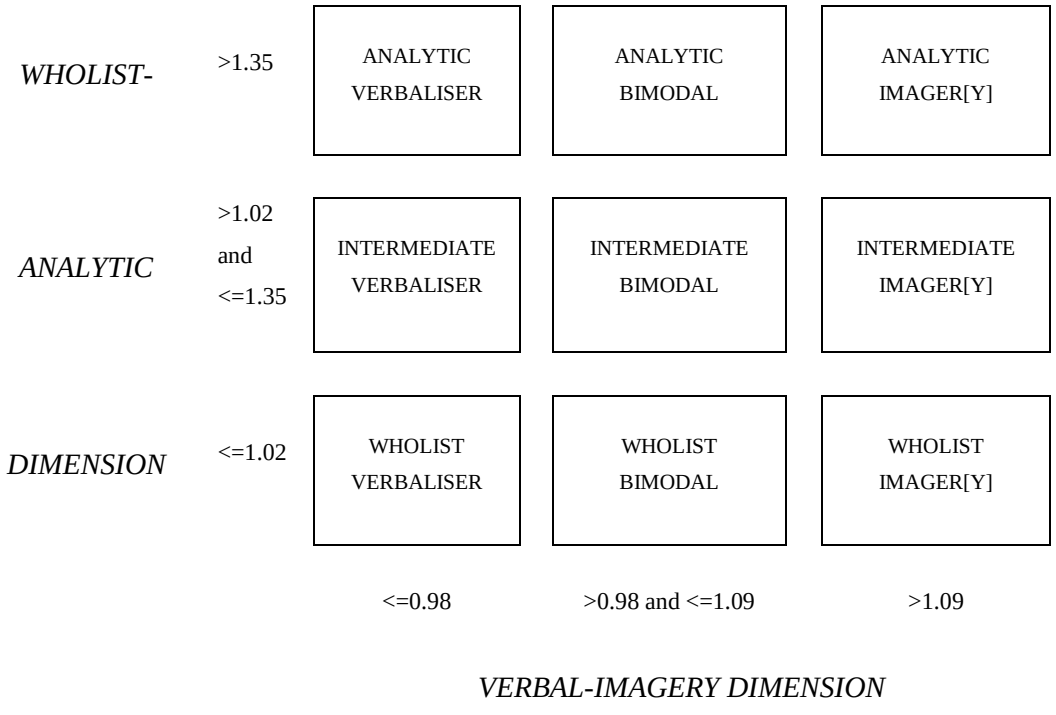

Figure 3. 1: The dimension of cognitive style [1]

[1] CSA manual. Making learning effective- Cognitive style and effective learning (Richard Riding, 2000)

Figure 3.1 is based on the two numbers that are the results of CSA test. Each number represents different style "*Wholist-Analytic"* and *"Verbal-Imagery".* These two styles are independent of one another. Participant's position on one dimension of cognitive style does not affect his/her position on the other.

An indication of test performance is built into the CSA. The results report both a Speed Index and the Percentage Correct for each of the dimensions of style. These may be used as an indication of how carefully an individual completed the CSA, and whether or not they were able to do it. If the Speed Index is very high, (i.e. greater than 10), then this may suggest that the individual did not take the test seriously and was simply pressing one of the response buttons with little regard for the content of the items. This is likely to be the case if the Percentage Correct is low (i.e., less than about 70%). While a few items might register as incorrect if the wrong key was accidentally pressed, or the person was genuinely uncertain about, say, the colour of an object, because the items are designed to be easy; normally an individual would get almost all of them correct. In a case where the Speed Index is low, it suggests that the individual took the test seriously, but if the Percentage Correct is also low, then it is likely that the person either did not understand the test or could not read the questions properly.

3.4.4 WebCT tracking system data

The objective data for this research was collected from the WebCT tracking system database. This type of data gathering has been used in previous research (Hoskins and Hooff, 2005; Phillips and Baudains, 2002; Wellman and Marcinkiewicz, 2004; Johnson, 2005). First of all, statistical data about the students' use of WebCT was collected weekly from the beginning of the term (for each study reported in this thesis). The WebCT tracking system provides information about students' use and visits to every tool and page on WebCT. There are number of main measures of students' use of WebCT; WebCT pages hits, total time they spent using WebCT, the number of times they accessed WebCT, and bulletin board use. WebCT pages hits is the number of times every student accessed each page such as homepage, content page (module resources page which contain lecture notes). Bulletin board use is the number of messages each student read or posted on the discussion board. Owston (2000) used WebTrends, the server log files analysis tool, as a data collecting tool

which is similar to WebCT's tracking system log files. Owston (2000) considered log files as a potentially rich data source for evaluating web-based learning.

Data that is available on the WebCT tracking system is of great importance for this research. It allowed the researcher to obtain accurate information about students and module leaders without asking them a large number of questions either in a questionnaire or an interview. The use of the data from the tracking system gave this research the strength of matching the results obtained from analysing questionnaire and interview data with results obtained from analysing the numerical data from the tracking system.

3.5 Analysing data

Students' general use of WebCT was measured by the number of times each student visited WebCT pages or used the discussion board. Student achievement was measured by the grades they obtained for the observed module. Students' attitudes towards WebCT were measured using a Likert scale. Students' cognitive styles were measured using the CSA test. The data was analysed by using SPSS.

The collected data were aggregated into an Excel spreadsheet for review and to run preliminary analytic reviews. The information obtained from student study records was kept strictly confidential. The confidentiality of the collected student information was preserved at all times. Subject names or other identifying information have not been disclosed or referenced in an identifiable way in either a written or verbal context.

The statistical tests that will be applied to the data must be decided upon during the planning stage of the study to ensure that the data can be analysed and that this analysis will allow the hypothesis to be either supported or rejected (Breakwell et al., 2000). Frequency measures were used to analyse the numerical data that were obtained from the questionnaire. Meta analysis was used to analyse the qualitative data from the lecturer's interview and the students' comments.

Bryman and Cramer (2005) stated that one of the most important explanations of the relationship between variables is the correlation. The measure of correlation between variables indicates the strength, significance and the direction of the relationship.

The measures of students' academic achievement in the modules used in the research studies reported in this thesis were correlated (Pearson's Product Moment Correlation Coefficient) with measures of WebCT use (e.g. WebCT hits and communication board use). The potential significance of the relationship between the students' achievements and their use of WebCT was also tested. In addition, scatter diagrams were used to illustrate any relationship between these variables.

A Paired t-test was used to compare means on the same or related subject over time or in differing circumstances. The observed data are from the same subject. An extension of this test is the repeated measure ANOVA. ANOVA is a powerful parametric means of analysing differences between three or more conditions, and was the technique used for the work reported in this thesis.

3.6. Summary

This methodology chapter has described the general methodologies and techniques used for the work conducted for this thesis. First, an overview of the research problem was presented. Then the general research approach was explained. Also, a justification for the selection of the methodological approach was provided. After that, a detailed explanation of the data collection instruments and procedures was given. Finally, an explanation of the data analysis procedure and the tests that have been conducted to draw conclusions from the studies reported in this thesis were presented.

Chapter 4

The affect of lecturers' attitude on students' use of web-enhanced courses

4.1 Introduction

As indicated in chapter 2 there has been a dramatic increase in the development of technology-based learning and teaching. A large number of educational institutes are now offering web-based courses. In order to satisfy the needs of these organizations many tools have been developed such as: WebCT and blackboard. The increased use of technology in the teaching and learning processes has highlighted the importance of understanding how these technologies improve the learning process. A variety of different online learning systems are now being utilised across higher education and therefore it would now seem timely to evaluate such systems in terms of their effectiveness.

The first study conducted as part of this thesis is reported in this chapter. Universities are implementing different types of technology-supported learning. This study will focus on web-enhanced courses only. Web-enhanced courses are traditional face-to-face courses which include web-related materials. Web-enhanced courses usually adopt a course management system (e.g. WebCT) (Sivo et al., 2007). As mentioned in chapter 2, WebCT (Web Course Tools) was developed by Murray Goldberg, a

faculty member at the University of British Columbia (Burgess, 2003; Volery and Lord, 2000). It is an integrated set of educational and management tools which is specifically used for the design and development of teaching and learning materials.

Lu, Yu, Liu (2003) stated that web course tools (WebCT) are becoming an important information system application for higher education. WebCT is believed to support development of problem-solving and critical thinking. However, the literature indicates that there is little research to explore the learning effectiveness of using WebCT. Learning effectiveness has been measured in terms of students' performance and satisfaction. A number of studies have been conducted to identify the effectiveness of WebCT as a learning tool, the impact of different styles and patterns in online settings, and the impact of student demographics.

Most of the universities in the UK are using technology to develop courses that meet students' educational needs and goals (O'Neil et al., 2004). Alavi and Leidner (2001) stated that technology features can enhance learning outcomes by facilitating efficient delivery of instructional strategies and by supporting certain activities such as cognitive problem-solving and decision-making processes of the learner. They suggest that the technology-mediated-learning research question should be shifted from "Does technology influence learning?" to "How can technology enhance learning?"

Studies have shown that using technology in learning can positively affect the students' learning process. Several studies explored the effect of course management software systems on student performance and attitude. Jones and Jones (2005) assessed the perceived effectiveness of the web course tools "CourseInfo", now known as WebCT, as implemented at a regional Midwestern U.S. university. They found that both students and faculty have positive attitudes towards CourseInfo. There was general agreement among students and faculty members that the Web is a beneficial educational tool. Moreover, students and faculty highly agreed that CourseInfo specifically is a beneficial educational tool which improves student learning. Regarding the communication through CoursInfo tools, students did not think that CourseInfo facilitated student-to-student communication while faculty did.

Also, faculty agreed more than students that CourseInfo facilitated faculty-student communication.

Understanding what factors influence students' satisfaction with a course is a significant step toward the development of successful courses (Kim and Moore, 2005). Kim and Moore investigated how students' characteristics and behaviour affect their satisfaction and learning experience within web-based courses. In their study students' interactions with each other and with their instructor were found to have an impact on students' satisfaction with web-based courses. Arbaugh (2002) used an MBA course to examine the effects of the technology used to deliver web-based courses on students learning and satisfaction. He found a positive relationship between the interaction during the course and the students' learning and satisfaction. Moreover, he suggested that the instructor may have an indirect influence on the interaction in a web-based course. Instructor behaviour in the class may encourage the student to interact more using the web-based communication tools (such as the discussion board). He suggested that the instructor as facilitator is significant for the success of a web-based course and said that instructor experience should still be considered in future studies.

Studies found a positive relationship between students' use of the communication board within WebCT and their achievement (Hoskins and Hooff, 2005). Hoskins and Hooff (2005) stated that it was extremely promising to find that the use of dialogue can influence the students' achievement in assessed coursework. Students' satisfaction with their web-based course is very important for the success of the course. Howland and Moore (2002) found that students with positive attitudes toward their web-based course experience were more able to understand the course content and trust self-assessment of their learning than students with negative attitudes. Moreover, students with a positive attitude toward web-based courses reported the need for less guidance than students with a negative attitude. They stated also that students' performance and strategies on online courses were influenced by their expectations of the course.

Fewer studies have assessed teachers' attitudes towards the effectiveness of course management software. Sun et al. (2008) investigated critical factors affecting learner

satisfaction on web-based courses. One of the factors they studied is instructors' attitudes towards e-learning. They stated that instructors' attitudes toward e-Learning have a significant effect on e-Learners' satisfaction. It was found that instructors' attitudes in handling learning activities affect learner satisfaction toward these learning activities. For example, a less enthusiastic instructor or one with a negative view of e-Learning education shall not expect to have students with high satisfaction or motivation. As the students' performance will be affected by the online instructor attitude toward e-learning, institutions should select instructors carefully.

Mazza and Dimitrova (2004) highlighted the importance of the log file data generated by course management systems. This data can be used to help the instructors become aware of their students' performance on an online course. They stated that monitoring the students' learning is an essential component of high quality education. WebCT log file data was found to be useful for instructors to quickly and more accurately grasp information about social, cognitive, and behavioural aspects of students. This information was provided in a graphical representation that was found to be helpful in identifying early problems with distance learning and prevent them from re-occurring in the future. In the study reported in this chapter, the log files were used as a main source of data that the study's results are based on.

Based on the results obtained from previous studies, the current study will investigate the relationship between the students' attitudes towards using WebCT and their module leaders' attitudes towards it. Additionally, the relationship between students' use of WebCT, their performance, and their attitudes towards WebCT will be investigated in relation to their modules leaders' attitudes towards WebCT.

4.2 Research Methods

The target population of the study was undergraduate students who were using a course management system to support their traditional face-to-face courses. The study was conducted at Brunel University, UK. All undergraduate and taught postgraduate courses delivered by the School of Information Systems, Computing and Mathematics at Brunel University are supported by WebCT. All students and module leaders at Brunel have to use WebCT. WebCT is the only source for the

students to get the course information such as lecture notes, timetables, and the study guides. A group of students was chosen randomly to be the sample of this study because any group of students at Brunel University is a suitable sample for this study.

4.2.1 Participants

131 students and two modules leaders from the School of Information Systems, Computing and Mathematics participated in this study. All the students were level 2 undergraduates studying on the same course. The age of respondents ranged between 18-20 years old. The observed modules were chosen from an Information System course. The module leaders were the lecturers for two of the modules on the students' courses. Data about the whole group of students were collected form WebCT log files. 29 out of the 131 students completed the attitude questionnaire for the two observed modules.

4.2.2 Data collection instruments

A mixture of qualitative and quantitative methods was used in this study. Information on students' use of WebCT throughout term time was obtained from the tracking system. The tracking system provides information on how many times each student visited each page in WebCT and how much time they spent exploring it. Also, it gives information about students' communications with each other and with their module leaders. Moreover, the modules leaders' approaches to using WebCT were explored by monitoring the web pages of their modules. These observations provided information about how they designed their modules, which tools they used, and how often they answered the students' questions. This data was collected and saved weekly through the term time covering the students and module leaders' use of WebCT for two modules until the exams.

One of the study's objectives was also to compare students' attitudes towards WebCT in relation to the module leader's method of using it in each module. To measure students' attitudes, a 5-point Likert scale questionnaire was used. A full copy of this questionnaire can be found in Appendix 2. Students were asked to respond to seventeen statements on a 5-pint scale ranging from strongly disagree to

strongly agree. In addition, the questionnaire contained four open-ended questions aimed at collecting information on the following areas:

- Students' problems when using WebCT.
- Students' thoughts on the module leader's method of managing the module through WebCT.
- The extent to which students felt they were in control of their learning using WebCT.

As two modules were observed for this study, the students were asked to complete the attitude questionnaire towards each module separately. Then the results were compared.

As part of the study the two lecturers were interviewed during the course. A copy of the interview question can be found in Appendix 1. The interview was structured but open-ended. This kind of interview depends on the interviewers' skills because they can guide the interview questions in their own way to get the information they need. This type of interview focuses on gathering information about a specific subject. The interview was designed to get background information on lecturers' experience of using WebCT and their experience of using it in the studied modules. Moreover, the interview aimed to gather information about a number of main subjects:

- The lecturers' general thoughts, attitude, and experience of using WebCT.
- Specific information about the effect of using WebCT on the learning process and its influence on students' performance and on the lecturers' way of teaching.
- Problems or difficulties that faced the lecturers or the students when using WebCT.
- The communication between the students and the lecturers via WebCT communication software.

4.2.3 Procedure

At the beginning of the second semester in the academic year 2006-2007 two module leaders were interviewed and their attitudes towards using WebCT on their courses were measured. Statistical data about students' use of WebCT was collected weekly from the tracking system. The information was saved for each module separately in order to compare them later in the study. The questionnaire was submitted on paper to all the students at the end of modules' lectures before the exams.

4.2.4 Data Analysis

Students' general uses of WebCT were measured by the number of times each student visited WebCT pages or used the discussion board for the observed modules. Students' achievement was measured by their grades in the coursework and exam. Students' attitudes towards WebCT were measured by using a Likert scale questionnaire. The data was analysed using SPSS software.

Frequency measures were used to analyse the numerical data which was obtained from the questionnaire. A Paired Samples T-Test was run on students' attitudes towards each module to compare the means and to find out if the differences in means were significant.

The measures of students' academic achievement in the module were correlated (Pearson's Product Moment Correlation Coefficient) with the measures of WebCT use (e.g. WebCT hits and communication board use). The relationship between the students' achievement and their use of WebCT was also analysed.

The differences between students' approach to using WebCT for both modules were examined. In order to compare the means and to find out if the differences in means are significant, an ANOVA for repeated measures was carried out on data about students' weekly use of WebCT.

As mentioned before, interviews were carried out with two module leaders. These interviews were recorded with the permission of the interviewee. This allowed the researcher to continue to carry on a conversation with the interviewee. The interview transcripts were transcribed. As there were only two interviews in this study, no

special software was used for the analysis. A thematic analysis technique has been used to analyse the interviews. The data from the interviews were used to either support or explain results obtained from the questionnaires or the tracking system.

4.3 Results

4.3.1 Instructor behaviour

The modules leaders used WebCT similarly for both observed modules. Both of them used WebCT in a basic way. They published the lecture slides, previous years' exams papers, study guides, and other resources such as useful reading list and web links to related subjects. They did not use the available tools to design special material for the modules such as special quizzes or uploading topic-specific videos. The only difference between their approaches was the use of the communication board and the difference in their attitude toward the use of WebCT. The communication board was used in module B from the beginning of the course and the module leader encouraged the students to use it. The module leader for module B stated: "*I asked the students to pay attention to the communication board because that is where I was going to post the messages to them. Sometimes could be very important message.* " However, in module A it was not used until the last three weeks of the term and the module leader did not follow the students' posts. The module leader for module A stated: "*On one stage I opened up discussion board which was not used in the way that I had expected it to be. It just have been opened on the last 3-4 weeks." "I looked to the material posted on communication board and I have not seen any one asking to do evaluation and they all asking about the examination and the course work. Questions were often about how the marks were allocated. I didn't find it useful. May be the student found it useful but I did not found it particularly useful. "*

The module leaders' opinions toward using WebCT in their courses were different. Module A leader had a negative attitude toward using WebCT. He did not like the experience of using WebCT to support his course. He said: "*I don't enjoy using WebCT it is over complicated for what I need it for which is to publish slides*" Module B leader believed that WebCT was a very good tool to support the learning and teaching process in his course. He said: "*Using WebCT was useful not only to distribute the module material but also for the communication.*" The reason for these

differences is that the first module leader used another system to support his course: his own specially designed website and he communicated with the students via email. He was familiar and experienced with using this system, therefore he disliked having to move to an unfamiliar new system and did not receive much training on how to use it. In contrast, with his own web pages he was in control of everything and could easily do whatever he wanted in terms of course material and the like. The second module leader did not have such previous experience so he appreciated the new system which he felt was easy to use and met his requirements.

4.3.2 Questionnaire results

29 students responded to the questionnaire for both modules. The students' responses to five point Likert scale questions were scaled from 1 (strongly disagree) to 5 (strongly agree) for positive statements and from 5 (strongly disagree) to 1 (strongly agree) for negative statements. In general students had a positive attitude towards using WebCT in both modules. The mean score obtained from the Likert questionnaire indicated that students had a more positive attitude towards using WebCT on module B than on module A. In order to find out if the difference in means was significant, a paired t-test was carried out. The Paired Samples T-Test results were $t(28) = 2.607$; $p<0.05$ which indicated that the students had a significantly more positive attitude toward WebCT use on module B than they had for module A.

The responses to the open-ended questions showed that the majority of the students did not have any technical problem using WebCT for both modules. Students did not need help to use WebCT. Furthermore, students stated that they were in control of their learning because of the flexibility of using WebCT anytime from any place. The only different response to the open-ended questions was regarding the communication board for module A. Students said that they prefer to have a communication board for each module.

Table 4.1 shows means for responses to 17 statements in the attitude survey.

Table 4. 1 The means of student responses to the questionnaire statements

Statements	Module A	Module B
The module leader presented the material in an interesting and helpful manner on WebCT for this module	3.72	3.86
The discussion board was used effectively in this module	2.41	3.76
The fact that I had to use WebCT for this module is a source of annoyance to me	3.59	3.86
WebCT helped me to achieve the learning outcome for this module	3.79	4.10
The amount of time required for WebCT used in this module was excessive	3.21	3.14
Using WebCT in this module increased my opportunity to pass this module's coursework assessment	3.69	3.86
Using WebCT in this module kept my interest engaged in the subject	3.28	3.69
Using WebCT in this module helped me to learn the subject more quickly	3.45	3.83
Having to use WebCT in this module changed how I learn	3.10	3.38
WebCT made it difficult to know what was expected of me in this module	3.55	3.86
I would recommend that this module continue using WebCT	3.83	4.21
I would like to have more interaction with the leader of this module through WebCT	1.90	1.97
I would like to have more interaction with other students of this module through WebCT	1.90	2.34
I can pass the exam and do all the assignments for this module without using WebCT	1.90	2.21
I can pass the exam and do all the assignments for this module without attending the lectures	1.83	1.93
Sufficient online resources were available for this module	3.59	3.38
WebCT for this module was easy to use	4.07	4.10
Average	3.11	3.38

4.3.3 The results from the tracking system

The results obtained from the tracking system indicated that students frequently used WebCT on the two modules. Students visited all the main pages such as: home page, content page, organizer, assessment page, and communication board.

A paired t-test was carried out on the numbers of hits which represent students' total access to each module. The mean number of the students' hits representing the students' total use of WebCT for module B (M= 356, SD= 233) was higher than the mean for module A (M= 329, SD= 193) resulting in a mean difference (M= 27, SD= 111) in the number of hits per participant. The difference was statistically significant, $t(131)= 2.831$, $p<0.05$, two tailed.

An ANOVA for repeated measures was carried out on the numbers of hits which represent students' total access to each module per week. The results showed that there was a significant difference between the means number of hits for modules A and B in thirteen weeks of the term. In the last nine weeks the mean number of the students' total use of WebCT for module B was significantly higher than the mean number of the students' total use of WebCT for module A. For four weeks (W2, W3, W4 & W5) the mean number of the students' total use of WebCT for module A was significantly higher than the mean number of the students' total use of WebCT for module B. The differences can be clearly seen in figure 4.1 below.

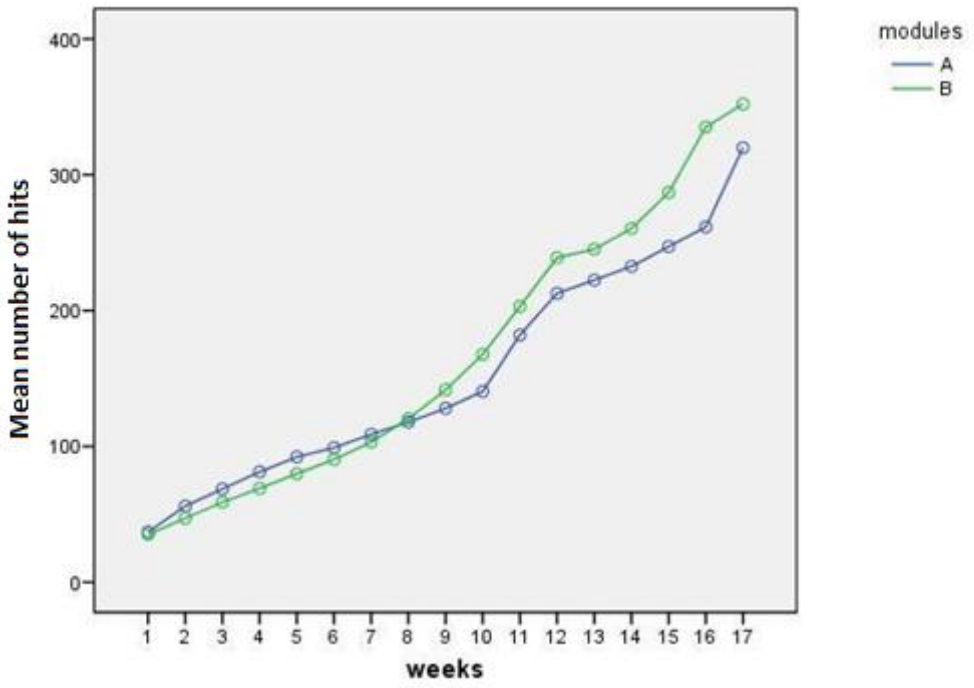

Figure 4. 1: Difference between students' total access to WebCT for modules A & B divided into weeks

In order to explore these results in more detail, the results of the total use of WebCT were divided into the students' visits to the following pages: home page, content page, organizer page, assignment page, communication board, quiz, calendar, and other. An ANOVA for repeated measures was carried out to examine the differences in the means of the number of hits which represent the students' visits to each of these pages in each module.

The results showed that there are significant differences between the means of the hits numbers which represent the students' visits to each page. These differences showed a significant increase in the means of the students' visits to home page and content page for module A. Also it showed a significant increase in the means of the students' visits to the organizer page, the assignment page, quiz, and other for module B. Figure 4.2 below shows differences between the means of the number of hits which represent the students' visits to each page.

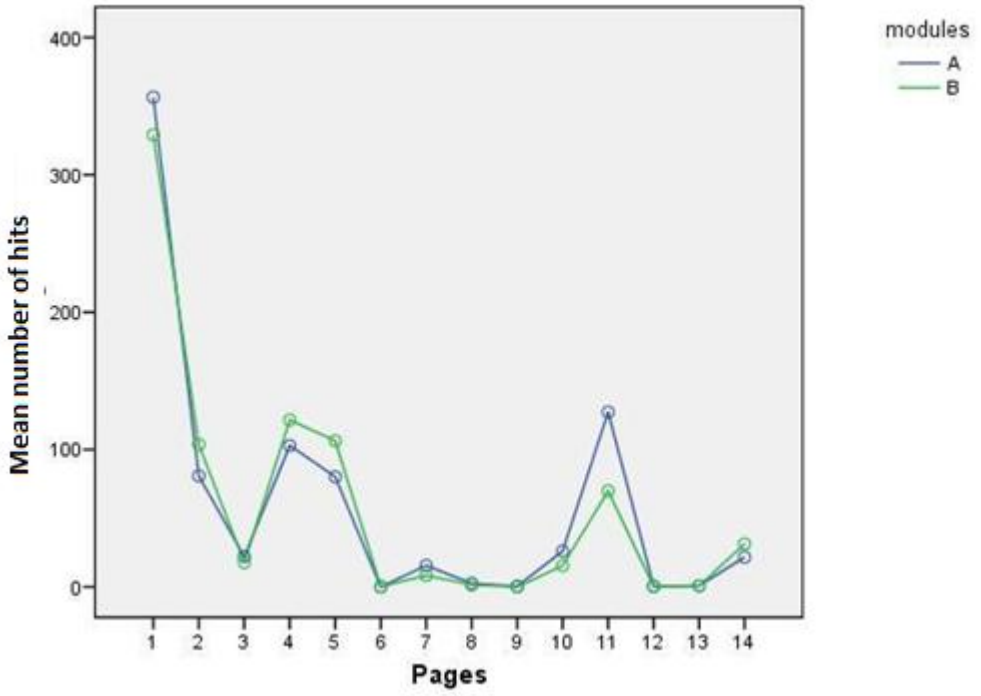

Figure 4. 2: Difference between students' total access to WebCT for modules A & B classified by pages

(Page 1: Total access, 2: Home page, 3: Organizer, 4: Home and Organizer, 5: Content page, 6: Notes, 7: Assignments, 8: Quiz, 9: Calendar, 10: Other, 11: read messages, 12: post messages, 13: Follow up post, 14: Number of different pages visited)

4.3.4 Achievement

Table 4.2 shows the results of a paired t-test which was carried out on students' grades for both modules. The test was undertaken to find out if the difference in means of students' grades was significant. The results indicate that students' exam grades and final grades were significantly higher for module B than module A, while coursework grades were significantly higher for module A than B.

Table 4. 2: summary of paired samples t-test measuring the differences between students' grades for modules A and B

	Mean	SD	t	Sig
Coursework B-A	-2.19	10	-2.5	0.01
Exam B-A	8.42	7.9	12.2	0.01
Overall grads B-A	8.1	13.2	7	0.01

The relationship between the students' activities on WebCT and their achievement on each module was studied. Pearson correlations were carried out to find the relationship between the students' grades and their use of different pages of WebCT.

The terms "read", "post", and "follow up" refer to the use of the communication board. "read" is the number of messages each student read on the communication board. "post" is the number of messages each student posted on the communication board. "follow up" is the number of messages that student posted in a discussion on the communication board.

A positive but weak significant correlation ($r=0.39$, $p<0.01$) was found between students' final grades, and "read" for module B. Also "read" was found to be significantly correlated with exam grades ($r=0.35$, $p<0.01$) and the coursework grades ($r=0.29$, $p<0.01$). A positive but weak significant correlation ($r=0.24$, $p<0.01$) was found between students' final grades, and "post" for module B. "post" was also found to be significantly correlated with exam grades ($r=0.20$, $p<0.01$) and the coursework grades ($r=0.2$, $p<0.01$). A positive but weak significant correlation ($r=0.33$, $p<0.01$) was found between students' final grades, and "follow up" for module B. "follow up" was also found to be significantly correlated with exam grades ($r=0.25$, $p<0.01$) and the coursework grades ($r=0.33$, $p<0.01$).

4.5 Discussion

All courses at Brunel University are supported by a course management system (WebCT). The students who participated in this study also have had the traditional face-to-face lectures and labs. In addition, they have all the learning materials available on WebCT with a communication board to facilitate their interaction with each other and with their instructors. This study benefits from the tracking data on

WebCT to calculate the students' actual use of WebCT and the instructors' method of presenting the learning materials on WebCT. The results of this study can be divided into two parts. First, there are findings related to students' attitudes, performance and achievement on web-enhanced courses in general. Second, there are findings related to students' attitude, performance and achievement on web-enhanced course in relation to their instructors' attitudes to WebCT.

The results showed that students had positive attitudes towards using WebCT as a web-based tool supporting their learning. In general, they agreed with statements such as "WebCT helped me to achieve the learning outcome for this module", "WebCT for this module was easy to use". The students' satisfaction and appreciation of web-based course materials can be explained by their familiarity with the technology, and the flexibility of WebCT (i.e. it can be used anytime anyplace). One of the students commented: "I have used WebCT before so I don't need help to use it." The results of students' satisfaction and appreciation of web-based courses can be found in previous studies such as Arbaugh (2002) and Sun et al. (2008).

This study aimed to examine the effects of students' activities on WebCT on their achievement. To observe students' actions on WebCT, this study used the numerical data from the tracking system log files. This data describes exactly how students performed on WebCT (how many time they accessed each page, how much time they spent, how many time they used the communication board, read or post, etc). Using the log files data is a strong approach in similar research. Log file data is essential to understand students' behaviour and performance on web-based course and to obtain information about how instructors should use WebCT to meet their students' needs (Mazza and Dimitrova, 2005). A significantly positive correlation between students' activity on WebCT and their achievement was observed. For example, there is a positive relationship between students' use of the communication board and their grades (exam and coursework). Moreover, a significantly positive correlation was found between students' total visits (and weekly visits) to different pages in WebCT and their grades. These results correspond to the findings of Hoskins and Hooff (2005). It can be concluded that students' activities on WebCT are an indicator for possible higher marks. Students' who visited and spent more

time on WebCT got better grades in the exam and the coursework. This result can be considered important and promising.

Most of the students believed that they were in control of their learning. The availability of the modules' resources online allowed students to access the learning material anytime from anyplace which is one of the important factors affecting students' learning. One of the students comment: "I am in control of my learning because I can look at lecture slides to prepare for lectures." Another student stated: "WebCT refers to a study guide for learning requirements to pass the module."

As the data collected for this study was from one group of students for two different modules, a comparison could be made between students' attitudes and behaviour during the course. At the beginning of the semester students visited WebCT for both modules similarly. Then their visits varied until they started to visit WebCT pages for module B more than visiting WebCT pages for module A. The reason for this behaviour can not be explained by one cause. However, the significant differences in students' attitudes towards WebCT and the modules leaders' way of using it can be considered an essential factor in this behaviour. Students had more positive attitudes towards module B than module A; this may explain that they preferred to visit WebCT for module B more than A. One module leader's negative attitude towards WebCT affected the students' attitude which may also have resulted in fewer visits to WebCT for that module. This backs up the findings of Sun et al. (2008) who stated that instructors' attitudes toward e-learning have a significant effect on e-learners' satisfaction. In related research Mahdizadeh et al. (2008) studied factors influencing teachers' use of different functions and capabilities of e-learning environments. Mahdizadeh et al. noted that teachers' perception of e-learning directly influence the actual use of e-learning environment. Module leaders' attitudes towards WebCT may have affected their way of using it. As stated in Mahdizadeh et al. (2008) teachers' attitudes and opinions about web-based learning activities are effective in shaping their attitude toward the e-learning environment. Module leaders differ in their preference to communicate with students through WebCT. Module A did not have a communication board. The absence of the discussion board resulted in fewer student-to-student and student-to-instructor communications. Therefore, the students did not have to access WebCT to ask follow up questions. There is a strong connection

between students' interaction and their satisfaction with a web-based course. Students who communicate well are more likely to have clear understanding of each other and learning materials and become more involved in learning (Kim and Moore, 2005).

Students' achievements were measured by their grades in coursework, exam and total grades. The students' exam grades and final grades were significantly higher for module B than module A, while the coursework marks were significantly higher for module A than for module B. These results are interesting; however, there is not enough evidence in this study to explain what caused these differences.

The results of this study suggest that instructors of web-enhanced courses should find methods to encourage students to use WebCT and to communicate through its communication board. Instructors may encourage students by providing feedback and observing students' communication and trying to answer their questions in a timely manner.

The study depended on the records of 131 students and on the 29 responses to a questionnaire. Furthermore, in this study only two modules were observed. Therefore, the study would have benefited from a larger sample population. The results of this study suggest more research should be undertaken on the impact of instructional behaviour and learner characteristics on students' learning processes on web enhanced courses.

4.6 Chapter summary

Most of the universities in the UK are using course management tools to support their traditional face-to-face courses. WebCT is one of the important systems being used in higher education. This chapter explored a study conducted to find out the relationship between students' attitudes toward using WebCT and their module leader's attitude towards it. Moreover, the relationship between the students' use of WebCT and their performance were studied. The study showed that students have positive attitudes towards using WebCT on their courses. The results also showed that module leaders' attitudes towards using WebCT affected students' attitude.

Students had a more positive attitude towards using WebCT when the module leader had a positive attitude towards it.

Additionally, the study showed a positive relationship between students' activities on WebCT and their achievement. However, there is no strong evidence in this study to confirm that the students' marks have been affected by their module leader's way of using WebCT.

As shown in this chapter, module leader attitude toward using WebCT is a significant factor that affects students' attitudes towards WebCT and the use of WebCT. More variables need to be explored; therefore the next chapter is a mixed method study to examine other factors that affect students' attitudes and performance on a web-enhanced course. The factor to be studied is students' cognitive styles. The next chapter will investigate the relationship between students' cognitive styles and their attitude and performance on a course supported by WebCT.

Chapter 5

Does cognitive style affect student performance on a web-enhanced course?

5.1 Introduction

The first study presented in chapter 4 of this thesis examined the factors that affect students' use and achievement on web-enhanced courses. One of the factors investigated was the module leaders' attitude towards using WebCT in their courses and its affects on students' attitude towards the same system. Moreover the study examined the relationship between student attitude, use of WebCT, and their achievement. The results from study one showed a significant positive relationship between students' attitude toward using WebCT and their module leader's attitude toward using it. A number of variables were found to be important when studying course management systems, such as students' achievement, students' attitude toward the system and students' ways of using the system. Students' use of WebCT was found to have positive significant correlation with their achievement.

The study presented in this chapter examines the relationship between students' cognitive styles and their use of web-enhanced courses. Psychological studies have shown that personal beliefs/opinions about learning and environmental preferences affect learning behaviours. However, these learner characteristics have not been

widely discussed in the context of web-based learning (Yang and Tsai, 2008). “Cognitive style is seen as an individual's preferred and habitual approach to organising and representing information” (Riding and Rayner, 1998, p. 8).

Most of the universities in the UK are using technology to develop courses that meet students’ educational needs and goals (O’Neill et al., 2004). Technology features can enhance learning outcomes by facilitating efficient delivery of instructional strategies and by supporting certain activities such as cognitive problem-solving and decision-making processes of the learner (Alavi and Leidner, 2001). Universities are implementing different types of technology-supported learning. This study will focus on web-enhanced courses only.

Technology has the possibility to enhance and transform teaching, but it can also be used incorrectly or in ways that may interfere with learning so it is important to know how we can achieve effective learning online (Salter, 2003). Different ways can be used to measure the effectiveness of web-based courses. Therefore studies in distance education differ in what they use as evidence of online course effectiveness. Wells (2000) studied the effect of an on-line computer-mediated communication course, prior computer experience and internet knowledge and learning styles on students’ internet attitude. Other research (Russo and Benson, 2005) investigated the relationship between student perception of others on an online class and both affective and cognitive learning outcomes. They demonstrated the significance of student-student as well as teacher-student interaction in online classes. They highlighted the importance of instructor presence and interaction among students on attitudes toward the course. They believed that interaction between students is an integral part of the class and that the instructor should encourage and support the interaction, although they recognised that facilitating interaction is time-consuming and often demanding.

Other research has investigated the relationship between cognitive style and web-based learning and design. Graff (2003) investigated the interplay between cognitive learning styles and the effectiveness of online courses in delivering instructional content. Students were categorized on a range from wholistic to analytical. Wholistic learners view ideas as complete wholes and are unable to separate the ideas into

discrete parts. In contrast, analytical learners are able to comprehend ideas in parts but have difficulty in seeing the complete picture. Along another axis, learning styles were arrayed from verbalizers to imagers. Verbalizers do well with text-based material, whereas imagers deal well with spatial data. The results showed that analytics performed better than the wholistics in the long-page format, which was 11 pages long with a lot of content on each page. That is because Analytics were able to learn the content in parts, and could integrate the information. Also, imagers performed better than verbalizers on the recall test in the short-page format, which contained 23 pages of content with little information on each page. The study concluded that Web-based learning environments should be matched to the cognitive style of the user.

In a similar vein Summerville (1998) stated that matching cognitive style to teaching environments may be important because of the potential to enhance learning. However, at this time, the relationship between matching cognitive style and learning has not been researched fully and the implications are inconclusive, especially for hypermedia learning environments.

In another study, Jelfs and Colbourn (2002) studied students' learning approaches within a group and how this affected their adoption or rejection of the electronic medium. They found weak correlations between deep, strategic and surface approaches to learning and perception of Communication and Information Technology. They said that measures of the deep, strategic and surface approaches to learning indicate potentially interesting relationships. They also suggested that to improve student interest in the use of computer-mediated communication and to motivate students then it has to be relevant to their course of study and that teaching staff have to also be active in their use of the technology. Students will quickly lose interest if they think that teaching staff are not paying attention to their online contributions.

Cook et al. (2007) studied the effectiveness of adapting Web-based learning modules to a given learner's style. They created 2 versions of a Web-based instructional module on complementary and alternative medications. One version of the modules directed the learner to ''active'' questions that provided learners instant and

comprehensive feedback, while the other version involved ‘‘reflective’’ questions that directed learners back to the case content for answers. 89 participants were randomly matched or mismatched based on their active-reflective learning. The results of their study suggested no interaction between learning styles and question types. The authors concluded that learning styles had no influence on learning outcomes. Also Cook et al. (2006) studied 121 internal medicine residents and also found no association between learning styles and preferences for learning formats (eg, Web-based versus paper-based learning modules). The participants' achievement on assessment questions related to learning modules was not statistically correlated with learning styles.

Johnson et al. (2006) compared learning styles and satisfaction of students enrolled in online versus traditional courses. 48 college students participated in the study. Students were surveyed with regard to their satisfaction with various study group formats online or traditional course. Then they tried to find the relationship between the students' satisfaction and performance on course examinations. Johnson et al. (2006) found no correlations between learning styles and learning outcomes of groups enrolled in either course type. The authors suggested that these results are evidence for courses employing hybrid teaching styles that reach as many different students as possible.

The aim of this study is to investigate the relationship between students' cognitive styles, their satisfaction, achievement, and their way of using a web-based course.

5.2 Research Methods

Similar to the first study, the intended participants for this study were undergraduate students who were taking traditional-face-to-face courses supported by a course management system (WebCT in this study). The study was conducted in the School of Information Systems, Computing and Mathematics at Brunel University. All the courses at Brunel University are supported by WebCT. The use of WebCT is obligatory for both students and module leaders. WebCT is the main source for the students to get the course information such as lectures' notes, timetable, and the study guide. Since any undergraduate group of students at Brunel is a suitable sample for this study, a group of students were chosen randomly as the sample of

this study. The used group were level one students in Mathematics and Computing department.

5.2.1 Participants

There were 72 students enrolled for the observed module; 51 of them (23 females and 28 males) responded to an attitude questionnaire and cognitive style analysis test CSA. The age of respondents ranged between 17-20 years old. All the students were level one undergraduates studying on the same course. The observed module was chosen from a mathematical course. All the participants were familiar with the technology and used WebCT for at least one semester before the study.

5.2.2 Data collection instruments

A number of tools were used to collect information from participants in this study. The tools were a 5-point Likert scale attitude questionnaire, WebCT tracking system, and CSA test. Owston (2000) stated that the richness and complexity of a web-based learning environment can be captured and understood in greater detail by mixing methods than using one single research approach.

First, the questionnaire was designed to measure students' attitude toward using WebCT in the observed module. A 5-point Likert scale type was used in the design of the questionnaire. The Likert scale was used as the questionnaire format in this study because it has been used in similar studies to assess respondents' attitude as for example Hisham at al., 2004; Wells, 2000. The questionnaire contained 25 statements to which students could indicate the extent of their agreement or disagreement with each attitude statement and one open-ended question. The students could add any comment or concerns they had regarding using WebCT as an answer to the open-ended question. The questionnaire was designed to collect data about students' opinions of the following:

- The use of WebCT in their courses.

  Example: *"It is easy to use WebCT"*
- Student-student interaction via WebCT.

Example "*The discussion board is an efficient way to communicate with other students"*

- Student-information interaction via WebCT.

Example: *"The availability of the lecture notes on WebCT helped me stay on schedule with my course work"*

- Student-teacher interaction via WebCT.

Example: *"It is difficult to communicate with the module leader through WebCT tools"*

A full copy of this questionnaire can be found in Appendix 2 at the end of this thesis. To get information about students' use of WebCT in the observed module for this study, data from WebCT tracking system were collected regularly. The data obtained from the tracking system gives details about students' use of WebCT, for example: how many times they accessed each page; how many times they downloaded a file; how much time they spent exploring each page. Also, it gives information about students' communication with their classmates and the module leader such as: how many times they posted/read a message on the communication board. Moreover, the module leader's approach to using WebCT was explored by monitoring the web pages of the observed module. This observation provided information about how the module leader designed the module, the tools that had been used, and how often the students' questions were answered. Mazza and Dimitrova (2004) stated that course management systems accumulate large log data of students' activities on web-based courses. They stated also this data is not actually clear for the instructor to monitor students' progress and actual learning that is taking place; only a skilled and technically confident instructor can use such information, though such information is very important for the instructor to understand in web-based courses.

For the study presented in this chapter, students' cognitive styles needed to be measured. Cognitive styles can be measured by a number of instruments such as the Group Embedded Figures Test (GEFT) (Witkin at al., 1977) and the Cognitive Style Analysis test CSA (Riding, 1991).The Cognitive Styles Analysis test was chosen for this study as a tool to measure students' cognitive styles. Rezaei and Katz (2004) investigated number of tools that measure cognitive styles. They stated that CSA is a

powerful tool for measuring cognitive styles because of its structure and the theoretical basis of the test.

The CSA computerised test consists of three subtests. The first group of items is related to verbaliser-imager style, the second group is related to wholist dimension and the last one is related to the analytic dimension of cognitive style. For each question the participant should answer by pressing either a "true" or "false" button.

The computer then calculates an individual's position on each style dimension by comparing response times between the verbal and imagery items and the wholist and analytic items on the test (Graff, 2003). The results of CSA provide two numbers and the name of the cognitive style. The numbers are WA which is the value of the *Wholist-Analytic* dimension, and VI which is the value of the *Verbal-Imagery* dimension. Figure 5.1, which is similar to Figure 3.1, shows the possible scores as a result of the CSA test and the cognitive style matching each score.

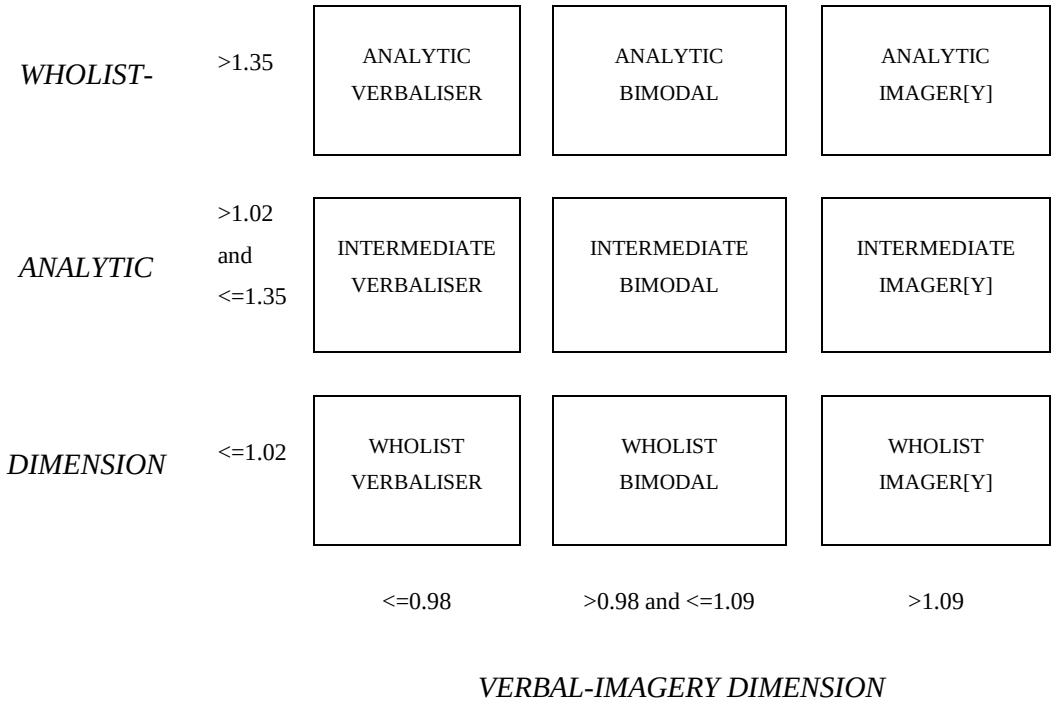

Figure 5. 1: CSA test possible scores and the cognitive style matching each score [2]

[2] CSA manual. Making learning effective- Cognitive style and effective learning (Richard Riding, 2000)

5.2.3 Procedure

Students' cognitive styles were measured using the CSA test instrument during term time. Statistical data showing the students' use of WebCT was collected regularly from the tracking system. The statistical data was mainly in numbers giving information about how many times each student visited the web page for a module. Moreover, it provided records on how many times a student read or posted on the communication board. Also, it gave information about how many times they visited each page within a module and how much time they spent on them. In order to measure students' attitude toward WebCT the questionnaire was given to the students during term time in one of their lab sessions for the observed module. The questionnaire was submitted to students after they completed the CSA test.

5.2.4 Data Analysis

The primary analysis method used in this study was the ANOVA (using SPSS software). The ANOVA test measures whether or not the means of several groups are significantly different.

In addition, Pearson's correlation was used to indicate the strength, significance and the direction of the relationship between the independent variable: students' cognitive styles and the dependent variables: students' attitude towards WebCT, students' use of WebCT, and students' achievement. Frequency measures were used to analyse the numerical data which was obtained from the tracking system log files, those numbers measures the students' use of WebCT; as an example: the number of messages that students' read/post in the communication board.

5.3 Results

5.3.1 CSA test result summary

When a participant completes the CSA, a screen shows two numbers and the name of the cognitive style that has been measured in the test. The numbers represent WA, which is the measure of *Wholist-Analytic* dimension, and VI which is the measure of the *Verbal-Imagery* dimension. Figure 5.2 shows the possible result of the CSA test.

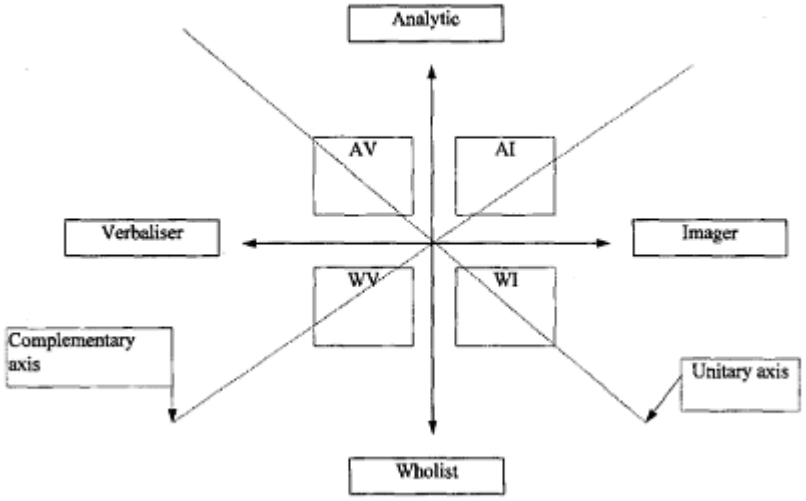

Figure 5.2: CSA cognitive style dimensions (Sadler-Smith & Riding, 1999, p. 358)

For the purpose of the analysis the sample was divided in terms of their cognitive style ratios into two categories to give four cognitive style groups of similar size as follows:

- wholist - analytical dimension: wholists, 1.19 or less; analytics, 1.20 or more.
- verbaliser-imager dimension: verbalisers, 1.05 or less; imagers, 1.06 or more.

This categorisation has been used in similar studies.(e.g. Sadler-Smith and Riding, 1999; Sadler-Smith 2001). The four cognitive style groups were labelled as follows: wholist verbaliser (WV); wholist imager (WI); analytic verbaliser (AV); analytic imager (AI). Riding and Rayner (1998) suggest that the different dimensions of style may either complement each other or augment each other. The four styles may be ordered from extreme wholists (in effect 'wholist wholists') to extreme analytics ('analytic analytics'); the first being the wholist imagers (wholist style augmented by the whole view provided by an image); the last being the analytic verbalisers (analytic style augmented by the analytic nature of verbal information). Table 5.1 shows the frequencies of each cognitive style in the sample.

Table 5. 1: The frequencies of students' cognitive styles in the sample

	CSA	
	Frequency	Percent
wholistic verbaliser	14	27%
wholist imager	11	21%
analytic verbaliser	13	26%
analytic imager	13	26%
Total	51	100%

5.3.2 Questionnaire results

Based on the students' responses to the statements the overall attitude of the students towards WebCT was positive. Table 5.2 shows a summary of students' attitude towards WebCT based on the result of the questionnaire. The students were grouped according to their cognitive styles.

Table 5.2: Students' attitude towards WebCT

Cognitive style	Attitude mean	N	Std. Deviation
WV	3.44	14	0.28
WI	3.55	11	0.25
AV	3.6	13	0.49
AI	3.24	13	0.43
Total	3.45	51	0.40

5.3.3 Results from the WebCT tracking system

Table 5.3: Summary of students' use of WebCT

	N	Minimum	Maximum	Mean	Std. Deviation
Sessions	51	26	420	79.24	57.77
Time	51	6.5	41.5	24.9	18.41
Read	51	0	724	129.39	196.59
Post	51	0	3	.33	.65
Assessments began	51	3	21	8.39	3.50
Assessment finished	51	3	21	7.98	3.53
Assignment submit	51	1	1	1.00	.00
Content folder	51	41	407	119.98	63.23
Files	51	68	488	193.47	80.71

Students used the WebCT for the observed course is summarised in the table 5.3. The use of WebCT is described as "Sessions" the number of times a student accessed WebCT for the observed module; "Time" is the total time, in minutes, that each student spent using WebCT; "Read" and "Post" is the number of messages that students read/posted on the communication board; "Assessments began" and "Assessments finished" is the number of times students practised the online assessment before submitting the assessment; "Assignment submit" shows if the students submitted their assessment; "Content folder" is the number of times students accessed the content folder which contains all the lecture slides and lab notes and other course materials; "Files" is the number of times that students accessed or saved a file in the content folder.

Table 5.4 presents the means of student visits to each page on WebCT. The students were grouped according to their cognitive styles.

Table 5.4: The means of students' use of WebCT

	Cognitive styles			
	Wholist verbaliser	Wholist imager	Analytic verbaliser	Analytic imager
	Mean	Mean	Mean	Mean
Sessions	71	79	95	72
Time	22.33	23.22	33.04	21.82
Content folder	114	128	138	101
Files	187	225	206	160
Read	103	115	156	143
Post	0.14	0.09	0.62	0.46
Assessments began	9	9	9	7
Assessment finished	8	9	8	7
Assignment submit	1	1	1	1

An ANOVA was carried out to find if the differences between students' use of WebCT were statistically significant; however, no significant differences were found. This result indicates that students' cognitive styles do not appear to have a significant effect on the students' way of using WebCT.

Table 5.5 presents the means of students' grades on all their assignments and exams for the observed module. The students were grouped according to their cognitive styles.

Table 5.5: The means of students' grades

	Cognitive style			
	Wholist verbaliser	Wholist imager	Analytic verbaliser	Analytic imager
	Mean	Mean	Mean	Mean
Total grade	58	53	47	53
Exam	52	47	39	51
Course work	65	59	54	54
Autumn test	45	38	41	41
Autumn coursework	63	58	48	43
Spring test 1	88	78	89	88
Spring test 2	67	70	50	56
Spring assignment	66	55	51	56
Spring coursework	74	68	66	68

To determine whether the differences between students' grades were significant, ANOVA test was performed on the data. The results indicated that Cognitive style is not a significant factor in students' grade achievement (Exam and coursework).

The relationship between the students' activities on WebCT and their achievement were then investigated. Pearson correlations were carried out to find the relationship between the students' grades and their use of different pages of WebCT. The significant correlations are shown in table 5.6.

As shown in table 5.6, a positive but weak significant correlation was found between students' grades (Exam and coursework and the total grades) and the number of times they accessed WebCT. Also the number of messages that students read in the communication board was found to be significantly correlated with the total grades and the coursework grades. A positive but weak significant correlation was found between students' coursework grades, and the number of times they practiced on the online assessment. Also the number of times students accessed the content folder was found to be significantly correlated with the total grades and the coursework grades.

Table 5.6: Significant correlations between students' use of WebCT & their grades

		Total grades	Exam	Coursework
Sessions	Pearson Correlation	.40(**)	.323(*)	.42(**)
	Sig. (2-tailed)	.003	.021	.002
	N	51	51	51
Read	Pearson Correlation	.29(*)		.28(*)
	Sig. (2-tailed)	.036		.049
	N	51		51
Assessment finished	Pearson Correlation			.35(*)
	Sig. (2-tailed)			.013
	N			51
Content folder	Pearson Correlation	.31(*)		.34(*)
	Sig. (2-tailed)	.028		.014
	N	51		51

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

5.4 Discussion

Based on the students' responses to the attitude questionnaire the overall attitude of the students toward using WebCT was positive. This result backs up previous research in the area such as (Hong, 2002; Paris, 2004). There are no statistically significant differences between students' attitude towards WebCT according to their cognitive styles (WA, WI, VA, VI). Moreover, this study does not provide evidence that students' cognitive style significantly affects their attitude towards using WebCT. This result is similar to Summerville (1998) who did not find a significant relationship between students' cognitive styles and their level of satisfaction with using an online learning environment.

Furthermore, cognitive style has not been found to affect students' way of using WebCT (e.g. the number of times each student visited WebCT, time spent exploring a page, number of pages visited, and posted or read messages). In addition, cognitive styles have not been found to have an affect on students' achievement in web-enhanced courses. These results back up the findings from studies such as (Lu et al., 2003; Cook et al., 2007). Lu et al. (2003) stated that students' cognitive style does

not have an impact on their learning performance in WebCT. Cook et al. (2007) stated that cognitive and learning styles had no apparent influence on learning outcomes. Also Cook et al. (2006) studied 121 internal medicine residents and also found no association between learning styles and preferences for learning formats (eg, Web-based versus paper-based learning modules). The participants' achievement on assessment questions related to learning modules was not statistically correlated with learning styles.

However, a significant positive relationship was found between students' use of WebCT and their achievement. This result supports the results obtained in the previous study presented in chapter 4.

The results of this study suggest that students are able to use WebCT efficiently regardless of their cognitive style. The study was limited in its lack of assessment of baseline knowledge, motivation, or other characteristics. Also, the difficulty of using WebCT may not have been sufficient to distinguish a difference between students; learners may have automatically adapted to the information they received regardless of their cognitive styles.

5.5 Chapter summary

The relationship between students' cognitive styles (wholistic-analytical, verbal-imagery) and their attitude, use of WebCT and achievement were examined in this chapter.

No significant relationship was found between students' cognitive styles and students' attitude towards using WebCT nor to their way of using the system. Students with different cognitive styles were found to have a positive attitude towards WebCT and use WebCT in an effective way despite their cognitive styles.

Based on the results of chapters 3 and 4, the next study will focus on developing a framework to understand the relationship between several variables related to web-enhanced courses using WebCT as a supporting tool. Variables from chapters 4 and 5 that were found to have significant impact on students attitude and performance on

web-enhanced courses will be divided into three dimensions that will be the main part of a framework which will be presented in the next chapter.

Chapter 6

A framework for clarifying the relationship between the main success factors in web-based courses

6.1 Introduction

The results from study one indicated a significant positive relationship between students' attitude toward using the course management system, WebCT, and their module leader's attitude toward the use of the same system. In the first study several variables were found to be important when studying course management systems, such as student achievement, student attitude toward the system and students' ways of using the system. A favourable student attitude towards WebCT was found to have a positive significant correlation with their way of using WebCT.

The second study reported in this thesis found more factors related to web-enhanced learning. The study looked more into student preference and personality and the relationship between students' cognitive styles and their use of WebCT. In this study, no statistically significant relationship between students' cognitive styles and their way of using WebCT was found. In addition, no statistically significant

relationship was found between their cognitive styles and their attitude towards using the system.

However, studies one and two showed relationships between students' use of the course management tool and their achievement. Students' use of the communication board was found to have a significant positive correlation with their exam grades. Based on the results of these studies a third study was devised and is reported in this chapter. This study aimed for a deeper understanding of critical success factors in web-enhanced courses that were supported by the course management system (WebCT). Based on the results obtained from the two previous studies and three models from the literature (Davis, 1993; Selim, 2003; Sun et al., 2008), a framework was designed to guide the third study.

The framework consists of three main dimensions: the technology dimension, the instructor dimension, and the student dimension. Each dimension is divided into a number of factors; each has been examined and is explained later in this chapter. First, the following sections will explore the related models on which the study was based. Afterwards the development of the study hypotheses will be presented including a detailed explanation of the model factors. Next a thorough report of the study will be presented including the research approach and the instruments used. Then the results of the study will be presented and discussed and conclusions will be drawn.

6.2 The framework development

As web-based learning is widely used, it is important to establish an appropriate framework for research to enhance the effectiveness of this new trend. Many researchers from the areas of psychology and information systems have identified variables dealing with web-based learning environments such as attitude ease of use and flexibility.

Many models have been designed to understand web-based learning success. The Technology Acceptance Model (TAM) put forward by Davis et al. (1989) is an information systems theory that models how users come to accept and use a technology. The model suggests that when users are presented with a new

technology, a number of factors influence their decision about how and when they will use it. Information system research clearly shows that user satisfaction is one of the most important factors in assessing the success of system implementation (Delon and McLean, 1992). Wu et al. (2006) stated that this model has partially contributed to understanding the success of e-Learning. The Technology Acceptance Model theory (Figure 6.1) is useful in explaining people's attitudes and behaviour towards using information technology (IT) (Davis et al., 1989). The theory was built upon Ajzen & Fishbein's (1977) theory of reasoned action which asserts that beliefs could influence attitudes which lead to intentions to use such systems and eventually influence actual usage behaviours. Understanding this causal relationship would be helpful in explaining behaviour in adopting information technology (including e-Learning systems).

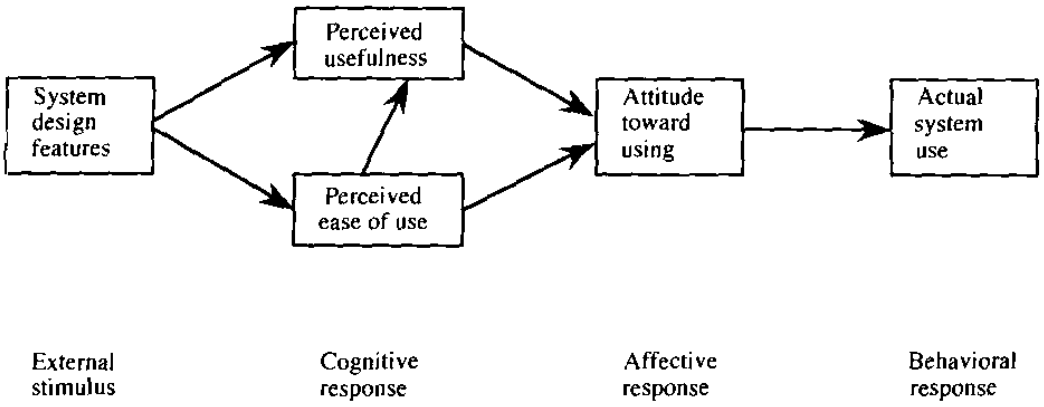

Figure 6. 1: Technology Acceptance Model (Davis, 1993, p. 985)

Davis (1993) stated that perceived usefulness and perceived ease of use represent beliefs finally leading to actual use of information technology. Perceived usefulness is the degree to which a person believes that a particular system will enhance his or her job performance (i.e., by reducing the time to accomplish a task or providing timely information). Perceived ease of use is the degree to which a person believes that using a particular system will be free of effort. The attitude toward use is the user's evaluation of the desirability of employing a particular information system application. Behavioural intention to use is a measure of the likelihood a person will employ the application (Ajzen & Fishbein, 1977). Both attitude and behavioural intention are critical in studying the use of information technology (Oliver, 1980). The technology acceptance model (TAM) describes that a person's behavioural

intention concerning the use of an application is determined by perceived usefulness and perceived ease of use. Since its introduction by Davis, TAM has been widely used for predicting the use of information technologies (Selim, 2003).

The use of information and communication technology (ICT) in education has been studied in terms of factors that influence the likelihood of implementation success for innovative technologies in an educational setting (Selim, 2003). Selim (ibid.) introduced a model for the use of ICT in education. He used the Technology Acceptance Model proposed by Davis et al. (1989) as shown in Figure 6.1, as a basis for research. Selim (ibid.) studied the effect of usefulness and ease of use of a course website on students' course website use (Figure 6.2). Course Website Usefulness is defined as the student's belief that using the course website will increase his or her learning performance, efficiency, and effectiveness. As mentioned above, Course Website Ease of Use refers to the degree to which the student expects the use of the course website to be free of effort. Course Website Use is the intention to use the course website, which is used as an indicator of the acceptance of course websites.

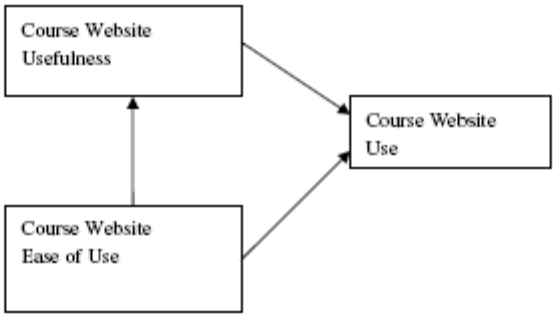

Figure 6. 2: Course website acceptance model (CWAM) (Selim, 2003, p. 347)

These models (TAM and CWAM) have tended to focus on technology. In addition, frameworks have been developed to identify critical factors influencing the success of web-based learning such as the six-dimension integrated model developed by Sun et al. (2008).

Sun et al. (2008) identified critical factors influencing e-Learning satisfaction. They designed a model consisting of thirteen factors in six dimensions as shown in Figure 6.3. They examined the validity of their model by conducting interviews with various experienced e-Learning learners. Then they developed a questionnaire based on the interview comments. The questionnaire results showed that only seven factors

of their model affected students' perceived satisfaction which were: learner computer anxiety, instructor attitude toward e-Learning, e-Learning course flexibility, e-Learning course quality, perceived usefulness, perceived ease of use, and diversity in assessments.

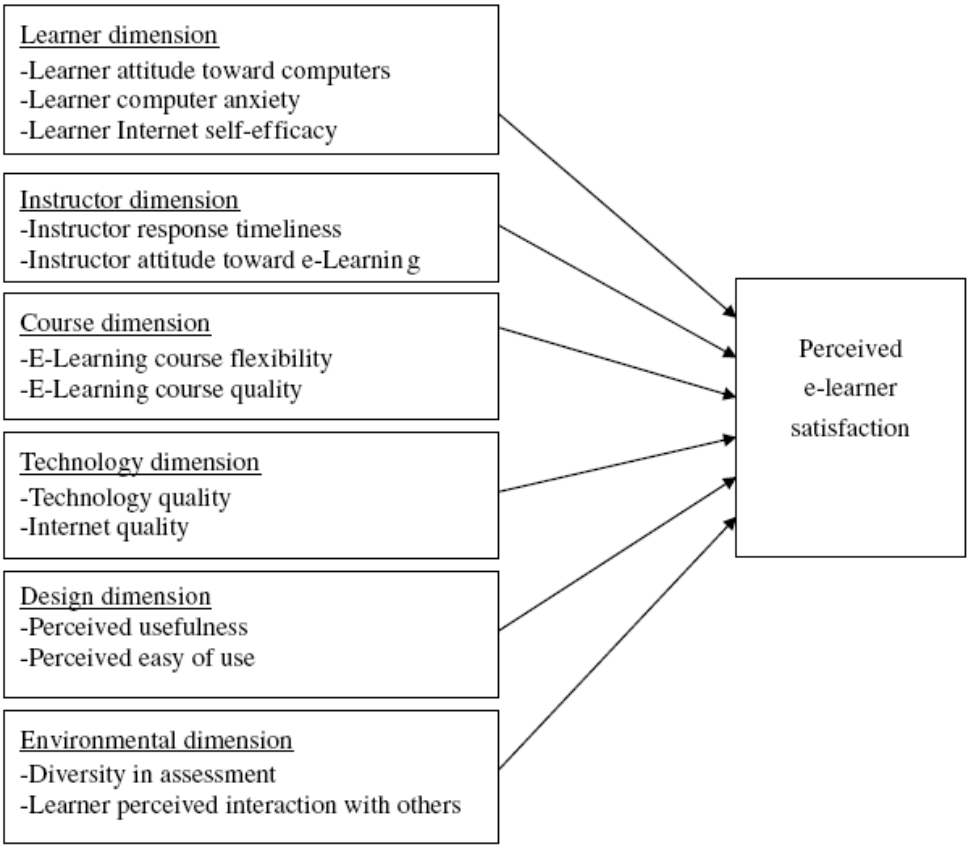

Figure 6. 3: Dimensions and antecedents of perceived e-Learning satisfaction (Sun et al., 2008, p. 1186)

Based on previous models and frameworks and the first two studies presented in chapters 4 and 5 of this thesis, a model was developed as the theoretical basis of the study reported in this chapter. The framework as shown in Figure 6.4 consists of three main dimensions with ten variables; technology dimension, instructor dimension, and learner dimension. These will be explained in detail in the Hypotheses development section (6.3). The framework has three dependent variables which are students' attitude towards using WebCT, students' achievement, and students' use of WebCT while the literature models only have one variable which is students' attitude or satisfaction with the web-based learning system. The study aimed to investigate the relationship between the three dimensions and three dependent variables: students' attitude towards using WebCT, students'

achievement, and students' use of WebCT. The study provides an advanced framework which can be applied on web-enhanced courses for undergraduate students.

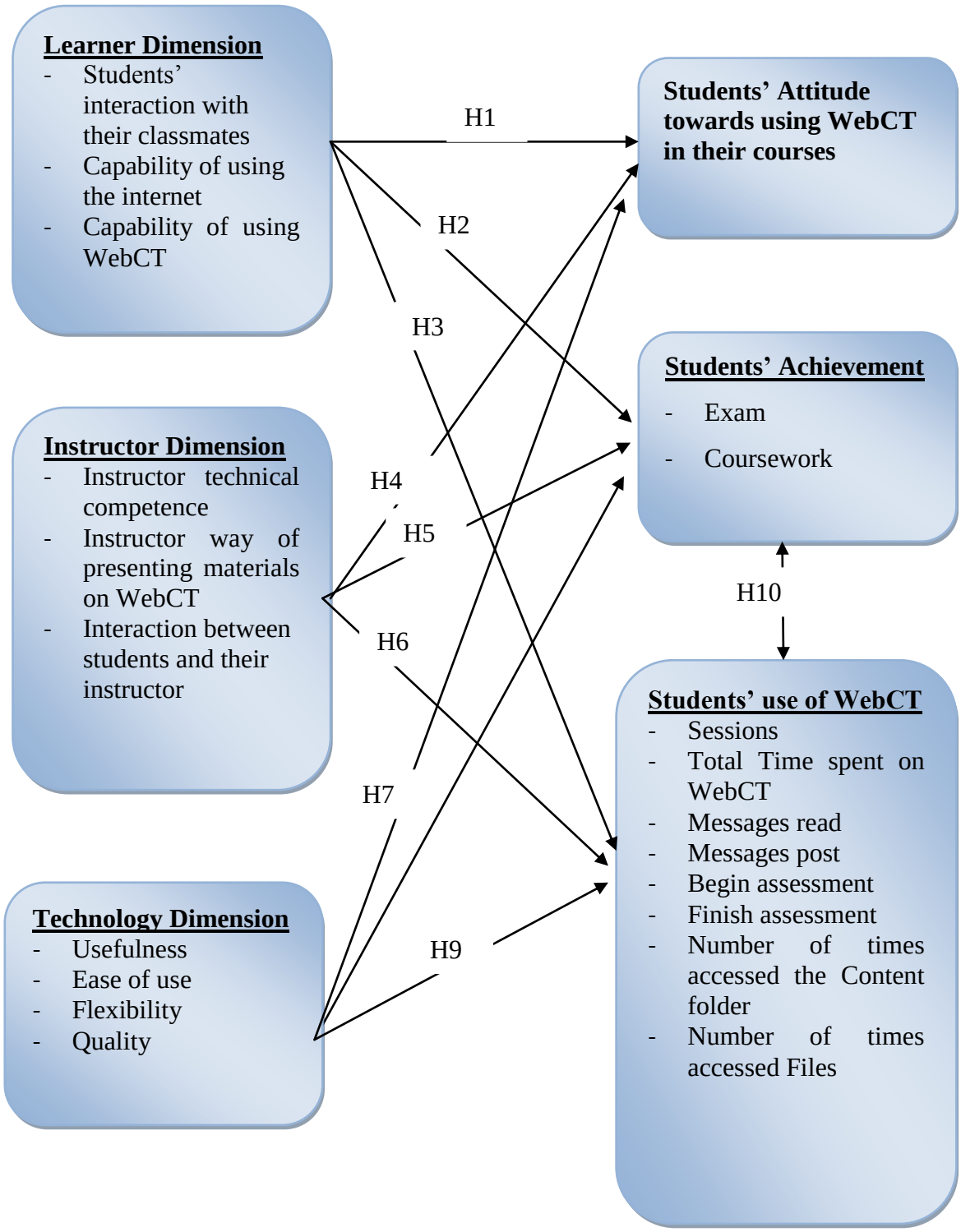

Figure 6. 4: A Framework for Studying Student Achievement, Attitude and Use of Web-based Courses in Relation to Technology, Instructor and Learner.

6.3 Hypotheses development

6.3.1 Learner dimension

As shown in Figure 6.4, the learner dimension has three factors:

- Students' interaction with their classmates
- Students' capability of using the internet
- Students' capability of using WebCT

Previous research has shown that there is positive relationship between learners' interaction with other students and their satisfaction on a web-based course (Arbaugh, 2000). Student-student and student-instructor interaction can improve the learning progress in a web-based learning environment (Piccoli et al., 2001). Previous research agree that interactive instructional design is an essential factor for learning satisfaction and success such as (Hong, 2002; Arbaugh, 2000). Moore (1989) identified three kinds of interactions in learning activities: students with teachers, students with materials, students with students. Interaction methods in web-based learning systems should be properly designed to improve frequency, quality, and promptness of interactions which could affect learner satisfaction (Sun et al., 2008). For this study, the variable "students' interaction with their classmates" is measured by their perception of the level (frequency and quality) of student-student interactions.

Students' satisfaction with a learning system is widely used in evaluating the effects of learning environments and activities both academically and practically (Alavi, 1994). Also, student satisfaction is a main indicator of whether or not learners would continue to adopt a learning system (Arbaugh, 2000). Prior ICT experience and its influence on students' attitudes toward online web-based learning is an important factor to be studied (Paris, 2004).

In the study reported in this chapter intends to assess web-based learning system (WebCT) affects through measuring the learner dimension and investigating the relationship between the learner dimension and the dependent variables: students' attitude toward WebCT, their achievement, and their use of WebCT.

Based on the discussion in this section, the following hypotheses are developed:

H1: The learner dimension will positively influence students' attitude towards using WebCT in their courses.
H2: The learner dimension will positively influence students' achievement.
H3: The learner dimension will positively influence the students' way of using WebCT.

6.3.2 Instructor dimension

The instructor dimension consists of three factors:

- Instructor's technical competence
- Instructor's way of presenting materials on WebCT
- Interaction between students and their instructor

Interaction between teachers and students is found to be one of the main factors of the success of a web-based course (Mahdizadeh, 2008). It has been pointed out that instructional and learning strategies in connection with computer technology use should be examined (Lowerison et al., 2006). Previous research has highlighted other factors which they think might be influential in teachers' and students' attitudes toward the use of ICT in education. According to Brett & Nagra (2005) before assessing the impact of technology on education, one should focus on how teachers teach and how students learn (Brett & Nagra, 2005). Lowerison et al. (2006) considered learning strategy and instructional technique as effective factors in students' perceived effectiveness of computer technology use. Previous research has indicated that instructors' timely response significantly influences learners' satisfaction. This can be explained by saying that if learners face problems on an online course, timely assistance from the instructor encourages learners to continue their learning (Arbaugh, 2002; Thurmond et al., 2002). Similarly, Soon et al. (2000) stated that instructors failing to respond to students' problems in time has a negative impact on student learning. Thus, instructor capability of handling web-based learning activities, and responding to students' questions and problems promptly, will improve learner satisfaction according to Arbaugh, (2002).

Instructor response timeliness is defined as whether students perceive that instructors responded promptly to their problems (Sun et al., 2008). Piccoli et al. (2001) found that the instructors' attitude toward e-Learning or IT positively influences results of e-Learning since instructors are major actors in learning activities. Volery & Lord (2000) state that instructors' attitudes toward distance learning should be considered in system evaluation in order to explicate online course user behaviors effectively and thoroughly.
The definition for instructor attitudes toward e-Learning is the learners' perception of their instructors' attitude toward e-Learning.

Consequently the following hypotheses were developed regarding the instructor dimension:

H4: The instructor dimension will positively influence the students' attitude towards using WebCT in their courses.
H5: The instructor dimension will positively influence the students' achievement.
H6: The instructor dimension will positively influence the students' way of using WebCT.

6.3.3 Technology dimension

The technology dimension consists of the following factors:

- Usefulness
- Ease of use
- Flexibility
- Quality

E-learning courses are flexible in time, location and methods which facilitate students participation and satisfaction of e-Learning (Arbaugh, 2000). In addition, elimination of physical barriers enables more dynamic interaction that fosters the establishment of constructive learning and opportunities for cooperative learning (Salmon, 2000). With no restrictions on time and space in e-Learning, students have the opportunity to communicate instantaneously, anytime, anywhere (Bangert, 2005). The definition of e-Learning course flexibility is the learners' perception of the efficiency and effects of adopting e-Learning in their working, learning, and

commuting hours (Sun et al. 2008). The quality of well-designed e-Learning programs is the precedent factor for learners when considering e-Learning.

Quality is another important factor influencing learning effects and satisfaction in e-Learning (Piccoli et al., 2001). The virtual characteristics of e-Learning, include online interactive discussion and brainstorming, multimedia presentation of course materials, and management of learning processes which assist learners in establishing learning models effectively and motivating continuous online learning (Piccoli et al., 2001). Therefore, both technology quality and Internet quality are important factors in e-Learning (Piccoli et al., 2001). The definition of technology quality is the learners' perceived quality of IT applied in e-Learning (such as microphones, earphones, electronic blackboards, and so on). The definition of Internet quality is network quality as perceived by learners.

In various organizations, usability testing has become a major part in the product development process (Davis, 1989). Though objective ease of use is related to user performance given the system used, subjective ease of use is more related to the users' choice whether or not to use the system and this may not be the same as objective measures (ibid.). Recall that Davis (1989) defined perceived usefulness as the degree to which a person believes that using a particular system would enhance his or her job performance. Also, he defined perceived ease of use as the degree to which a person believes that using a particular system would be free of effort. Both factors (ease of use and usefulness) influence users' attitudes toward a software tool and moreover affect individuals' beliefs and behaviours when using the tool. The more learners perceive usefulness and ease of use in web-based courses, the more positive their attitudes are toward web-based learning, accordingly improving their learning experiences and satisfaction, and increasing their chances for using web-based courses in the future (Arbaugh, 2002; Arbaugh & Duray, 2002; Pituch & Lee, 2006).

Based on the previous discussion, the following hypotheses were developed:

H7: The technology dimension will positively influence the students' attitude towards using WebCT in their courses.
H8: The technology dimension will positively influence the students' achievement.
H9: The technology dimension will positively influence the students' way of using WebCT.

Webster & Hackley (1997) remarked that students' performance, measured by their marks, represents a key aspect of teaching effectiveness. Students' use of WebCT was measured by a number of methods. The results for the first two studies in this thesis (chapters 4 and 5) showed a positive significant relationship between students' use of WebCT and their achievement. For instance, in the study presented in chapter 4, there was a positive significant relationship between the students' use of the communication board and their grades in the exam and coursework.

The following hypothesis was developed to see whether this third study supports the results of the two previous ones.

H10: There is positive relationship between students' activities on WebCT and their achievement.

6.4 Methodology

6.4.1 Research design

A mixed methods approach is used when conducting the study reported in this chapter. The design supports collection of sampling data with validated collection instruments. The data were objectively analyzed using statistical procedures provided by SPSS software.

6.4.2 Participants

The participants in this study were undergraduate students enrolled at a UK university. The sample for this study was made up of students from three different courses: computing and mathematics, information systems, and business. The age of respondents ranged between 17-20 years old. The data collection took place during

semester time. Students were divided into three groups depending on the course they were taking (group one n= 476; group two n=110; group three n=119). Only 120 students responded to a paper-based questionnaire submitted to them in their classrooms and labs. Therefore, the final sample size was approximately 17.6% of the original sample. Table 6.1 shows the number of participants in each course and the number of participants who responded to the questionnaire.

Table 6. 1: The study sample

	M1	M2	M3	Total
Number of the student in the course	476	110	119	705
Number of students who completed the questionnaire	41	41	38	120
Response rate %	9%	37%	32%	17%

6.4.3 Data collection

The aim of this study was to examine the relationship between three developed dimensions of the model described above and students' attitude towards using WebCT, their achievement, and their actual use of the system and to test the hypotheses.

The objective data for this research was collected from the WebCT tracking system database. This type of data gathering has been used in previous research (Hoskins & Hooff, 2005; Phillips & Baudains, 2002; Wellman & Marcinkiewicz, 2004; Johnson, 2005). First of all, statistical data about the students' use of WebCT was collected weekly from the beginning of the term. The WebCT tracking system provides information about students' use and visits to every tool and page on WebCT. There are two main measures of students' use of WebCT: WebCT page hits and use of the communication board. WebCT pages hits is the number of times every student accessed each page such as homepage, content page (module resources page which contains lecture notes). Communication board use is the number of messages each student read or posted on the discussion board. Moreover, the time that students spent using WebCT is considered to be an indicator of their use of the system.

For this study, a measure of students' attitude (based on the framework described above) towards using WebCT was needed. For this purpose a questionnaire was specially designed and validated. The following section will explain the questionnaire validation.

6.4.3.1 Measurement development (The development of the questionnaire; content validation)

To gather subjective attitude data for the work conducted for this study and to measure students' perception of the three dimensions as presented in the previous section, a 39-item, 5-point Likert scale questionnaire was designed. The questionnaire was designed to measure students' attitude toward using WebCT, Learner dimension, Technology dimension, and Instructor dimension. Above it was pointed out that Likert scales are used for measuring opinions, attitudes, beliefs, and have been widely used for evaluating user satisfaction with products. Coolican (1994) stated that there are a number of advantages of using the Likert technique as it is easy to complete and keeps the respondents direct involvement and it has been shown to have a high degree of validity and reliability. Scales usually range from 1 to 3 points, to a maximum of 1 to 9 points, but it is generally agreed that taking the middle ground, by using scales of 1 to 5, or 1 to 7 is the most effective method (Dix et al. 2004). For the work reported in this thesis, it was therefore decided to use a scale of 1 to 5, as follows:

Strongly agree	Agree	Neutral	Disagree	Strongly disagree

It is important to consistently label the scales because it gives a direction of agreement and more reliable, so that, for example, a '1' always indicates low agreement, while a '5' always indicates high agreement.

A central issue for scientific research is reliability and validity. Reliability refers to the consistency in the results of the measurement, while validity concerns whether the questionnaire measures what it claims to be measuring (Brinkman, 2009). To find the degree to which the questionnaire measured what it was designed to

measure, it was evaluated through a process of content validity. Content validity addresses the question whether the full content of a construct is represented in the measure or have some dimensions been left out. Content validity is a consensus issue. For content validity, experts have to agree that the construct has been applied capturing all aspects of the construct (Brinkman, 2009).

This process involved asking colleagues with an expert knowledge of the domain to evaluate the content of the questionnaire to ensure that the items were representative of the area that they were supposed to cover, and were not weighted towards specific aspects of the area.

A 39-item questionnaire was sent via email to experts at different universities. The questions were collected from related literature. This process was conducted with 11 experts. The experts are academic researchers working in related areas such as e-learning environments and educational software. The purpose of the questionnaire and what it was designed to measure was explained. The experts rated each question as "*Essential, Useful but not essential, and Not necessary*". Also they wrote their comments and suggestions. Items that were rated as *Essential* from more than 5 experts were used in the questionnaire. The comments were used in forming some of the questions and the questions that measure the same variable were deleted. This process resulted in a total of 30 questionnaire items. These items were then divided into two groups of equal numbers of positively and negatively worded statements, in order to prevent bias effects caused by a respondents' tendency to habitually agree or disagree with the statements.

Some statements were found to be not necessary to be in the questionnaire from the experts such as:

- U-link needs a lot of improvement
- Receiving responses to my questions in timely manners motivated me to use the communication board.
- The instructor regularly monitored the discussions
- I feel confident printing materials from the Internet.
- I believe that using U-link requires technical ability

- I believe that using U-link is only advisable for people with a lot of patience
- The fact that I had to use U-link for this module is a source of annoyance to me
- U-link made it difficult to know what was expected of me in this module

The questionnaire consisted of 30 statements to which students give their level of agreement/disagreement. The list of questions that was been sent to the experts can be found in appendix 4 and the questionnaire in appendix 5.

6.4.4 Procedure

All the courses that were used in this study are supported by a course management system (WebCT). Students have face-to-face lectures and they can access module resources by using WebCT. This allows them to communicate with each other and with the module leader to ask any question they want in relation to the module. Students can also get all the information about the assignments, workshops and marking schemes for every module on WebCT. This study was conducted by tracking students' use of WebCT in three modules on different courses at a UK University. These three courses were chosen to examine the framework in three different subject areas but at the same time the three groups of students are using the same learning management system under the same conditions as it is the only place they can find the lectures and notes for the courses. Moreover they have to submit their assignments via the system. The three courses use the same online instructional strategies using the WebCT Learning Management System application and departmental procedures.

In lectures students were reminded that they can get the information about the module from WebCT. Traditional lectures were given weekly over two terms. A special communication tool is available on WebCT which is known as the discussion board. Students can use the discussion board to communicate with the module leader and with each other. Lecture notes, workshop sections and other information about the module were posted weekly on WebCT. The modules were assessed by either

coursework or examination or both. Students were required to submit their assignments via WebCT.

The information available on the tracking system was saved weekly. The students were only asked to respond to a questionnaire in one of their course labs or lectures. Further information was collected from the module leaders and the tracking system. The questionnaire was submitted to the students towards the end of the second semester before the exam period. The students were asked to give their names. Only questionnaires that have the student's name have been used. The reason for this was that the study aimed to match the students' attitude, achievement and use of WebCT. In addition, it also investigated the relationship between these variables and the students' perception of the independent variables in the study's framework.

6.4.5 Data analysis

Data were collected from the semester data related to the three undergraduate level courses supported by WebCT. The data of interest were extracted from the course information, the WebCT tracking system, the end of course grade (performance), and the questionnaire data. Students' general uses of WebCT were measured by the number of times each student visited WebCT pages, the time they spent using WebCT or their use of the discussion board. Student achievement was measured by the grades they obtained for the observed modules. Students' attitudes towards WebCT were measured using a Likert scale questionnaire. The independent variables (Technology dimension, instructor dimension, learner dimension) of the study framework were also measured by using a Likert scale questionnaire.

The collected data were aggregated into an Excel spreadsheet for review and to run a preliminary analysis. The information in the study records was kept strictly confidential. Participants' names or other identifying information are not disclosed or referenced in an identifiable way in any written or verbal context.

Data analysis and generation were carried out using SPSS software. A first look at the data includes frequency tables. Summary statistics related to the questionnaire in the study are reported (mean, standard deviation).

Bryman & Cramer (2005) stated that one of the most important explanations of the relationship between variables is the correlation. The measures of correlation between variables indicate the strength, significance and the direction of the relationship. Pearson's (r) gives the strength and the direction of the linear relationship between variables to be assessed. Pearson's (r) varies between -1 and +1. A relationship of -1 or +1 would indicate a perfect relationship, negative or positive respectively, between two variables. The significant (p) value tells us how confident we can be that there is a relationship between two variables. Scatter diagrams are useful in understanding the correlation between two variables. A scatter diagram can also be used to illustrate some of the basic features of correlation; it shows the direction and the strength of the relationship.

The measures of students' attitude towards using WebCT, academic achievement, and use of WebCT in the three modules were correlated using *Pearson's Product Moment Correlation Coefficient* with the measures of technology dimension, instructor dimension, and learner dimension. The significant relationships between the variables are presented in the results section, 6-6. Also, a scatter diagram for each significant relationship was used to illustrate any relationship between these variables.

6.5 Results

The three modules are coded as M1, M2, and M3 for reasons of confidentiality. M1 is a module in business, M2 is a module in computer science and M3 is a module in mathematics. To test the model proposed in this study only data from students who completed the questionnaire and provided their names was used. This resulted in data for a total of 120 participants being used.

The mean and standard deviations of the four variables measured by the questionnaire are reported in table 6.2.

Table 6. 2: Mean and SD of the variables measured by the questionnaire

Group (number)	Attitude M(SD)	Learner dimension M(SD)	Instructor dimension M(SD)	Technology dimension M(SD)
M1 (41)	3.55 (0.41)	3.44 (0.51)	3.29 (0.39)	3.76 (0.4)
M2 (41)	3.66 (0.42)	3.58 (0.60)	3.51 (0.48)	3.9 (0.46)
M3 (38)	3.55 (0.44)	3.27 (0.48)	3.33 (0.39)	3.76 (0.42)

As stated earlier, this study aimed to find a framework to assess students' use of a course management system and the factors that influence their learning process with such a system. In order to test the proposed framework, data from three modules were collected. The modules are from three subject areas. The modules are different in terms of several factors such as: the number of lectures, assessments, and module leaders. Therefore, the data from any module cannot be compared to the others. However, we tested the framework in three modules and the results are presented for each group separately.

6.5.1 Results from Module One:

Students used WebCT extensively in this module. Most of the students used various pages such as home page, content page, organizer page, and assignment page. The discussion board was also much used, as shown in table 6.3 below. The data is only from students who filled out the questionnaire.

Table 6. 3: Descriptive Statistics of students' use of WebCT for M1

	N	Minimum	Maximum	Mean	Std. Deviation
Sessions	41	19	172	69.78	33.99
Total_time	41	1:54	23:32	9:00	5:35
Read_messages	41	0	107	46	23
Post_messages	41	0	16	.88	2.64
Content_folder	41	77	545	336.22	125.47
Files	41	18	140	79.83	26.27
Valid N	41				

To examine to what extent the dependent variables in this study were related to the independent variables, a Pearson correlation test was used.

A positive significant correlation ($r=0.5$, $p<0.01$) was found between students' perception of the technology dimension and their attitude towards using WebCT; shown in figure 6.5. However, no significant correlation was found between the technology dimension and the students' achievement or their use of WebCT.

A positive but weak significant correlation ($r=0.3$, $p=0.04$) was found between students' perception of the instructor dimension and their attitude towards using WebCT; as shown in figure 6.6. Also, a positive, but weak, significant correlation ($r=0.35$, $p=0.02$) was found between students' perception of the instructor dimension and their coursework grades (which is an indicator of students' achievement). However, no significant correlation was found between the instructor dimension and students' use of the course management system (WebCT) as shown in figure 6.7.

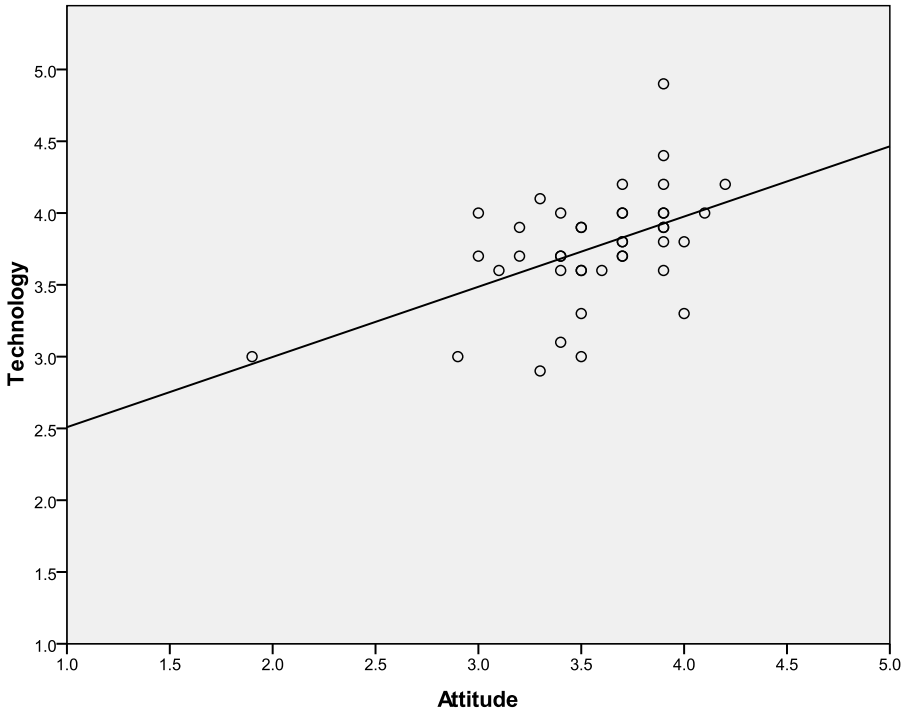

Figure 6. 5: Scatterplot - students' attitude and the technology dimension in M1

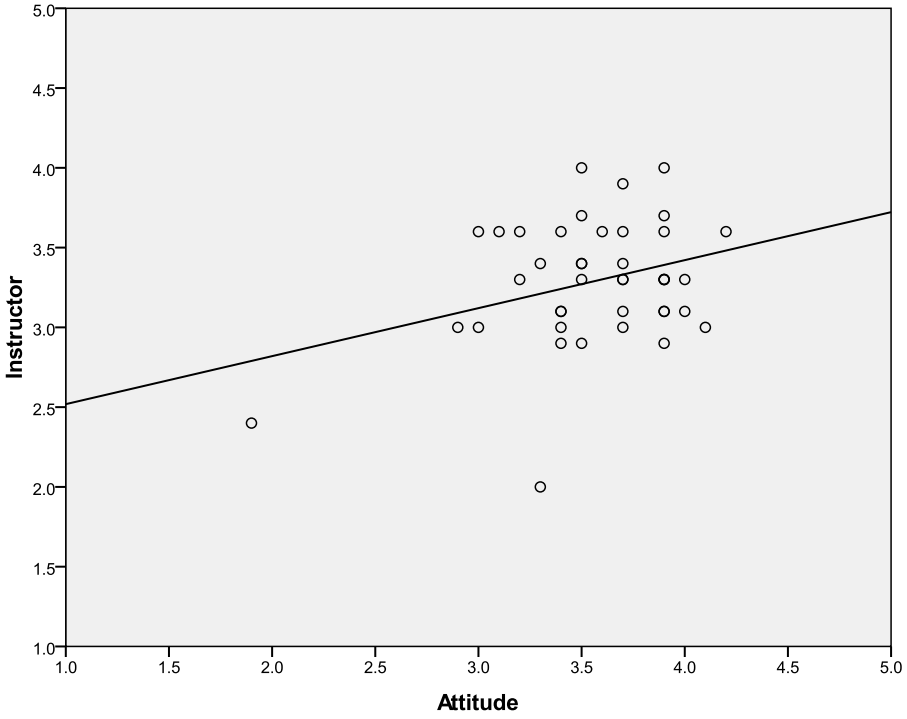

Figure 6. 6: Scatterplot - students' attitude and the instructor dimension in M1

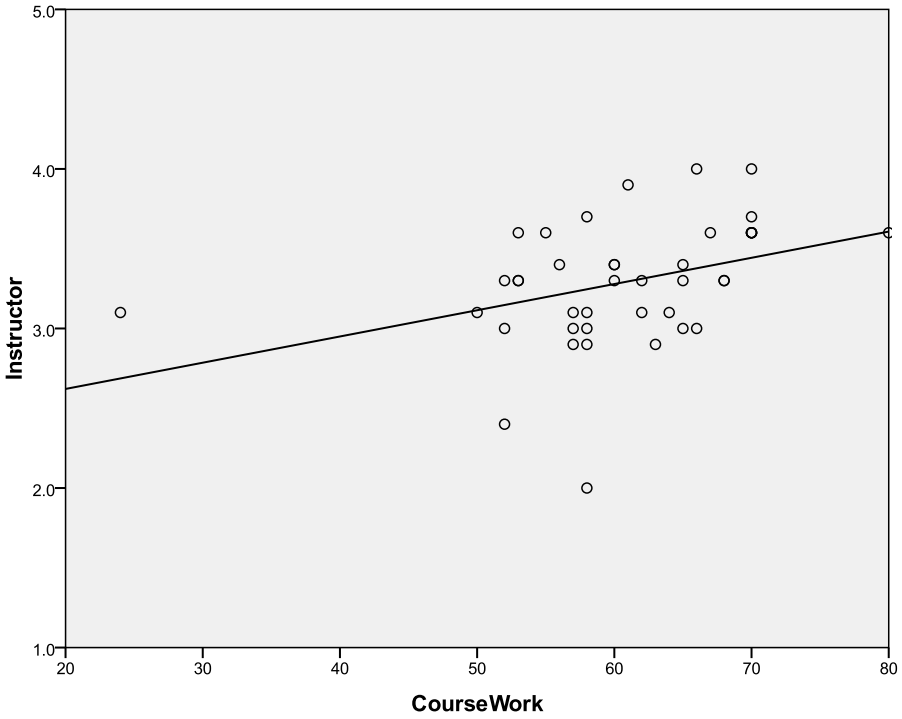

Figure 6. 7: Scatterplot - students' coursework grades and the instructor dimension in M1

A positive significant correlation (r=0.5, p<0.01) was found between students' perception of the learner dimension and their attitude towards using WebCT as shown in figure 6.8. Also, a positive significant correlation (r=0.3, p=0.04) was found between students' perception of the learner dimension and their exam grades as shown in figure 6.9; and a positive significant correlation (r=0.47, p<0.01) was found between students' perception of the learner dimension and their coursework grades as shown in figure 6.10. A positive but weak correlation was found between the students' perception of the learner dimension and the number of times they accessed WebCT (r= 0.32, p= 0.04), as shown in figure 6.11, and between the students' perception of the learner dimension and the total time they spent using WebCT (r=0.32, p=0.04), as shown in figure 6.12.

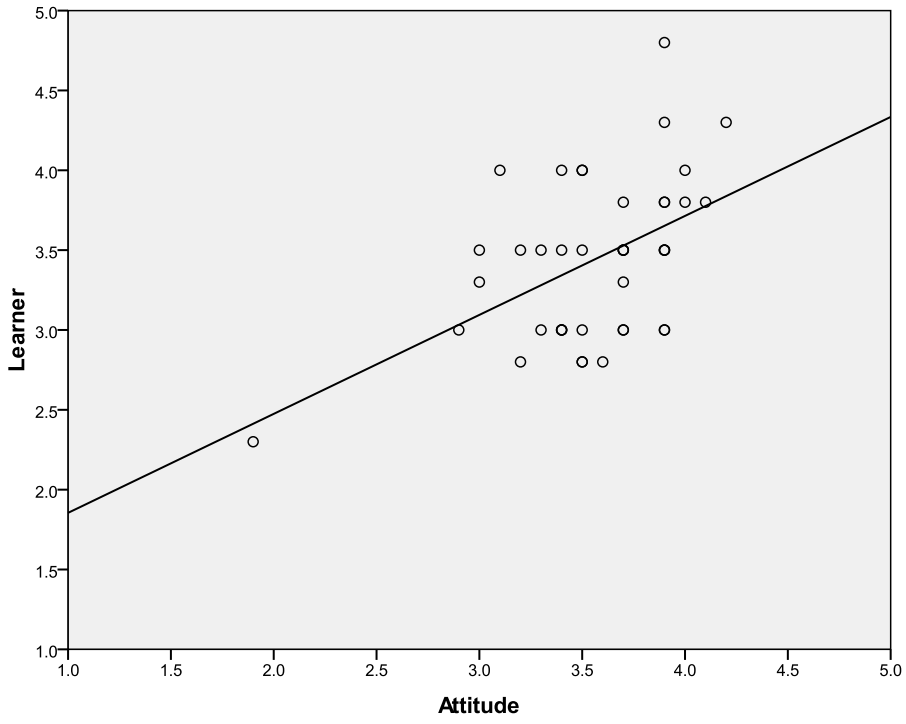

Figure 6. 8: Scatterplot - students' attitude and the learner dimension in M1

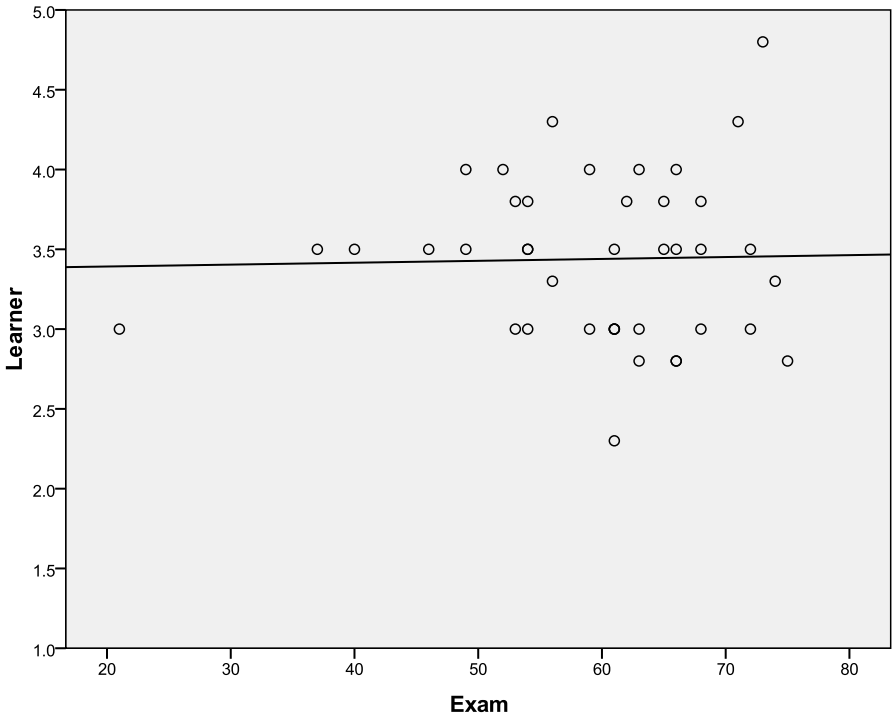

Figure 6. 9: Scatterplot - students' exam grades and the learner dimension in M1

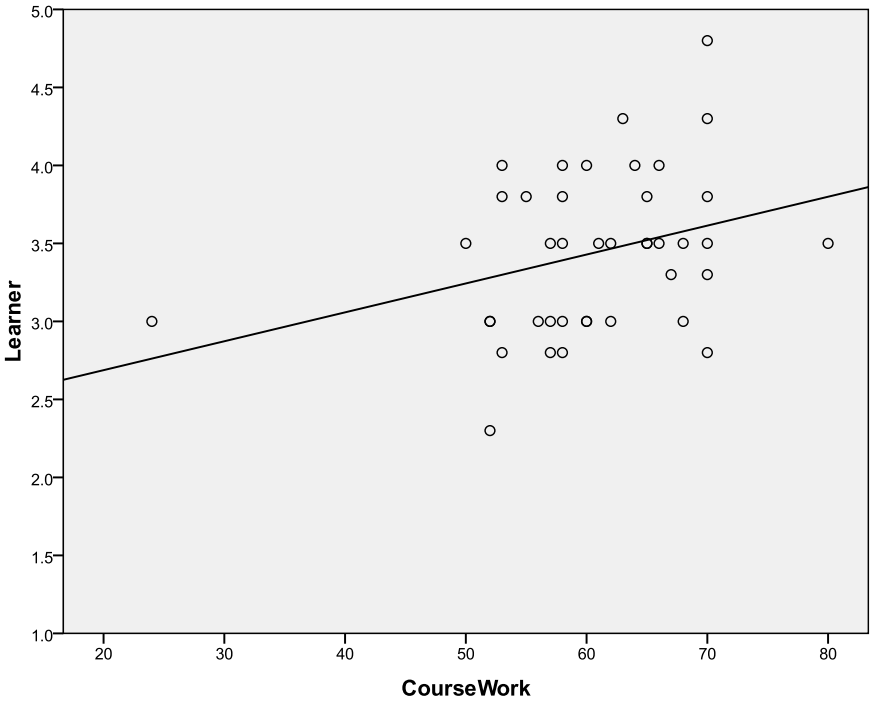

Figure 6. 10: Scatterplot - students' coursework grades and the learner dimension in M1

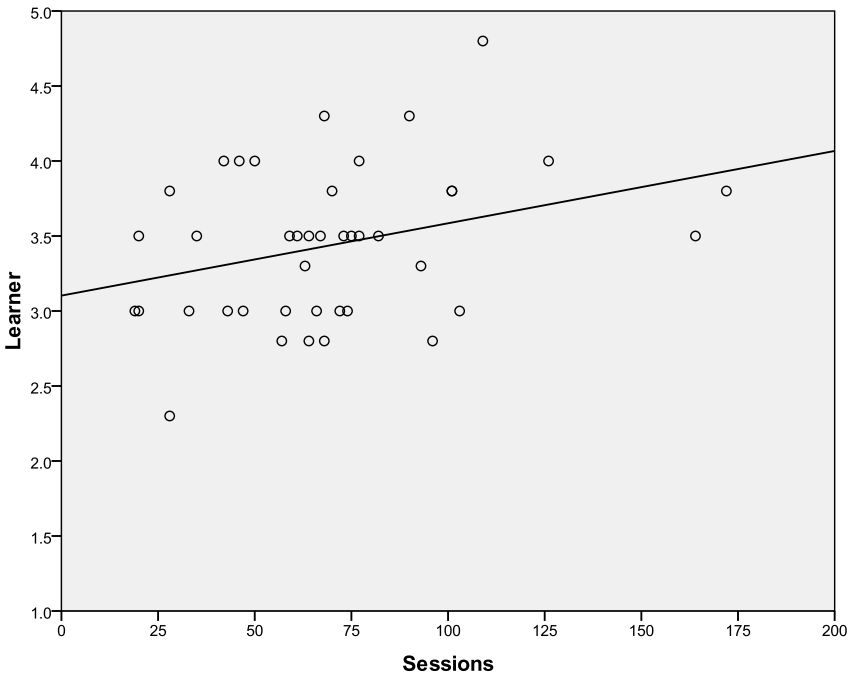

Figure 6. 11: Scatterplot - number of times students accessed WebCT and the learner dimension in M1

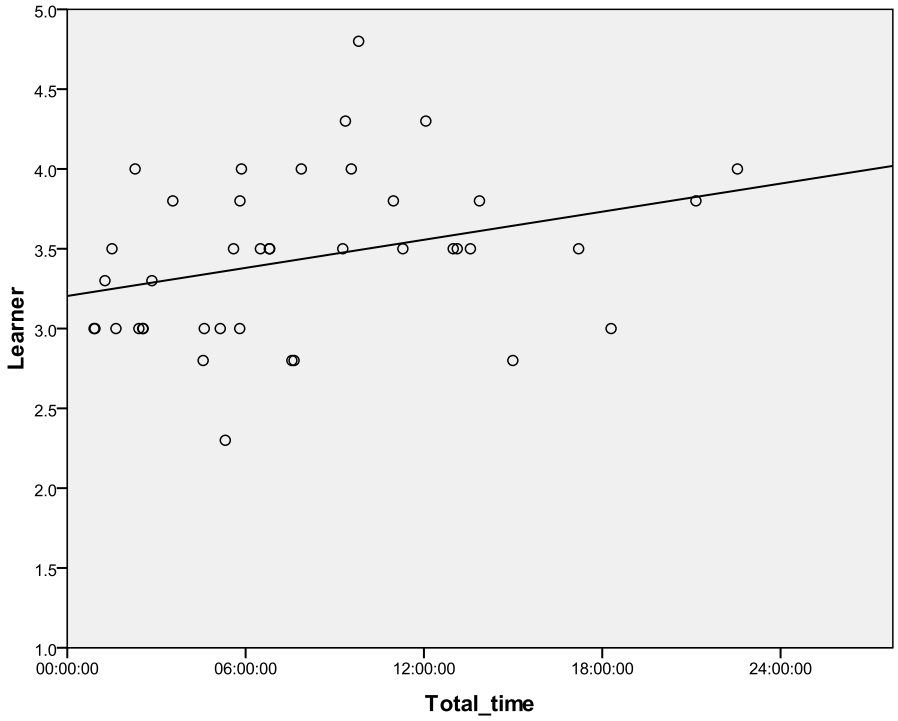

Figure 6. 12: Scatterplot - total time students spent on WebCT and the learner dimension in M1

Table 6. 4: Correlations between students' grades and their use of WebCT in M1

		Sessions	Total time	Read messages	Post messages	Begin assessment	Finish assessment	Submit assignment	Content folder	Files
Exam	Pearson Correlation	.275**	.217**	.089*	.091*	.100*	.154**	.313**	.294**	.298**
	Sig.(2-tailed)	.000	.000	.043	.038	.022	.000	.000	.000	.000
	N	520	520	520	520	520	520	520	520	520
Course Work	Pearson Correlation	.299**	.193**	.124**	.127**	.135**	.118**	.076	.267**	.263**
	Sig.(2-tailed)	.000	.000	.007	.006	.003	.010	.098	.000	.000
	N	476	476	476	476	476	476	476	476	476

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 6.4 shows positive significant correlations between students' achievement (exam and coursework) and their use of WebCT in module one.

6.5.2 Results from Module Two

Students also used WebCT extensively in this module (M2) as shown in table 6.5.

Table 6. 5: Descriptive Statistics of students' use of WebCT for M2

	N	Minimum	Maximum	Mean	Std. Deviation
Sessions	41	1	119	24.88	25.46
Total_time	41	0	20:06	3:43	4:31
Read_messages	41	0	98	16.39	25.35
Post_messages	41	0	9	.32	1.44
Content_folder	41	2	425	105.44	94.31
Files	41	0	134	44.39	32.16

A positive significant correlation ($r=0.52$, $p<0.01$) was found between students' perception of the technology dimension and their attitude towards using WebCT. Also, a positive significant correlation was found between students' perception of the technology dimension and:

1) the number of times they accessed WebCT (r=0.5, p< 0.01); shown in figure 6.13.

2) the total time they spent using WebCT (r=0.35, p=0.02); shown in figure 6.14.

3) the number of messages they read on the communication board (r= 0.53, p<0.01); shown in figure 6.15.

4) the number of messages they posted on the communication board (r=0.43, p<s0.01); shown in figure 6.17.

However, no significant correlation was found between the technology dimension and the students' achievement (coursework or exam).

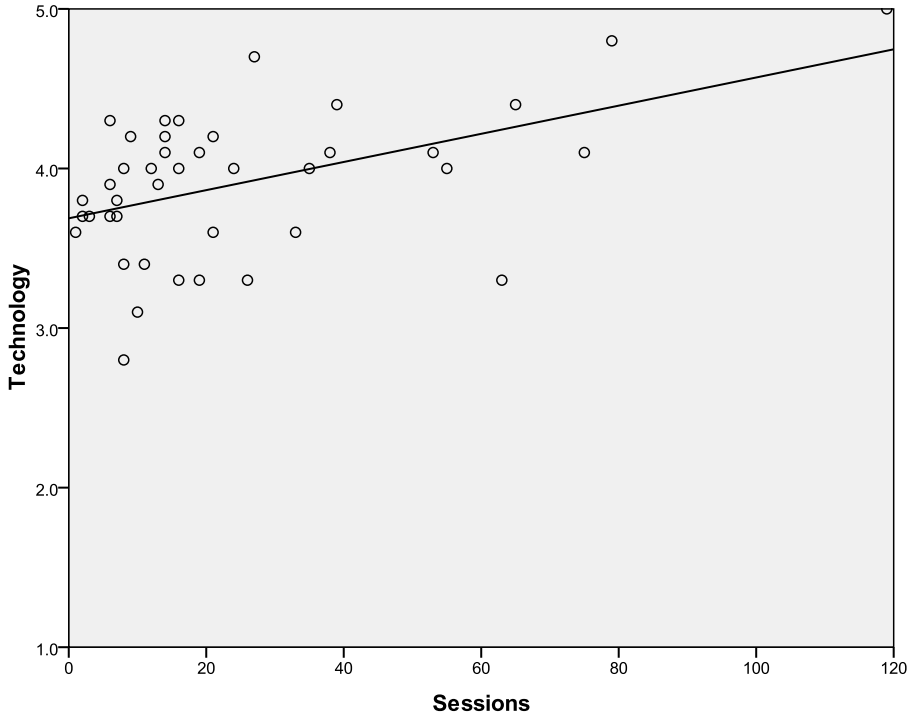

Figure 6. 13: Scatterplot – the number of times students accessed WebCT and the technology dimension in M2

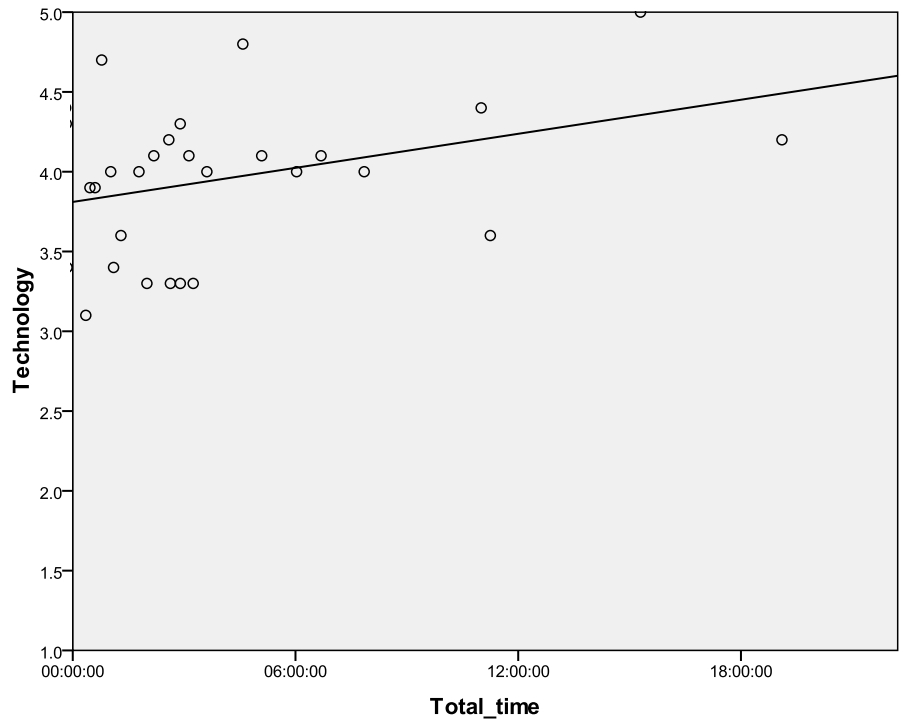

Figure 6. 14: Scatterplot - total time students spent on WebCT and the technology dimension in M2

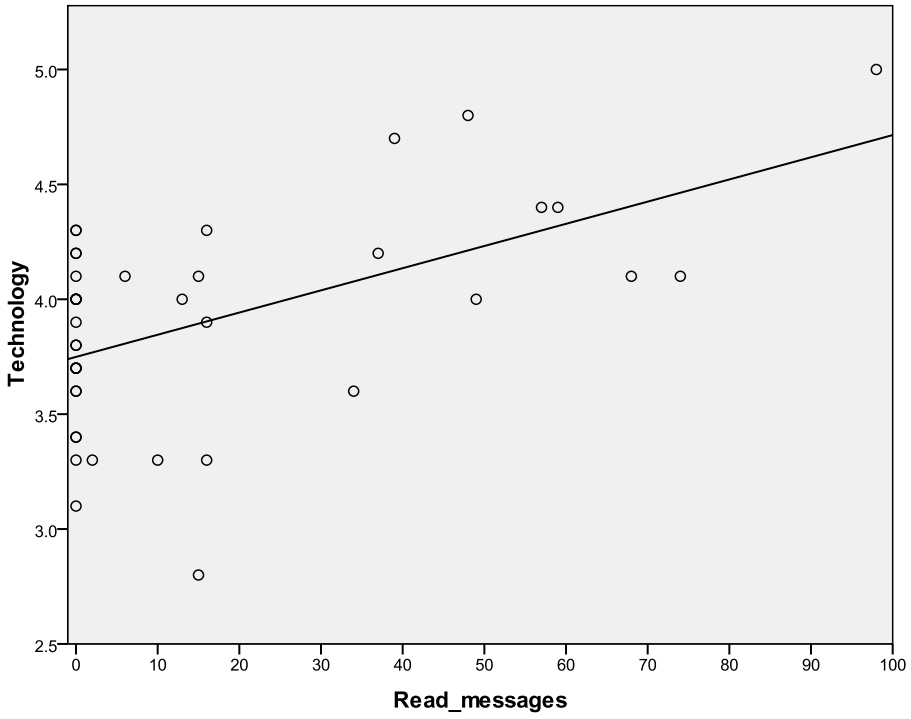

Figure 6. 15: Scatterplot - number of messages each student read on WebCT and the technology dimension in M2

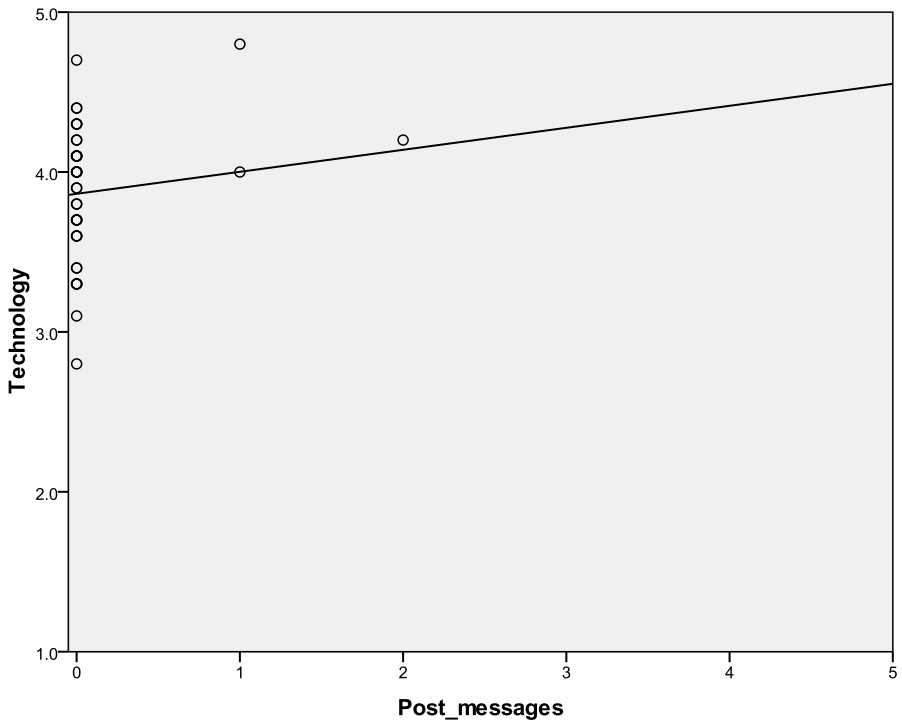

Figure 6. 16: Scatterplot - number of messages each student posted on WebCT and the technology dimension in M2

A positive significant correlation was found between students' perception of the learner dimension and their attitude towards using WebCT ($r=0.5$, $p<0.01$), shown in figure 6.17. Also, a positive significant correlation was found between students' perception of the learner dimension and the number of messages they posted on the communication board ($r=0.34$, $p=0.03$), shown in figure 6.18.

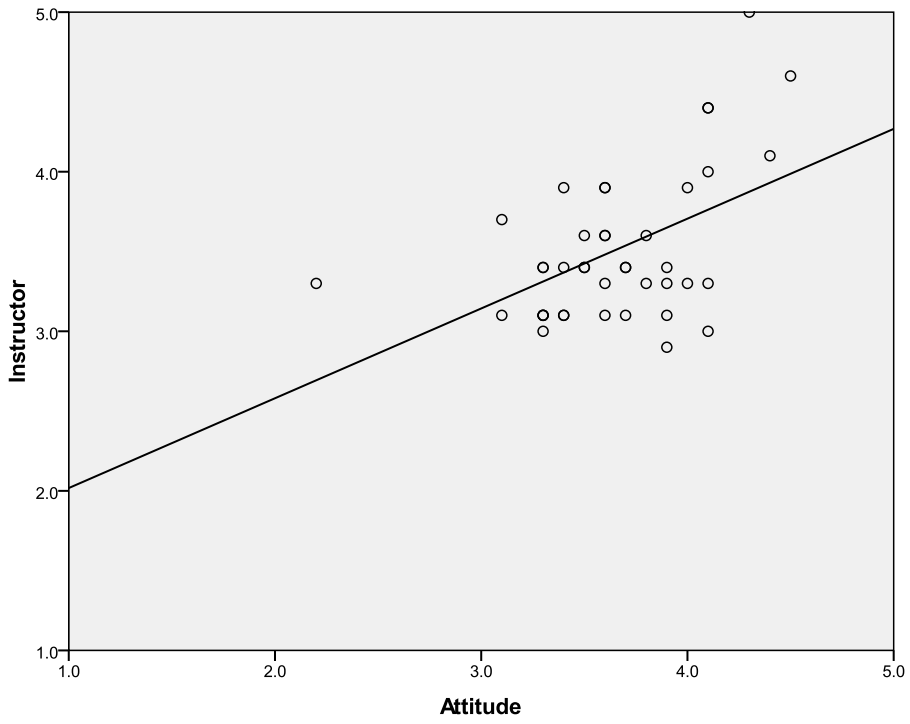

Figure 6. 17: Scatterplot - students' attitude and the instructor dimension in M2

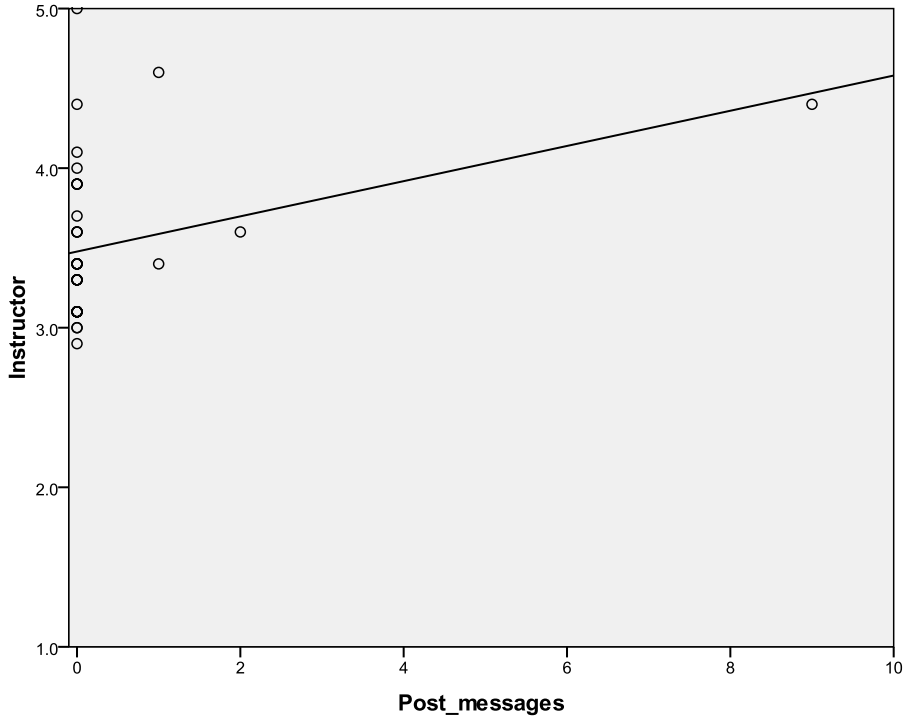

Figure 6. 18: Scatterplot - number of messages each student posted on WebCT and the instructor dimension in M2

Furthermore, a positive significant correlation was found between students' perception of the learner dimension and:

1) the number of times they accessed WebCT (r=0.32, p=0.03); shown in figure 6.19.

2) the number of messages they read on the communication board (r=0.39, p=0.01) shown in figure 6.20.

3) the number of messages they posted on the communication board (r=0.4, p=0.02) shown in figure 6.21.

4) the students' achievement (exam) (r=0.33, p=0.03), shown in figure 6.22. However, no significant correlation was found between the learner dimension and the students' attitude towards using WebCT.

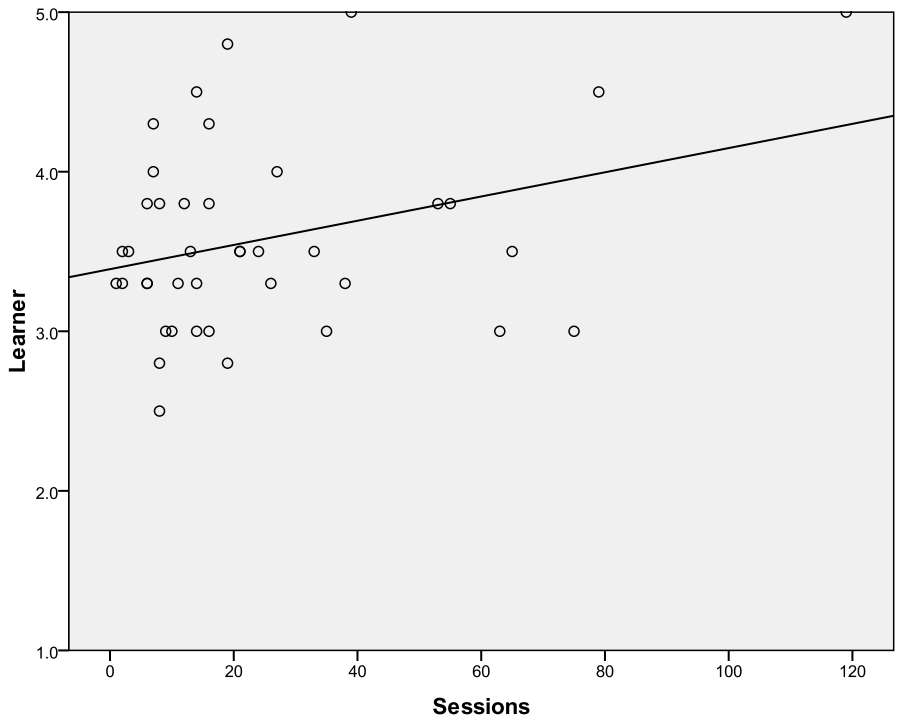

Figure 6. 19: Scatterplot - number of times students accessed WebCT and the learner dimension in M2

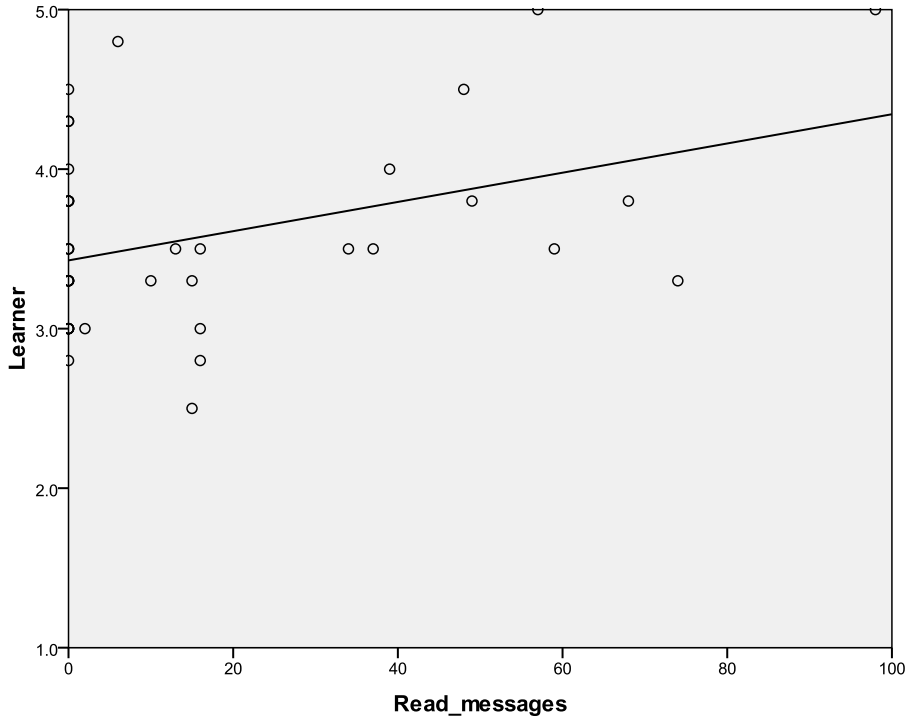

Figure 6. 20: Scatterplot - number of messages each student read on WebCT and the learner dimension in M2

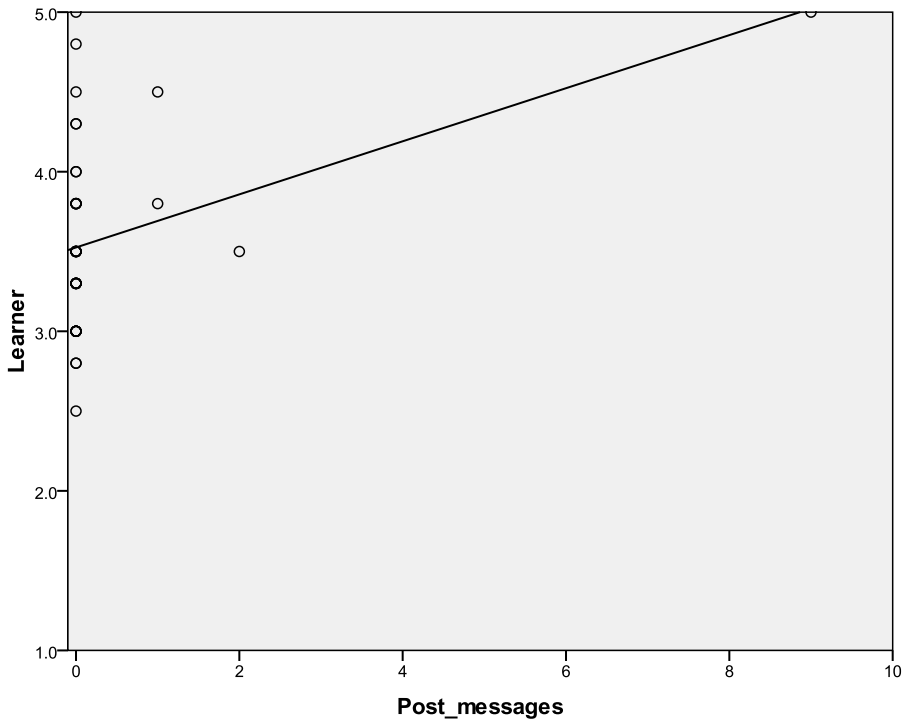

Figure 6. 21: Scatterplot - number of messages each student posted on WebCT and the learner dimension in M2

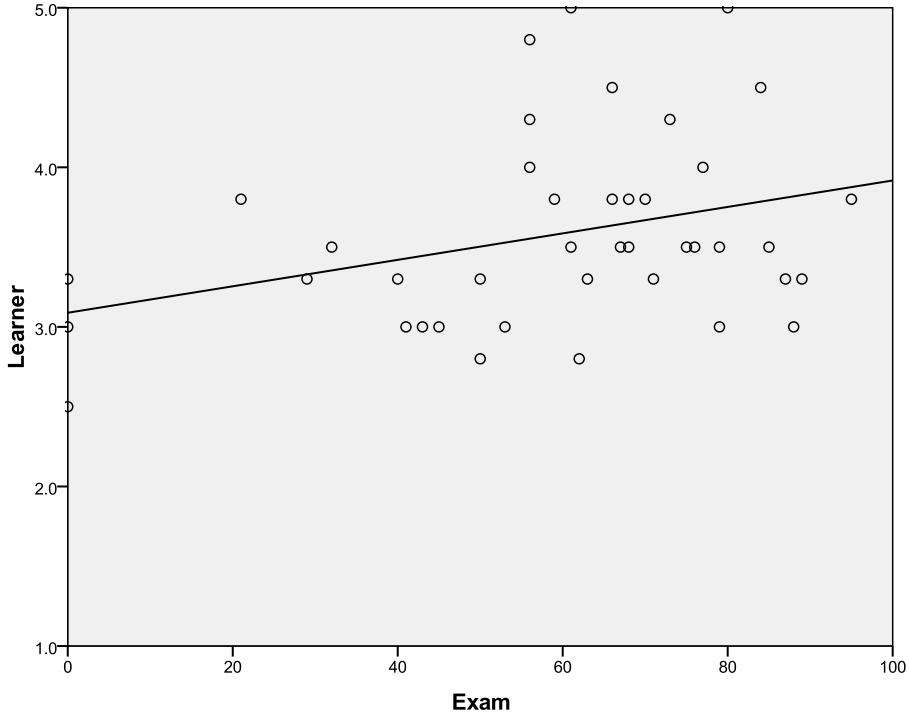

Figure 6. 22: Scatterplot - students' exam grades and the learner dimension in M2

Table 6. 6: Correlations between students' grades and their use of WebCT for M2

		Sessions	Total time	Read messages	Post messages	Content folder	Files
Exam	Pearson Correlation	.340**	.287**	.285**	.188*	.334**	.344**
	Sig. (2-tailed)	.000	.002	.003	.049	.000	.000
	N	110	110	110	110	110	110

** Correlation is significant at the 0.01 level (2-tailed).

Table 6.6 shows a positive significant correlation between students' achievement (exam) and their use of WebCT in module two.

6.5.3 Results from Module Three

Students also used WebCT extensively in this module (M3) as shown in table 6.7.

Table 6. 7: Descriptive statistics of students' use of WebCT for M3

	N	Minimum	Maximum	Mean	Std. Deviation
Sessions	38	21	234	68.76	42.84
Total_time	38	0:29	23:37	12:56	5:54
Read_messages	38	0	132	45.58	42.39
Post_messages	38	0	4	.45	1
Content_folder	38	45	273	102.16	56.74
Files	38	54	333	148.29	72.12

The technology dimension was found to only correlate with students attitude towards using WebCT ($r=0.6$, $p<0.01$) as shown in figure 6.23.

The instructor dimension was found not to correlate with any of the dependent variables.

The learner dimension was found to only correlate with student attitude towards using WebCT ($r=0.37$, $p<0.02$) as shown in figure 6.24.

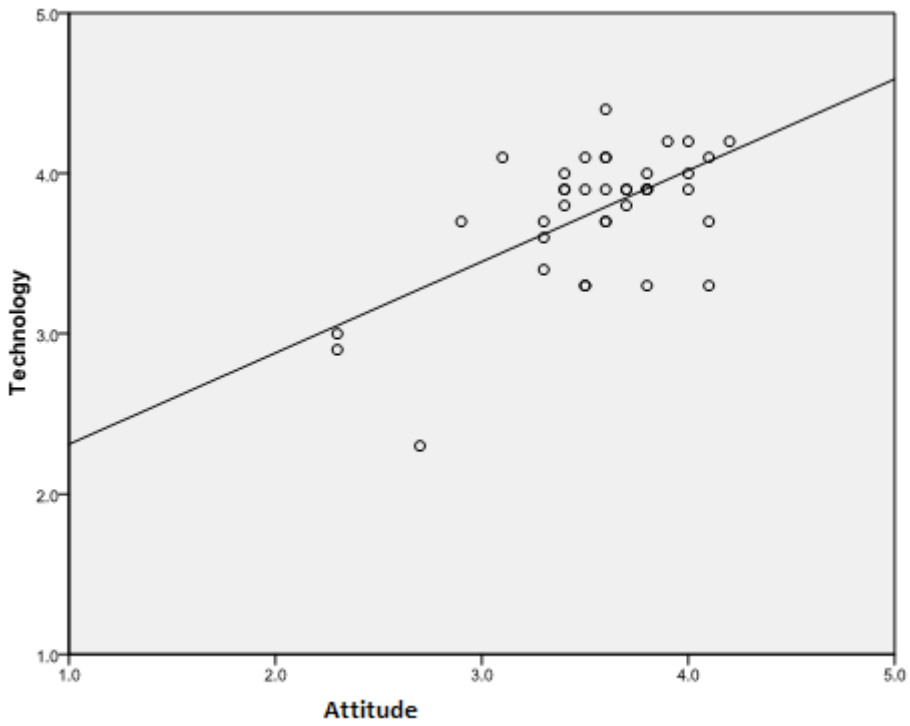

Figure 6. 23: Scatterplot - students' attitude and technology dimension in M3

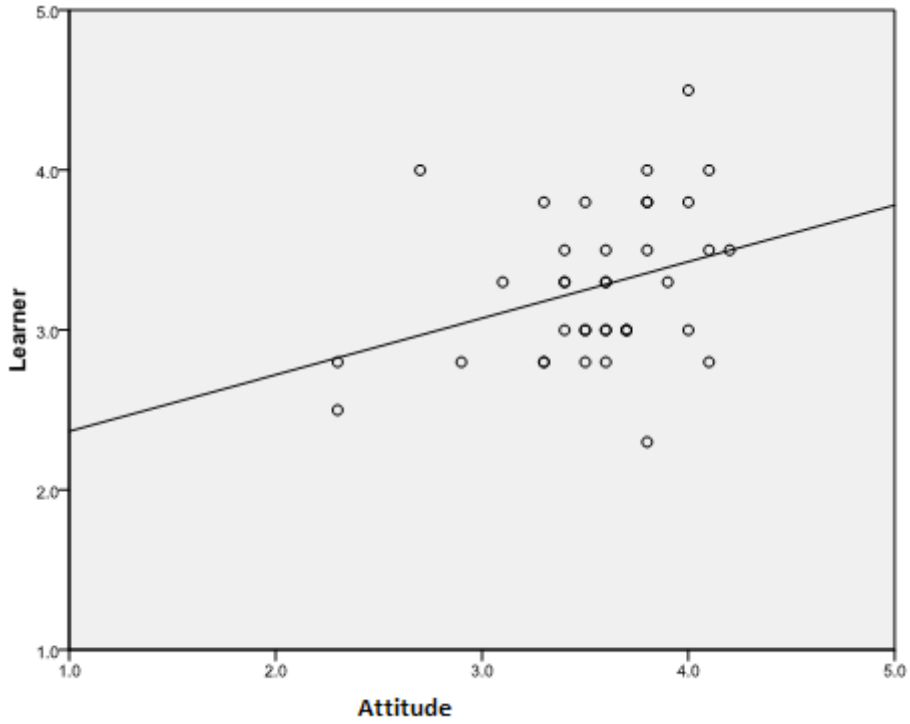

Figure 6. 24: Scatterplot- students' attitude and learner dimension in M3

Table 6. 8: Correlations between students' grades and their use of WebCT for M3

		Sessions	Total time	Read messages	Post messages	Begin assessment	Finish assessment	Read assignment	Submit assignment	Content folder	Files
Exam	Pearson Correlation	.513**	.498**	.505**	.302**	.549**	.550**	.399**	.632**	.567**	.436**
	Sig.(2-tailed)	.000	.000	.000	.001	.000	.000	.000	.000	.000	.000
	N	119	119	119	119	119	119	119	119	119	119
Course Work	Pearson Correlation	.558**	.632**	.490**	.307**	.700**	.684**	.477**	.811**	.581**	.49**
	Sig.(2-tailed)	.000	.000	.000	.001	.000	.000	.000	.000	.000	.000
	N	119	119	119	119	119	119	119	119	119	119

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 6.8 shows a positive significant correlation between students' achievement (exam and coursework) and their use of WebCT in module three.

The previous results are summarised in table 6.9.

Table 6. 9: Summary of the results

Hypotheses		Significant		
	Learner dimension	**M1**	**M2**	**M3**
H1	The learner dimension will positively influence the students' attitude towards using WebCT in their courses.	YES		YES
H2	The learner dimension will positively influence the students' achievement.	YES	YES	
H3	The learner dimension will positively influence the students' way of using WebCT.	YES	YES	
	Instructor dimension			
H4	The instructor dimension will positively influence the students' attitude towards using WebCT in their courses.	YES	YES	
H5	The instructor dimension will positively influence the students' achievement.	YES		
H6	The instructor dimension will positively influence the students' way of using WebCT.			
	Technology dimension			
H7	The technology dimension will positively influence the students' attitude towards using WebCT in their courses.	YES	YES	YES
H8	The technology dimension will positively influence the students' achievement.			
H9	The technology dimension will positively influence the students' way of using WebCT.		YES	
H10	H10: There is a significant positive relationship between students' activities on WebCT and their achievement	YES	YES	YES

6.6 Discussion

The purpose of this study was to develop a model of the critical factors influencing use of a course management system (WebCT) by undergraduate students. Moreover, the study aimed to investigate the relationship between the independent model variables (Learner, instructor, and technology dimensions) and the dependent variables (student attitudes toward using WebCT, their achievement, and their way

of using WebCT). The discussion will mainly be based on the significant correlation relationships that were found between the variables. Next is a diagram that shows the significant relationships that been found between the study framework variables (figure 6.25).

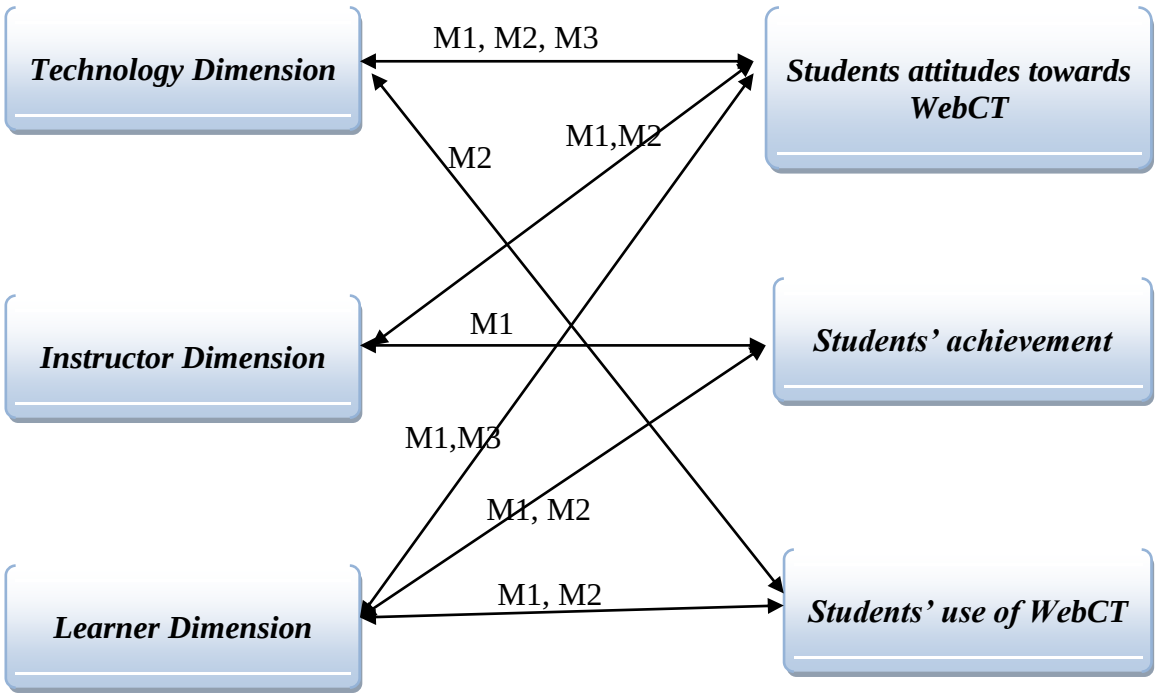

Figure 6. 25: The significant relationship in the study framework

6.6.1 Attitude

The results showed that students have a positive attitude towards using a course management system (WebCT) on their courses. The technology dimension was found to correlate significantly with students' attitudes towards using WebCT. This result was also found to be true on the three courses that were observed as part of this study. The technology dimension is the students' perception of the usefulness, ease of use, flexibility, and the quality of the course management system that have been used to support their courses. The positive correlation implies that the higher scores on the technology dimension tend to go with a higher positive attitude toward using WebCT. This finding is similar to the findings of Bangert (2005); he found that flexibility of accessing web-based courses at anytime from anywhere is appreciated by students. Using WebCT keeps students up to date with new

information in the course content. Also this result indicates that the more students find the system easy to use and useful, the more positive attitude they have towards using it. The students prefer to use WebCT more when they think it is a clearly an easy system and it is a system where they can find the information they need without difficulty. Several studies have found similar results such as (Minton & Willett 2003; Matuga 2001; Jurczyk et al. 2004; Collins 2000; Hong et al. 2003; Lee & Shih 2001).

The instructor dimension was found to significantly correlate with students' attitudes towards using WebCT in two of the observed courses (M1 and M2) positively. The instructor dimension has three factors: technical competence of the instructor, the instructor's way of presenting materials on WebCT, and the interaction between students and their instructors. The importance of instructor interaction with students can be found in previous studies. Swan (2001) stated that the frequency of instructor interaction with students has a significant effect on the success of online courses. The results from this study suggest that students' attitudes toward using WebCT have been affected by their module leaders' way of presenting material on WebCT and their technical competence, and the student-instructor interaction. The affect of instructors' activities on web-based courses on students' attitude towards using the system can be found in Sun et al. (2008). They stated that learner satisfaction toward e-Learning activities can be affected by their instructors' attitudes in handling these learning activities. This suggests that a less enthusiastic instructor or one with a negative view of e-Learning education should not expect to have students with high satisfaction or motivation. Students who had more interaction with an instructor and other classmates tended to be more satisfied with their Web courses (Kim & Moore, 2005).

The learner dimension was found to significantly correlate with students' attitudes towards using WebCT in two of the observed courses (M1 and M2) positively. The learner dimension has three factors which are students' interaction with their classmates, their capability of using the internet, and their capability of using WebCT. This means that students who have more experience using the internet and

WebCT tend to have a more positive attitude towards using WebCT. This result corresponds to the findings of Sun et al. (2008); they stated that students' computer experiences have an affect on their preference of using e-Learning courses. Related results were found by Arbaugh and Duray (2002); they stated that students who have previous experience in using the internet and on-line courses were found to be more satisfied with the course delivery medium.

6.6.2 Use of WebCT

The technology dimension was found to correlate significantly with students' use of WebCT in one of the observed courses (M2) positively. This means that WebCT usefulness, ease of use, flexibility and quality affect the students' use of WebCT. The more students feel that WebCT is flexible, useful and easy to use the more they use it. This backs up the finding of Davis (1989) whose Technology Acceptance Model describes that a person's behavioural intention concerning the use of an application is determined by perceived usefulness and perceived ease of use. Similarly, Felix (2001) found that the quality of the delivered information is highly essential and the instructor has to be sure of the level of the material quality going online.

The learner dimension was found to correlate significantly with the students' use of WebCT in two of the observed courses (M1 and M2) positively. This suggests that students who have experience using the internet and WebCT tend to use WebCT more often than those who do not. Moreover, students who appreciate student-student interaction via WebCT use WebCT more than those who do not. Similarly, Hong et al. (2003) stated that computer skills are found to be an important aspect for students' improvement in web-based courses. Computer science students accept WebCT more than other students because they are more familiar with the technology. Moreover, Kalifa and Lam (2002) stated that learner interaction with the web-based course is the most important aspect of the learning process.

6.6.3 Achievement

The instructor dimension was found to correlate significantly with the students' achievement in one (M1) of the observed courses positively. This suggests that module leaders' way of using WebCT and their interaction with the students affected the students' achievement. This finding backs up results arrived at by Thurmond et al. (2002). They stated that student achievement could be improved by multiple feedbacks from the instructor. Moreover, Hong et al. (2003) stated that training for module leaders may also be needed as this affects their way of posting information which is considered to be an important aspect affecting students' achievement.

The learner dimension was found to correlate significantly with the students' achievement in M1 and M2 positively. This indicates that students who have more experience using the internet and WebCT have achieved better marks that those who do not. In addition, students who appreciated the student-student interaction tend to achieve better than those who did not. This suggests that student-student interaction might affected the students' achievement which is similar to the result of the study by Hoskins and Hoof (2005); they found that there is a relationship between using the discussion board and student achievement. Similarly, Picciano (2002) indicated that there is a relationship between student interaction and achievement on a web-based course.

An important aspect of this study is the relationship between students' use of WebCT and student achievement. Analyzing the data from the tracking system showed a notable result regarding student achievement. First of all there is a positive significant relationship between the total use of WebCT (hits) and the students' grades, which suggests that students who visit WebCT more often get better grades. Visiting different pages within the module resources was found to have a positive significant relationship with student grades. This result is similar to the findings of Sayers et al. (2004). They found that students who used WebCT got slightly better grades than those who did not use it and they also found in the same study that using WebCT does not have a negative effect on written exam performance.

Furthermore, the results from the tracking system showed a positive relationship between the number of messages students read in the communication board and their

achievement. Students who read more messages got better grades. Reading the discussion board messages has a positive relationship with students' grades for exam and coursework. These correlations clearly show that using the bulletin board has a positive influence on student achievement. It can be concluded from these results that students who use the discussion board more may get better grades than those who do not. This result corresponds to the findings of Hoskins and Hooff (2005); they stated that it was extremely promising to find that the use of dialogue can influence the students' achievement in assessed coursework. Sayers et al. (2004) compared students' performance with and without the support of WebCT. The comparison showed that the students who used WebCT achieve slightly better results than the previous year students who did not have WebCT.

6.7 Chapter summary

Course management systems are widely used in universities and educational institutions. It is important to establish an appropriate framework for research to enhance the effectiveness of these systems. Many researchers have identified variables dealing with course management systems. Different systems have been studied and WebCT is one of the most used systems.

This study has presented a framework to understand the relationship between several variables related to web-enhanced courses using WebCT as a supporting tool. Firstly, this chapter started with a brief explanation of models and frameworks this study depended on. Then the framework for a new model was presented. This new framework has three dimensions: a technology dimension, an instructor dimension, and a learner dimension. These dimensions were measured using a questionnaire submitted to students at Brunel University. The framework also has three dependent variables: student attitude towards using WebCT, their achievement, and their use of WebCT. Student attitude towards using WebCT was measured by a questionnaire. Information about the students' use of WebCT was collected from the WebCT tracking system. In addition, students' achievement was measured by their grades in the coursework and exam. This study used information on three modules at different departments (Information Systems, Computing and Mathematics, and Business).

The relationships between the three dimensions and the dependent variables were tested. First, the students' attitude towards using WebCT was found to have a positive relationship with the three dimensions of the framework. The students' achievement was found to have positive relationship with the instructor and learner dimensions. In addition, students' use of WebCT was found to have positive relationship with the technology and learner dimensions.

Overall, the positive results from this study led to the development of a new framework that can be used to explain the complex relationship between the success factors of web-enhanced courses.

The following chapter is a summary of the finding of the research work of this thesis. Moreover, the next chapter will talk about the research contributions f this thesis, its limitations, and suggestions for future work.

Chapter 7

Discussion and conclusion

7.1 Introduction

Teaching and learning are no longer limited by place or time. A large number of educational institutions are offering web-based courses or course management systems such as WebCT or Blackboard. Interaction is central in teaching and learning; the learning process is based on student interaction with instructors, other students, and with the course content. At the same time, communication and collaboration between students and instructors can be enhanced by the internet and WWW. Students' attitudes towards web-based learning are important in determining the effectiveness of web-based courses. The body of literature on web-based learning is large and growing. However, research dealing with factors that influence the success of web-enhanced courses and the relationship between these factors is limited. Most of the studies in the literature are based on comparing students' performance and attitude with and without using WebCT. The effectiveness of web-based learning remains to be examined and research is needed to find out if there is a relationship between specific aspects of the online environment and students' achievement.

The purpose of this research has been to investigate the use of a web-based tool on undergraduate courses and to examine factors that affect students' attitudes and performance on such courses and to find the relationship between these factors.

Three studies were carried out to achieve the stated aim of this research thesis. Different courses and groups of students were observed for each study to explore the use of WebCT in different subject areas. In terms of methodological design, a mixed methods design was used in the studies reported in this thesis. Using in-field design enables the results to be generalized. The richness and complexity of a web-based learning environment can be captured and understood to greater potential by mixing methods rather than using a single approach (Owston, 2000). Data from participants were collected via a number of instruments such as questionnaires, interviews, a cognitive style analysis test, and numerical data from the WebCT tracking system.

The following is a summary of the main findings of the in field studies reported in this thesis.

7.2 Summary of the studies findings

Three studies were carried out as presented below.

7.2.1 Students' attitudes and performance when using WebCT to support their courses in relation to their module leaders' attitude towards WebCT

The research work reported in chapter 4 of the thesis investigated the influence of module leaders' attitudes towards using WebCT on the students' attitudes and performance in these courses. The main finding from this study was that a module leader's attitude toward using WebCT has a significant effect on students' attitudes towards WebCT and the use of WebCT. Students had a more positive attitude towards using WebCT when the module leader had a positive attitude towards it. The results suggested that lecturers on courses supported by a course management system should find methods to encourage students to use the system (WebCT in this case) and to communicate through its interaction tools. One method is to encourage students to use WebCT by providing online feedback and observing students' communications and trying to answer their questions in a timely manner.

In this study, data were collected from undergraduate students doing a course in Information Systems. Two of their modules were observed and used in this research. The data that was gathered in this study was comparative so the students' attitude towards WebCT on each module could be measured and compared. The data obtained from the WebCT log files indicated that at the beginning of the semester, students used WebCT for both modules in a similar way. As the semester progressed, their use of WebCT began to vary until they started to visit WebCT pages for one module more than the other. There is not a single reason that explains this behaviour. For example, the statistically significant differences in students' attitudes towards WebCT and the module leaders' ways of using are shown to be essential factors in this behaviour. Students had more positive attitudes towards one module and they preferred to use WebCT in that module more than the other module. One module leader's negative attitude towards WebCT affected student attitude which resulted in fewer visits to WebCT for that module. A similar conclusion has been made by Sun et al. (2009); they stated that instructors' attitudes toward e-learning have a significant effect on e-learners' satisfaction.

In related research, Mahdizadeh et al. (2008) studied factors that influence teachers' use of different functions and capabilities of e-learning environments. They noted that teachers' perception of e-learning directly influence the actual use of an e-learning environment. Module leaders' attitudes towards WebCT may have affected the students way of using it. As stated in Mahdizadeh et al. (2008) teachers' attitudes and opinions about web-based learning activities are effective in shaping the students attitude toward the e-learning environment. There was one main difference between the module leaders' ways of using WebCT in this first study, which is the use of the communication board. One of the module leaders of the observed modules for this research did not set up a communication board for his module. The absence of the discussion board resulted in fewer student-to-student and student-to-instructor communications. Consequently, students did not have to access WebCT to communicate with their classmates or module leader. This behaviour is one of the reasons that caused the differences between students' attitudes and the use of WebCT in the two observed modules. This result supports Kim and Moore's (2005) research findings. They stated that there is a strong connection between students' interaction and their satisfaction with a web-based course. Students who

communicate well are more likely to have a clear understanding of each other and learning materials and become more involved in the learning process for that module.

7.2.2 The relationship between students' cognitive styles and their attitude and performance on a WebCT course.

As the aim of this research was to investigate factors that affect student attitude and performance on web-enhanced courses, another factor has been investigated as part of this thesis was cognitive style (reported in chapter 5 of this thesis). This second study investigated the relationship between students' cognitive styles, their satisfaction, achievement, and their way of using a web-based course. To achieve the aim of the study, data were collected from undergraduate students during term time. Students' cognitive styles were measured using a cognitive style analysis test (CSA) and their attitudes measured by using a questionnaire on attitude. Cognitive style was not found to be a factor that has a significant influence on student attitude towards using WebCT, nor to their way of using the system. The students' attitudes towards using WebCT on their courses were found to be positive. There were differences between students' attitudes towards WebCT according to their cognitive style; however these differences were not statistically significant. Students were found to have a positive attitude towards WebCT and to use WebCT efficiently despite cognitive style. Therefore, the results obtained from this study suggest that students are able to use WebCT successfully regardless of their cognitive style. Based on this, the results of the study did not provide evidence that there is a relationship between students' cognitive styles and their attitude towards WebCT. A similar conclusion can be found in previous studies such as Summerville, 1998; Johnson et al., 2006; Cook at al., 2007.

Additionally, no relationship was found between students' cognitive styles and students' ways of using WebCT (e.g. the number of times each student visited WebCT, time spent, number of pages visited, and posted or read messages). WebCT page contents were mainly text files and web links. Also, no relationship was found between students' cognitive styles and their achievement in the observed module. These results support the findings from studies such as Lu et al., (2003); Cook et al.,

(2007). Lu et al. (2003) stated that students' cognitive style does not have an impact on their learning performance in WebCT. Cook et al. (2007) stated that cognitive and learning styles had no apparent influence on learning outcomes. In other words, students with different cognitive styles are able to learn equally well on WebCT online courses.

7.2.3 The relationship between main success factors in web-enhanced course

The final study that was aimed to achieve the aim of this research is presented in chapter 6. The study was developed and designed based on the results of the first two studies (presented in chapters 4 and 5). The objective of the study was to develop a framework for the critical factors influencing the use of a course management system (WebCT) by undergraduate students. Furthermore the study aimed to investigate the relationship between the framework variables. The variables were determined generally from the background research in the area and specifically from the results of the first two studies presented in this thesis. The study framework consisted of three main dimensions with ten variables involving the technology dimension, instructor dimension, and learner dimension. The learner dimension has three factors which are: students' interaction with their classmates, students' capability of using the internet, and the students' capability of using WebCT. The instructor dimension consisted of three factors which are: the technical competence of the instructor, the instructor's way of presenting materials on WebCT, and interaction between students and their instructor. The technology dimension consisted of the following factors: usefulness, ease of use, flexibility, and quality. The study was deigned to investigate the relationship between the framework's three dimensions and students' attitudes towards WebCT, their achievement in the observed modules, and their use of WebCT tools. In order to achieve the aim of the study, three groups of students from different subject areas were observed. The results indicated, that students' attitude towards using WebCT was found to have a positive relationship with the three dimensions of the framework. The students' achievement was found to have positive relationship with the instructor and learner dimensions. In addition, students' use of WebCT was found to have positive relationship with the technology and learner dimensions. A detailed explanation of the main findings is given below.

7.2.3.1 Attitude

The results suggest that students have a positive attitude towards using a course management system (WebCT) on their courses. In the third study, the technology dimension was found to correlate significantly with students' attitudes towards using WebCT. The technology dimension is the students' perception of the usefulness, ease of use, flexibility, and the quality of the course management system that have been used to support their courses. The significant positive correlation obtained here, implies that higher scores on the technology dimension tend to go with a more positive attitude towards using WebCT. This finding is partly similar to the findings of Bangert (2005); he found that flexibility of accessing web-based courses at anytime from anywhere is appreciated by students. Using WebCT keeps students up to date with new information in relation to course content. Moreover, course quality was found to be associated with students' positive attitude towards using WebCT. Similarly, Felix (2001) found that the quality of the delivered information is essential and the instructor has to be sure of the quality of the material going online. This result also indicates that the more students find the system easy to use and useful, the more positive an attitude they have towards using it. Students prefer to use WebCT more when they think it is a clear and easy system to use and it is a system where they can find the information they need without difficulty. Several studies have found similar results such as (Minton & Willett 2003; Matuga 2001; Jurczyk et al. 2004; Collins 2000; Hong et al. 2003; Lee & Shih 2001).

The instructor dimension was found to correlate positively and significantly with students' attitudes towards using WebCT. The instructor dimension has three factors: technical competence of the instructor, the instructor's way of presenting materials on WebCT, and the interaction between students and their instructors. Swan (2001) stated that the frequency of instructor interaction with students has a significant effect on the success of online courses. The results from this study suggest that students' attitudes toward using WebCT have been affected by their module leader's way of presenting material on WebCT and their technical competence, and also the student-instructor interaction. The affect of instructors' activities on web-based course on students' attitudes towards using the system can be found in Sun et al. (2008). They stated that learner satisfaction toward e-Learning activities can be

affected by their instructors' attitudes in handling these learning activities. This suggests that a less enthusiastic instructor or an instructor with a negative view of e-Learning education should not expect to gain high satisfaction or motivation in their students. Students who had more interaction with an instructor and other classmates tended to be more satisfied with their Web courses as also reported in Kim & Moore (2005).

The learner dimension was found to correlate significantly and positively with students' attitudes towards using WebCT. The learner dimension has three factors which are: students' interaction with their classmates, their capability in using the internet, and their capability in using WebCT. This means that students who have more experience in using the internet and WebCT tend to have a more positive attitude towards using WebCT. This result corresponds to the findings of Sun et al. (2008); they stated that students' computer experience has an affect on their preference in using e-Learning courses. Related results were found by Arbaugh and Duray (2002); they stated that students who have previous experience in using the internet and on-line courses were found to be more satisfied with the course delivery medium.

7.2.3.2 Use of WebCT

The technology dimension was found to correlate significantly and positively with students' use of WebCT. This means that WebCT usefulness, ease of use, flexibility and quality affect the students' use of WebCT. The more the students feel that WebCT is flexible, useful and easy to use, the more they use it. This backs up the finding of Davis (1989) whose Technology Acceptance Model describes that a person's behavioural intention concerning the use of an application is determined by perceived usefulness and perceived ease of use. Similarly, Felix (2001) found that the quality of the delivered information is essential and the instructor has to be sure of the quality of the material going online.

The learner dimension was found to correlate significantly and positively with the students' use of WebCT. This suggests that students who have experience in using the internet and WebCT tend to use WebCT more often than those who do not.

Moreover, students who appreciate student-student interaction via WebCT use WebCT more than those who do not. Similarly, Hong et al. (2003) stated that computer skills are found to be an important aspect for students' improvement in web-based courses. Computer science students accept WebCT more than other students because they are more familiar with the technology. Moreover, Kalifa and Lam (2002) stated that learner interaction with the web-based course is the most important aspect of the learning process.

7.2.3.3 Achievement

The instructor dimension was found to correlate significantly and positively with the students' achievement (students' coursework and exam marks). This suggests that the module leaders' way of using WebCT and their interaction with the students affected students' achievement. This finding backs up results reached by Thurmond et al. (2002). They stated that student achievement could be improved by multiple feedbacks from the instructor. Moreover, Hong et al. (2003) stated that training for module leaders may also be needed as this affects their way of posting information which is considered to be an important aspect affecting students' achievement.

The learner dimension was found to correlate significantly and positively with the students' achievement. This indicates that students who have more experience using the internet and WebCT achieved better marks that those who do not. In addition, students who appreciated the student-student interaction tend to achieve better than those who did not. This suggests that student-student interaction affected students' achievement which is similar to the result of the study by Hoskins and Hoof (2005); they found that there is a relationship between using the discussion board and student achievement. Similarly, Picciano (2002) indicated that there is a relationship between student interaction and achievement on a web-based course.

7.2.3.4 The relationship between students' use of WebCT and their achievement

An important aspect of this study is the relationship between students' use of WebCT and student achievement. Analyzing the data from the tracking system showed a notable result regarding student achievement. First of all there is a positive significant relationship between the total use of WebCT (hits) and the students'

grades, which suggests that students who visit WebCT more often get better grades. Visiting different pages within the module resources was found to have a positive significant relationship with student grades. This result is similar to the findings of Sayers et al. (2004). They found that students who used WebCT got slightly better grades than those who did not use it and they also found in the same study that using WebCT does not have a negative effect on written exam performance.

Furthermore, the results from the tracking system indicated a positive relationship between the number of messages students read in the communication board and their achievement. Students who read more messages got better grades. Reading the discussion board messages has a positive relationship with students' grades for exams and coursework. These correlations clearly show that using the bulletin board has a positive influence on student achievement. It can be concluded from these results that students who use the discussion board more may get better grades than those who do not. This result corresponds to the findings of Hoskins and Hooff (2005); they stated that it was extremely promising to find that the use of dialogue can influence the students' achievement in assessed coursework.

Course management systems are widely used in universities and educational institutions. It is important to establish an appropriate framework for research to enhance the effectiveness of these systems. Many researchers have identified variables dealing with course management systems. Different systems have been studied and WebCT is one of the most used systems.

7.3 Originality of the research

There are studies in the literature investigating the relationship between instructor behaviour and the learner satisfaction in web-based courses. The originality of the first study, in chapter 4, is the idea of observing a number of modules and module leaders' behaviour and attitude on a web-enhanced course and finding its impact on students. The literature does not report such a study that gives the opportunity to the researcher to compare between different courses and module leaders behaviour and attitude towards using an online learning environment.

Likewise, the work discussed in chapter 6 of this thesis presents a framework that been developed to understand the relationship between main success factors in web-enhanced courses. The framework is original and has not been presented in any previous research studies. The strength of the study is the evaluation process that was carried out after designing the framework.

One of the main characteristics distinguishing this research from that reported in the literature is the methodological approach. This research depended on quantitative and qualitative data that have been collected from participants. The unique feature is that the quantitative data for this work were gathered from the log file of the system which explained exactly how students used WebCT. These data allowed the researcher to compare students' and module leaders' attitude towards the system and how they actually used the system. Moreover, it gave the possibility to support the results that were concluded from qualitative work by this type of quantitative data.

7.4 Limitations of the study

This thesis used a mixture of qualitative and quantitative methodology. Three forms of data were used: questionnaire, interview and field study. For example, the purpose of using a questionnaire was because it can feel natural for participants to complete, and maintains the respondents' direct involvement (Coolican, 2004). However, as a questionnaire may not provide rich enough feedback from participants, log file data were used to capture more thoroughly the students' way of using WebCT.

For the first study, reported in chapter 4, the differences between students' grades in the exam and coursework could not be fully explained on the basis of the data collected for the study. Therefore more data could be gathered from more than two modules to get a better understanding of the results. Additionally, the study showed a positive relationship between students' activities on WebCT and their achievement. However, there is no strong evidence in the study to confirm that students' grades have been affected by their module leader's way of using WebCT.

In the second study, reported in chapter 5, the difficulty of using WebCT may not have been sufficient enough to distinguish a difference between students; they may have automatically adapted to the use of WebCT regardless of their cognitive styles.

In the third study, reported in chapter 6, no relationship has been found between the Technology Dimension and the students' achievement nor between the Instructor Dimension and the students' use of WebCT. Based on the background research these relationships were predicted to be significant. The study lacks the necessary data to explain such results that are not significant. Part of this limitation could be overcome by interviewing students and module leaders.

It could be argued that laboratory studies might have been employed in studies 1, 2 and 3 instead of the field studies. In laboratory study the variables can be controlled more than in a field study which may have resulted in a better understanding of the relationship between the variables. However, it is unlikely that this approach would have provided a better understanding of the real way of using a course management system in an undergraduate course.

Another limitation of this research is that the sample size used in this research is not large. In the first study only 29 students and 2 module leaders participated in the study. In the second study 51 students participated in the study and 120 students participated in the third study. A small sample size may increase the chance of a few data points having a large effect on the outcome. A larger sample size would have provided more data. Furthermore, the studies that were undertaken in this research could benefit from observing all the modules on a number of courses and comparing the results. However, such research needs a team of researchers and should be performed over a long period of time (e.g. one or two academic years).

One of the limitations of this research is the content of modules in the studies. The studies were based on selecting modules from undergraduate courses in Information Systems, Computing and Mathematics and Business. This affects the generalization of the study results as there is a large number of subjects that have not been studied and the results may vary depending on the course content.

Only WebCT had been studied as the course supporting tool in this thesis. This may cause uncertainty in generalizing the results into other course management systems. However, most available course management systems have the same features such as: posting announcements, learning materials; asynchronous online students-tutors and student-student communication; electronic submission of assignments; setting and taking of online assessments with automatic marking and feedback facilities; recording of student grades in a secure environment; tracking of student progress.

7.5 Future work

In the first instance more research is required to confirm the findings of these studies, and this should be carried out on a larger number of students. A relevant future study would be one with qualitative interviews with students and instructors regarding the three dimensions discussed in the final study. These data would be valuable in constructing an in-depth understanding of the relationship between the framework variables. For example, future work would benefit from obtaining information on the students' opinions about the course management tools and why they use or do not use these tools.

Over the course of this PhD research, a number of course management systems have appeared on the market. These systems are being widely used in higher education. Course management systems generally have similar functions and tools. A future study could apply the framework that has been developed in this thesis to other course management systems to find out if the relationships between the variables vary when a different course management system is used.

The study described in chapter 4 of this thesis has the potential to be applied on a larger scale. The study investigated the influence of module leaders' attitudes towards WebCT in comparison to students' attitudes and performance on a course supported by WebCT. A future study could use the same mixed approach methods and apply it to a larger number of courses that were supported by a course management system. Such a study could produce a set of practical suggestions to instructors and institutes on how to apply a course management system effectively.

7.6 Chapter summary

This chapter has discussed the main findings of the research work that was undertaken to achieve the aim of this PhD research thesis. A thorough discussion of the main finding has been presented. In addition, the originality of this research has been illustrated. Finally, the limitations and future work were discussed.

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Appendix 1

Module leaders' interview questions

1. Would you please tell me about your experience in using WebCT in this module? Are you satisfied with it? Why?
2. Was the use of WebCT for this module helpful (for you as teacher and for the students as learners)? Why?
3. Which tools did you like to use on WebCT for this module and which not?
4. Which do you think had more influence on student performance and learning?
5. If you want something to be changed in WebCT for your module what would it be?
6. Did you have problems/difficulties using WebCT this semester? Did you need help in using WebCT this semester? If so, whom did you ask for help?
7. What do you think might affect the students learning in face-to-face classes supported by web course tool, WebCT?
8. Do you think that the time of the lecture is enough to teach the students all needed information for the module; and to answer the students' questions?
9. Don't you think that the availability of WebCT could help you to pass all needed material to the students?
10. What is your opinion on student discussions with each other?
11. What do you think of the discussion board in general?
12. As all of the module material available online, do you think that the students have opportunity to pass the exams even if they miss the lectures?
13. Have you achieved the course outcomes (by the help of) using the WebCT or do you think it is not affecting the learning outcomes of the course?
14. How many years have you been teaching this course, with and without WebCT?
15. The exams papers for the last 4 years are different? Do you know if the course contents are the same for the last 4 or 5 years?

Appendix 2

Students Questionnaire for .....

The purpose of this questionnaire is to assess the students' use of WebCT or Vista on module ..... **The information you give will be entirely confidential** and will not be shared with the module leader or any other university staff. Please answer honestly and as accurately as you can. Please answer the questions **based on you experience of using WebCT or Vista just on X module.** Your contribution is much appreciated.

- Name: _ _ __ _ __ _ __ _ __ _ __ _ __ _ __ _ _
- ID number: _ _ __ _ __ _ __ _ __ _ __ _ __ _ _
- Gender: _ _ __ _ __ _ __ _ __ _ __ _ __ _ __ _
- Date of birth: _ _ __ _ __ _ __ _ __ _ __ _ __ _
- How many years have you been using WebCT or Vista? __ _ _ ___ _ _ ___ _

Please choose the one most appropriate response to each statement.

1. The module leader presented the material in an interesting and helpful manner on WebCT for this module.

   - ❑ Strongly agree
   - ❑ Agree
   - ❑ Neither agree or disagree
   - ❑ Strongly disagree
   - ❑ Not applicable

2. The discussion board was used effectively in this module

   - ❑ Strongly agree
   - ❑ Agree
   - ❑ Neither agree or disagree
   - ❑ Strongly disagree
   - ❑ Not applicable

3. The fact that I had to use WebCT for this module is a source of annoyance to me.

   - ❑ Strongly agree
   - ❑ Agree
   - ❑ Neither agree or disagree
   - ❑ Strongly disagree
   - ❑ Not applicable

4. WebCT helped me to achieve the learning outcome for this module.

   - ❑ Strongly agree
   - ❑ Agree
   - ❑ Neither agree or disagree
   - ❑ Strongly disagree
   - ❑ Not applicable

5. The amount of time required for WebCT use in this module was excessive.

   - ❑ Strongly agree
   - ❑ Agree
   - ❑ Neither agree or disagree
   - ❑ Strongly disagree
   - ❑ Not applicable

6. Using WebCT in this module increased my opportunity to pass this module's coursework assessment.

   - ❑ Strongly agree
   - ❑ Agree
   - ❑ Neither agree or disagree
   - ❑ Strongly disagree
   - ❑ Not applicable

7. Using WebCT in this module kept my interest engaged in the subject.

   - ❑ Strongly agree
   - ❑ Agree
   - ❑ Neither agree or disagree
   - ❑ Strongly disagree
   - ❑ Not applicable

8. Using WebCT in this module helped me to learn the subject more quickly.

   - ❑ Strongly agree
   - ❑ Agree
   - ❑ Neither agree or disagree
   - ❑ Strongly disagree
   - ❑ Not applicable

9. Having to use WebCT in this module changed how I learn.

   - ❑ Strongly agree
   - ❑ Agree
   - ❑ Neither agree or disagree
   - ❑ Strongly disagree
   - ❑ Not applicable

10. WebCT made it difficult to know what was expected of me in this module.

    - ❑ Strongly agree
    - ❑ Agree
    - ❑ Neither agree or disagree
    - ❑ Strongly disagree
    - ❑ Not applicable

11. I would recommend that this module continues using WebCT.

- ❑ Strongly agree
- ❑ Agree
- ❑ Neither agree or disagree
- ❑ Strongly disagree
- ❑ Not applicable

12. I would like to have more interaction with the module leader of this module through WebCT.

- ❑ Strongly agree
- ❑ Agree
- ❑ Neither agree or disagree
- ❑ Strongly disagree
- ❑ Not applicable

13. I would like to have more interaction with other students of this module through WebCT.

- ❑ Strongly agree
- ❑ Agree
- ❑ Neither agree or disagree
- ❑ Strongly disagree
- ❑ Not applicable

14. I can pass the exam and do all the assignments for this module without using WebCT.

- ❑ Strongly agree
- ❑ Agree
- ❑ Neither agree or disagree
- ❑ Strongly disagree
- ❑ Not applicable

15. I can pass the exam and do all the assignments for this module without attending the lectures.

- ❑ Strongly agree
- ❑ Agree
- ❑ Neither agree or disagree
- ❑ Strongly disagree
- ❑ Not applicable

16. Sufficient online resources were available for this module.

- ❑ Strongly agree
- ❑ Agree
- ❑ Neither agree or disagree
- ❑ Strongly disagree
- ❑ Not applicable

17. WebCT for this module were easy to use.

- ❑ Strongly agree
- ❑ Agree
- ❑ Neither agree or disagree
- ❑ Strongly disagree
- ❑ Not applicable

18. I needed help to use WebCT in this module.

- ❑ Strongly agree
- ❑ Agree
- ❑ Neither agree or disagree
- ❑ Strongly disagree
- ❑ Not applicable

Please explain you answer

19. Do you think that you were in control of your learning in this module because of WebCT? (please explain your answer)

- ❑ Yes
- ❑ No

20. The module leader's way of using WebCT tools in this module affected my use of WebCT in this module

    - ❑ Strongly agree
    - ❑ Agree
    - ❑ Neither agree or disagree
    - ❑ Strongly disagree
    - ❑ Not applicable

Please explain your answer:

21. Did you have any technical problems with WebCT or vista? (please check what applicable)

    - ❑ Logging on WebCT
    - ❑ Submitting assignment
    - ❑ Posting/replaying on discussion board
    - ❑ Did not have any problem
    - ❑ Other (please explain)

Thank you for your response

Appendix 3

Students' questionnaire for: .....

The information you give will be kept confidential and will not be shared with the module leader or any other member of university staff. Please answer honestly and as accurately as you can. Please answer the questions based on your experience of using U-link in general unless the question indicates different. Your contribution to this research is much appreciated.

- **ID number**: ……

On a Scale of 1 to 5 indicate with an X how strongly you Agree or Disagree with each statement.

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.	U-link's discussion board is an efficient way to communicate with other students.	1 □	2 □	3 □	4 □	5 □
2.	It is difficult to communicate with other students using U-link tools.	1 □	2 □	3 □	4 □	5 □
3.	I need more encouragement to motivate me to put time and effort into online discussions.	1 □	2 □	3 □	4 □	5 □
4.	Having access to other students' questions encourages me to post my questions.	1 □	2 □	3 □	4 □	5 □
5.	Other students' posts on the discussion board helped me to understand the topic.	1 □	2 □	3 □	4 □	5 □
6.	I would like my classmates to participate more in the discussion board for this module	1 □	2 □	3 □	4 □	5 □
7.	I felt comfortable when using the discussion board on this module via the discussion board.	1 □	2 □	3 □	4 □	5 □
8.	The quality of the discussion with my classmates via the discussion board is good.	1 □	2 □	3 □	4 □	5 □
9.	I would have participated more through the discussion board if the participation was anonymous.	1 □	2 □	3 □	4 □	5 □
10.	In general, it is easy to use U-link.	1 □	2 □	3 □	4 □	5 □
11.	I find it difficult to find course materials on U-link.	1 □	2 □	3 □	4 □	5 □

		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
12.	The availability of the Specimen Computer Based Tests on U-link made me more prepared for the tests.	1 □	2 □	3 □	4 □	5 □
13.	The availability of seminars problem sheets on u-link allowed me to participate regularly and actively on the course.	1 □	2 □	3 □	4 □	5 □
14.	I prefer the traditional face-to-face way of delivering course materials (lecture notes, past exam papers, study guide, and reading materials)	1 □	2 □	3 □	4 □	5 □
15.	The availability of the lecture notes on U-link helped me stay on schedule with my course work.	1 □	2 □	3 □	4 □	5 □
16.	There is no benefit of having the study guide on U-link.	1 □	2 □	3 □	4 □	5 □
17.	I believe that I can pass the exam and do all the assignments for this module without using U-link.	1 □	2 □	3 □	4 □	5 □
18.	The availability of the assignments, solutions and marking schemes helped me to understand the topic and prepare for the exam.	1 □	2 □	3 □	4 □	5 □
19.	It is difficult to communicate with the module leader through the U-link tools.	1 □	2 □	3 □	4 □	5 □
20.	I prefer to email my questions to the module leader than using the discussion board.	1 □	2 □	3 □	4 □	5 □
21.	The module leader presents the materials in helpful manner on U-link for this module.	1 □	2 □	3 □	4 □	5 □
22.	The module leader used the announcement tool in a useful way.	1 □	2 □	3 □	4 □	5 □
23.	The lecturer responding to the students' questions in a timely manner motivated me to post my questions on the discussion board.	1 □	2 □	3 □	4 □	5 □
24.	I am satisfied with the quality of feedback provided by the module leader for this module.	1 □	2 □	3 □	4 □	5 □
25.	I would recommend using U-link to support all the courses at Brunel university.	1 □	2 □	3 □	4 □	5 □

26. Please use the space below to write down any comments you have about your U-link experience that was not covered in this survey.

Thank you

Appendix 4

Questionnaire test

Thank you for testing the questionnaire items!

The questionnaire we are currently developing is designed to assess factors that affect learner's satisfaction with web-enhanced courses. Web-enhanced courses are traditional face-to-face courses which include web-related materials. Web-enhanced courses usually adopt a course management system such as WebCT. The following questionnaire is designed to investigate factors that affect learners' satisfaction towards WebCT (U-link at Brunel University). In our study participants have to use WebCT in all their modules. They get their learning materials, labs and seminar notes from WebCT. Moreover they have to submit their coursework via WebCT.
This questionnaire aims to investigate the following factors:

1. **Technology dimension**
    - Perceived ease of use (ease of access, navigate, and interact)
    - Perceived usefulness
    - Reliability
    - Quality
2. **Instructor dimension**
    - Instructor attitude towards U-link
    - Instructor technical ability
    - Instructor interaction with students
3. **Learner dimensions**
    - Students' capability of using the internet
    - Students' interaction with others (Students, content, and instructor).
4. **Students' attitude towards WebCT**

Please rate the following questionnaire items on how it measures their underlying construct.
(If you have specific comments on particular questions, these can be raised below this section of the test.)

Items	Essential	Useful, but not essential	Not necessary
Technology dimension			
1. It is hard to find the information I am looking for when using U-link			
2. U-link needs a lot of improvement			

3. U-link allows me to cover the module content in details			
4. The communication software in U-link enables me to interact directly with my instructor			
5. The communication software in U-link enables me to interact directly with other students in the module			
6. U-link allows me to feel better prepared for the module requirements.			
7. I feel the information technologies used in U-link are easy to use			
8. I feel the information technologies used in U-link have many useful functions			
9. I am happy that I can access the course materials anytime from anyplace			
10. Having U-link to support face-to-face lectures improved the quality of the course			
Instructor dimension			
11. The instructor was able to help me to overcome any technical problems when using U-link			
12. I received comments on assignments or examinations for this course in a timely manner.			
13. I received responses to my questions in a timely manner from the instructor			
14. Receiving responses to my questions in timely manners motivated me to use the communication board.			
15. The instructor regularly monitored the discussions			
16. I was satisfied with the quality of interaction with the instructor			
17. The module leader presented the material in an interesting and helpful manner on U-link for this module			
18. I would like to have more interaction with the module			

leader through U-link			
19. Sufficient online resources were available for this module			
Learner dimension			
20. I feel confident locating necessary information on the Internet for a specific topic			
21. I feel confident printing materials from the Internet.			
22. Using the discussion board made me communicate with my fellow students more that I would in a traditional face-to-face course.			
23. There were sufficient opportunities to interact with classmates via U link			
24. I was satisfied with the level of interactivity with classmates in the course			
25. Having access to other students questions and answers in the communication board helped in answering my questions			
26. Having access to other students discussions helped me to understand the topics covered in this module			
27. Having classmates reply to my discussion topics was helpful			
Students attitude towards WebCT			
28. I believe that using U-link is difficult			
29. I believe that using U-link requires technical ability			
30. I believe that using U-link is only advisable for people with a lot of patience			
31. I believe that using U-link helps me to obtain good grades			
32. I enjoy using U-link in my course			
33. The fact that I had to use U-link for this module is a source of annoyance to me			
34. U-link helped me to achieve the learning outcomes for this module			

35. The amount of time required for U-link used in this module was excessive			
36. Using U-link in this module increased my opportunity to pass this module's coursework assessment			
37. Using U-link in this module kept my interest engaged in the subject			
38. Using U-link in this module helped me to learn the subject thoroughly			
39. U-link made it difficult to know what was expected of me in this module			

If you would like to add questionnaire items or think that some questionnaire items are in need of further clarification or improvement please tell us. *When commenting, please use the number of the question for easier identification.*

Please describe any further points that you would like to make with regard to this questionnaire here:

Thank you very much for testing the constructs of this questionnaire!

Appendix 5

Student questionnaire

The purpose of this questionnaire is to assess the students' use of U-link on module, X. **The information you give will be entirely confidential** and will not be shared with the module leader or any other university staff. Please answer honestly and as accurately as you can. Please answer the questions **based on your experience of using U-link on X**. Your contribution is much appreciated.

Name:

Student ID number: *

Gender:

On a Scale of 1 to 5 indicate with an X how strongly you Agree or Disagree with each statement

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1.	2.	3.	4.	5.

1. **It is hard to find the information I am looking for when using U-link**

1. 2. 3. 4. 5.

2. **U-link allows me to cover the module content in details**

1. 2. 3. 4. 5.

3. **The communication software in U-link enables me to interact directly with my instructor**

1. 2. 3. 4. 5.

4. **The communication software in U-link enables me to interact directly with classmates in the module**

1. 2. 3. 4. 5.

5. **U-link did not help me to prepare myself for the module requirements.**

1. 2. 3. 4. 5.

6. **I find that U-link is hard to use**

1. 2. 3. 4. 5.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1.	2.	3.	4.	5.

7. I find that U-link has many useful functions

1. 2. 3. 4. 5.

8. I am happy that I can access the course materials anytime from anyplace

1. 2. 3. 4. 5.

9. Having U-link to support face-to-face lectures improved the quality of the course

1. 2. 3. 4. 5.

10. The module leader was not able to help me to overcome any technical problems when using U-link

1. 2. 3. 4. 5.

11. I received comments on assignments or examinations for this course from the module leader in a timely manner.

1. 2. 3. 4. 5.

12. I did not receive responses to my questions in a timely manner from the module leader

1. 2. 3. 4. 5.

13. I was not satisfied with the quality of interaction with the module leader

1. 2. 3. 4. 5.

14. The module leader presented the material in an interesting and helpful manner on U-link for this module

1. 2. 3. 4. 5.

15. I would like to have more interaction with the module leader through U-link than I had for this module.

1. 2. 3. 4. 5.

16. Sufficient online resources were available for this module on U-link.

1. 2. 3. 4. 5.

17. I find that using U-link is difficult

1. 2. 3. 4. 5.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1.	2.	3.	4.	5.

18. I would not recommend using U-link for other students.

1. 2. 3. 4. 5.

19. I find that using U-link helps me to obtain good grades.

1. 2. 3. 4. 5.

20. I enjoy using U-link on my course

1. 2. 3. 4. 5.

21. U-link helped me to achieve the learning outcomes for this module

1. 2. 3. 4. 5.

22. The amount of time required for U-link used in this module was excessive

1. 2. 3. 4. 5.

23. Using U-link in this module increased my ability to pass this module's coursework assessment

1. 2. 3. 4. 5.

24. Using U-link in this module kept my interest engaged in the subject

1. 2. 3. 4. 5.

25. Using U-link in this module helped me to learn the subject thoroughly

1. 2. 3. 4. 5.

26. Using u-link cost me time but improved my engagement and commitment to the module.

1. 2. 3. 4. 5.

27. Using the discussion board made me communicate with my classmates more than I would in a traditional face-to-face course.

1. 2. 3. 4. 5.

Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1.	2.	3.	4.	5.

28. I was not satisfied with the level of interactivity with classmates in the course

1. 2. 3. 4. 5.

29. Having access to other students' questions and answers on the communication board helped in answering my questions

1. 2. 3. 4. 5.

30. Having classmates reply to my discussion topics was helpful

1. 2. 3. 4. 5.

Thank you for your response

Appendix 6

Output data for study presented in chapter 4 is reported next.

Paired t-test results on the numbers of hits which represent students' total access to each module per week

		Mean A	Mean B	Std. Deviation	t	Sig. (2-tailed)
Pair 1	W1_B - W1_A	37.02	35.19	39.013	-0.535	0.593
Pair 2	W2_B - W2_A	56.06	47.10	41.822	-2.453	0.016*
Pair 3	W3_B - W3_A	68.69	58.89	43.614	-2.572	0.011*
Pair 4	W4_B - W4_A	81.26	69.07	44.980	-3.102	0.002**
Pair 5	W5_B - W5_A	92.24	79.89	48.419	-2.918	0.004**
Pair 6	W6_B - W6_A	99.03	90.31	50.769	-1.965	0.052
Pair 7	W7_B - W7_A	108.92	103.24	55.391	-1.174	0.243
Pair 8	W8_B - W8_A	117.82	120.34	61.978	0.465	0.643
Pair 9	W9_B - W9_A	128.02	141.63	72.283	2.155	0.033*
Pair 10	W10_B - W10_A	140.50	167.75	89.242	3.495	0.001**
Pair 11	W11_B - W11_A	182.07	203.06	100.971	2.380	0.019*
Pair 12	W12_B - W12_A	212.71	238.98	102.855	2.923	0.004**
Pair 13	W13_B - W13_A	222.43	245.25	101.071	2.585	0.011*
Pair 14	W14_B - W14_A	232.50	260.43	102.637	3.114	0.002**
Pair 15	W15_B - W15_A	247.11	286.94	104.105	4.379	0.000**
Pair 16	W16_B - W16_A	261.56	335.13	112.516	7.484	0.000**
Pair 17	W17_B - W17_A	319.88	352.07	111.737	3.297	0.001**

* Significant at the 0.05 level
** Significant at the 0.01 level

Paired t-test results on number which represent the students' visits to each of these pages in each module

			Mean A	Mean B	t	Sig. (2-tailed)
Pair 1	Home page A_B		103.687	80.77863	-4.93176	0.000**
Pair 2	Organized A_B		17.83969	22.1374	2.675942	0.008**
Pair 3	Home+ Organizer A_B		121.5267	102.916	-3.41856	0.000**
Pair 4	Content A_B		106.374	80.14504	-7.22359	0.000**
Pair 5	Take notes A_B		0.244275	0.045802	-2.23049	0.027*
Pair 6	Assignments A_B		8.328244	15.54198	10.78566	0.000**
Pair 7	Quiz A_B		1.442748	2.572519	4.693367	0.000**
Pair 8	Calendar A_B		0	0.496183	4.843158	0.000**
Pair 9	Other A_B		15.53435	26.09924	6.629919	0.000**
Pair 10	Read A_B		69.84733	127.2595	7.465716	0.000**
Pair 11	Post A_B		0.282443	0.48855	1.31019	0.192
Pair 12	Follow up A_B		0.778626	0.908397	0.612368	0.541
Pair 13	Different pages visited A_B		31.34351	21.62595	-16.1176	0.000**

* Significant at the 0.05 level
** Significant at the 0.01 level

Person correlations between the students' grades and their use of different pages of WebCT for module B

	Coursework	Exam	Final grads
Total use of WebCT	0.233**	0.420**	0.421**
Home page	-	0.353**	0.325**
Organizer	-	0.228**	0.217*
Home+organizer	-	0.348**	0.322**
Content	-	0.297**	0.222*
Other	-	0.268**	0.277**
Read	0.294**	0.348**	0.390**
Post	0.197*	0.202*	0.237**
Follow up	0.33**	0.251**	0.33**
Different pages visited	0.245**	0.403**	0.413**

* Correlation is significant at the 0.05 level 2-tailed
** Correlation is significant at the 0.01 level 2-tailed

Person correlations between the students' grades and their use of WebCT in seventeen weeks for module B.

	Coursework	Exam	Final grads
Week 1	0.194*	0.246**	0.270**
Week 2	0.207*	0.255**	0.283**
Week 3	0.214*	0.273**	0.299**
Week 4	0.217*	0.280**	0.306**
Week 5	0.210*	0.294**	0.314**
Week 6	0.213*	0.303**	0.322**
Week 7	0.211*	0.312**	0.329**
Week 8	0.216*	0.322**	0.339**
Week 9	0.243**	0.328**	0.354**
Week 10	0.238**	0.345**	0.366**
Week 11	0.240**	0.354**	0.373**
Week 12	0.222*	0.368**	0.376**
Week 13	0.223*	0.374**	0.382**
Week 14	0.234**	0.392**	0.400**
Week 15	0.234**	0.412**	0.415**
Week 16	0.237**	0.426**	0.428**
Week 17	0.230**	0.422**	0.422**

* Correlation is significant at the 0.05 level 2-tailed
** Correlation is significant at the 0.01 level 2-tailed

Person correlations between the students' grades and their use of WebCT in seventeen weeks for module B.

	Coursework	Exam	Final grads
Week 11	-	-	0.181*
Week 12	-	-	0.195*
Week 13	-	-	0.197*
Week 14	-	-	0.2*
Week 15	-	-	0.204*
Week 16	-	0.179*	0.206*
Week 17	-	0.184*	0.204*

* Correlation is significant at the 0.05 level 2-tailed