CHAPTER II

LITERATURE REVIEW

In this chapter, the relevant literatures were reviewed for this dissertation. The aims of the review are to provide a foundation for the study, to position this study among other research studies already completed, and to identify areas related to the critical success factors in virtual classroom environments.

The literature reviewed falls into the following four categories:

1. Virtual classroom
2. Online learning environment
3. Project-based learning
4. Team learning

1. Virtual classrooms

This section begins by defining the virtual classroom, then providing definitions of specific features of the virtual classroom, and discussing on the related research about virtual classrooms.

1.1 The definition of virtual classroom.

Helic, Maurer and Scerbakov (2002) defined the virtual classroom as a special synchronous/asynchronous collaborative learning and working environment. A virtual classroom provides all the necessary tools that both tutors and learners need to conduct training sessions with highly sophisticated, adaptable, extensible and collaborative training strategies.

On the other hand, Chadha and Kumail (2002) defined the virtual classroom are a place where teachers and learners meet. Teaching and learning is a social activity, and if the World Wide Web is where students spend most of their time, that is where they will learn. It is important to mention that education was one of the first uses of the Internet.

Galloway, Boland and Benesova, (2002) state that it is difficult to define virtual classrooms because they are constantly changing and evolving, but virtual classrooms can be divided into three broad categories:

1.1.1 Independent models are often referred to as asynchronous because they do not rely upon direct communication between teachers and students since they do not offer chat or videoconferencing facilities. Students access and interact with materials at their convenience, so the learning structure is considered unscheduled.

1.1.2 Synchronous models usually involve more communication and collaboration through the use of videoconferencing and live chats, so there are more opportunities for socializing. Because online meetings are usually scheduled there is limited flexibility.

1.1.3 Broadcast models simply allow students to view lectures on the Internet, so interaction is often limited.

In summary, a virtual classroom is a teaching and learning environment developed by information technology to improve learning activities by allowing learners and instructors to participate in remote learning communities using personal computers and Internet connections at home or at work.

1.2 The features of virtual classrooms.

Modern virtual classroom software not only replicates nearly all of the functionalities of a real classroom but also provides significant additions that are not possible in a real classroom (GurukulOnline, 2005). A virtual classroom can include the following features:

1.2.1 Voice conferencing. Fully integrated, multi-way, full duplex audio conferencing allows the instructor to identify and manage the student who is speaking or raising a query.

1.2.2 Video conferencing. Real-time, multi-point video conferencing enables users to see the session leader or other designated participants from within the interface.

1.2.3 Shared whiteboards. Whiteboards allow students to write or draw while at their computer just as if they were in front of a classroom. Multi-user, interactive whiteboard markup, including content created in a breakout room, can be

saved for later review allowing the instructor to spend more time with the learners as the course material is pre-prepared.

1.2.4 Live presentation tools. Instructors can broadcast video or audio directly to the students. This material can be a live presentation or it can include pre-recorded video clips, audio clips, animated GIFs and other multimedia content created with Flash, DHTML, and JavaScript.

1.2.5 Application sharing. The instructor and learners can also share any Windows application, including their entire desktop or even a remote server. In virtual classrooms, a particular application will be residing on all the PCs whereas in the traditional classroom all of the participants can share only one application.

1.2.6 Live tests. The assessment of a student's learning process can be shown immediately. The assessment is tracked and reported online and additional custom reports can easily be generated. In the traditional classroom, results of such tests will usually only be published after a short wait.

1.2.7 Audience control tools. These can include microphone and camera control. In a real classroom, the teacher may ask a mischievous student to go out of the classroom, whereas in a virtual classroom the teacher may refuse to turn on the microphone of such a student.

1.2.8 Feedback. In a virtual classroom students can raise their hands, indicate yes/no through polling, demonstrate laughter and applause responses, use public/private text chat, and provide anonymous feedback to the instructor and presenters. Anonymous feedback is usually not possible in the traditional classroom, which prevents students from giving their genuine views.

1.2.9 Chat. The students and instructor gather at specific times to communicate directly with one another. Instructors can deliver lectures to the students, questions can be answered, and confusion can be cleared up immediately. The immediate response ensures that all virtual classroom participants understand necessary information, thus making students feel connected to the instructor and the course (Luehmann, 2001). Computer chat has the benefit of allowing multiple conversations to take place simultaneously; in the traditional classroom this could lead to pandemonium.

1.2.10 Live voting. Students can be asked to give their feedback/answers to surveys presented by the teacher, much like the real classroom. In the virtual classroom, the teacher has the discretion, to make the results public or private.

1.2.11 Web safari. This refers to leading a live Web browsing session. It allows the session instructor to take the learners on a synchronized Web tour. They can see the instructors "pointer" and automatically scroll when the instructor scrolls up and down on a Web page. This feature is not available in a traditional classroom.

1.2.12 Breakout rooms. The instructor can break the main session into multiple breakout rooms for team or individual lab exercises. The instructor can also "look over the participant's shoulder" and even take control of the application. The physical classroom offers similar facility, though instructors usually cannot "look over the shoulder" of all breakout rooms simultaneously, which is possible in the virtual classroom.

1.3 Related research on virtual classroom.

Fisher (2004) investigated the roles, experiences, and perceptions of faculty and students in the development of the community and the social construction of knowledge that occurs in virtual classrooms. Semi-structured interviews were conducted in two stages with two professors, one teaching assistant, and nine students from two sections of an Adult Education 470 class at a state-related research university's online campus. The first stage was an orienting interview that delved into the emergence of the online community. The second stage was a discussion of collected cultural artifacts by students and further investigation with all participants into the social construction of knowledge. The interviews explored the sense of connection amongst community members, collaborative learning influences, culture and symbols, faculty delivery mode, social and deliberate nature of computer-mediated communication, and the social construction of knowledge. This approach uncovered emerging themes, provided the foundation for a new model of the dynamics in a virtual learning community with sharing of personal narratives at the core of socio-emotional-driven interactions fostered via teacher confirmation, and established case studies on faculty and student perceptions of their experience in a virtual learning community.

Anchana Juntarasook (2002) studied the opinions of a variety of online learning experts in order to present a proposed virtual classroom management model on the Internet for students in higher education. The samples were twenty-five experts in virtual classroom management. The Delphi Technique was used for the data collection. The result of this research revealed that: 1) the organization must prepare carefully; the need to have appropriate equipment such as authoring tools for courseware development and learning management systems, a classroom Webpage for teaching and learning support, a discussion group facility, and an appropriate Web server. 2) The institution's policies for creating and managing virtual classrooms must conform to its directions, aims, budgeting, planning, and staff management. 3) The instructors who will teach in a virtual classroom must consider their abilities to use English, teaching methods, computer and Internet skills, including the abilities to use the software to develop the lessons as well as virtue and morality. 4) The instructors must also consider the learners' abilities to use English, computer and Internet skills, financial supported, reading skills, and self-analysis. 5) The teaching methods and activities must be suitable to the virtual classroom environment and conform to the Internet service available.

In summary, virtual classroom environment is a teaching and learning environment developed by information technology and communications to improve learning activities by allowing learners and instructors to participate in remote learning communities using personal computer and internet at home or at work. In a new virtual classroom software provides many features that support and enhance all learning activities for improving learning outcome.

2. Online learning environment

There are two important aspects of online learning environments that concern this study: the concept of an online learning environment and the factors affect online learning environment design. The details are:

2.1 Concept of online learning environment.

There are numerous names for online learning environments, including e-learning, Web-based learning, Internet-based learning, and so forth. An online learning environment uses the Internet to access coursework, electronic

communications, instructional activities, or other related information posted on the Web. The online learning environment includes a software system designed to facilitating the management of educational courses. The system can often track the learners' progress, which can be monitored by both teachers and learners.

Online learning environments can be extremely effective ways to deliver course content to students and support them in their studies. They can also be ideal constructivist learning environments that allow students to become more actively involved in developing their knowledge and understandings. However, this is still a relatively new field of study, and research increasingly shows that students do not always use online environments in the ways designers and tutors expect or desire.

Online learning environments typically combine hypertext-based course materials with asynchronous communication facilities, supportive multimedia, and other interactive features to aid understanding (Hill, 2000). They have the obvious advantage over traditional environments that learners can study when and for as long as they want, using whichever resources they require at any particular moment.

With the increasing demand for this form of learning, the institutions involved in online learning must consider crucial elements that will ensure their credibility, reputation, and survivability (Best of the On-line, 2001; Phillips, 1998). As shown in Figure 2.1, success in online learning comes about by bringing together at least three crucial factors, namely the institution, the students, and technology. Ineffectiveness in any one of these factors will have an adverse effect on the successful conduct of learning. Merging these factors is a great challenge for institutions conducting online courses.

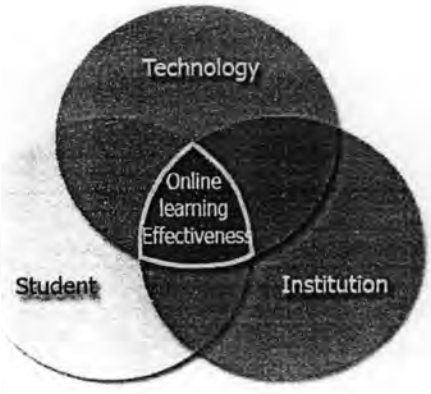

Figure 2 The online learning environment (Tham & Werner, 2002).

2.1.1 Institution. Motivation, behavioral changes, and increased workloads for both students and instructors are concerns that educational institutions are struggling to balance these days, and administrators need to address how they can best prepare their faculty for adaptation. When it comes to adopting new technology, such as virtual classrooms, educational institutions must ensure there is proper support infrastructure for faculty members. Many of today's educators are facing the challenge of transferring knowledge using this new technology. The information age is new to many of them, especially with regards to online educating. Seminars, training workshops, and talks can increase educators' awareness. However, by themselves, these approaches are not likely to teach them the ideal approaches that they should use for this unique coursework. According to Bonk (2000), online educators wear many hats including:

Table 1 The different hats of online educators (Bonk, 2000)

The Technological Hat	Educators must be prepared to understand how to use the application software they are using and also that adopting new technology will require different strategies in teaching.
The Pedagogical Hat	Creativity is needed to design a course that brings students "nearer" in an online learning environment. In the virtual classroom, educators must use the most appropriate tools/applications and not simply use all the tools that are available.
The Social Hat	In the online environment, the communication tools should be used to establish a friendly, cohesive and comfortable learning environment. Educators wear this hat least because of the task-oriented setting of the online syllabus. However, this hat is important in creating opportunities to maximize student learning and ensure that student motivation levels remain high.

In order to properly support faculty members conducting online courses, institutions must both provide proper technology and training, as well as sufficient preparation time. They must be a training and induction program available for these faculty members.

2.1.2 Students. In comparison with the traditional classroom, students in the virtual learning environment are generally much more isolated from their classmates. Students rarely have the chance to socialize physically with other classmates, except when they are assigned group- or teamwork as part of the requirements for projects or assignments in a synchronous environment. With the lack of face-to-face communication, students can feel that they are "left in the dark" (Tham & Werner, 2002) unless they communicate with the educator and receive prompt responses.

Student reactions to these environmental changes have other implications for the success of online learning. Institutions need to consider what they can do to help minimize student fears in dealing with technology. Most importantly, how can institutions ensure that the standards and knowledge imparted to students do not suffer or lose their essence in this new mode of delivery?

Students are reasonably well prepared concerning what is expected for online-learning (Tham & Werner, 2002); however institutions still need to provide training and support for students in the virtual classroom. Student satisfaction with their online classes was considerably higher when students felt they had received adequate training to use the necessary technology (Schramm, Wagner, & Werner, 2001).

Even though students may not be daunted by the new technology, they can become overwhelmed with their coursework if they lack of face-to-face communication with their instructors. Thus, communication becomes a key requirement for effective online learning. Additionally, self-discipline on the part of the student increases the likelihood of individual success in extracting value from an online learning environment. Institutions should address self-motivation in course training.

2.1.3 Technology. The effectiveness and efficiency of the infrastructure plays an important role in creating the ideal learning environment (Tham & Werner,

adopted? How best to set up organizational support for the faculty and the students for daily operation? And, to what extent does the institution plan to support this learning environment?

Carter (2001) wrote of a significant increase in learning performance for students in South Carolina. The results for the Beaufort County School District showed the average Metropolitan Achievement Test scores of students using laptops was 64.9, compared to an average of 48.9 for non-laptop students. Similarly, in El Paso, Texas, the Rio Bravo Middle School achieved increased scores after implementing similar notebook programs. Both of these results show that technology can increase learning capability and educational effectiveness, provided there is the proper support and infrastructure.

Institutions need a suitable structure to support online learning for both the faculty and students; one possibility is to adopt Mintzberg's (1993) well-known "Structure in Fives" (see table 2).

Every institution is unique and has it own strengths in conducting different courses online, and what works well in one institution may not be applicable for another. The answers to the questions posed above are no different from those found in business environments. The main goal is to ensure that online learning objectives are achieved without sacrificing the standards and professionalism of the institution. By seriously addressing these questions institutions can make the online learning environment seem less hostile to faculty and students and they can also see the learning experience reach a higher level than previously achieved.

Table 2 Structure in Fives to support online learning (Mintzberg, 1993)

A committee board	To oversee the strategic plans and induce the necessary grants to support the online environment.
A management board	To ensure that the direction and requirements are within the boundaries of the institution.
A network administration section	To help meet the needs of both the faculty and the invisible infrastructure environment.

Table 2 (continue)

An evaluation and training section	To ensure that learning objectives are met and appropriate training is provided to educators. In addition, this section should seek out suitable technology to enhance the learning environment and import successful programs that other institutions have developed.
A help desk section	To help students who need guidance and assistance using the virtual environment. Day-to-day operational problems in the online environment should be tackled immediately and effectively.

2.2 Factors affecting online learning environment design.

Based on the reviews of previous studies on the factors that influenced the learner outcomes in online learning environment settings, the researcher developed a theoretical framework for influenced the factors on the learner achievement and team learning in virtual classroom environments. The factors influencing the design of virtual classroom environments are categorized into four main groups: learner factors, pedagogy and instructional design factors, environment and community of learner factors, and group dynamic and peer impact factors.

2.2.1. Learner factors. Learner factors are variables such as age, learning style, cognitive style and so on that can influence the online learning environment design. The learner factors influencing online learning are described below.

2.2.1.1 Gender. A number of researchers have pointed out that gender can be a factor in determining the amount and pattern of interaction in online learning environments (Graddy, 2004; Herring, 1993, 1994, 2000; James & Drakich, 1993; Ley & Klein, 1993). Nancy (2002) found that gender related to knowledge achievement. Moreover, Herring (2000) revealed that female online conversations were more apologetic and supportive. Her research further indicated that during the online discussions, female learners were less persistent when others did not respond

to their postings. But, female learners were active participants when there was an instructor or facilitator who led the discussion or coordinated the group dynamics. In one study, female students reported more belonging feeling toward the learner and the social community with greater knowledge gains (Rovai & Baker, 2005)

Based on an extensive reviews of the literature on communication studies, James and Drakich (1993) concluded that males talk more than females in mixed-gender discussions and females tend to spend more time talking with each other than males do. Monson's (2003) study showed that gender plays a significant role when it comes to the importance of certain instructional activities such as informational feedback and intellectual discussions. Females perceived informational feedback in online courses as more important than males, while males perceived intellectual discussion more positively than females. However, some studies showed that gender was not a significant factor to predict the learner's self-confidence in using computer (Lim, Morris & Yoon, 2006; Contreras, 2004)

Regarding the review of the literature above, it is reasonable to assume that gender differences can be an influential factor that impacts learner preferences for activities during online interactions. Although it is quite possible that gender differences may not play a role on learner preferences in all instructional activities that require online interactions, examining any interaction effects of gender and preferences for activities will deepen our understanding of the current topic and thus can provide practical implications for online educators.

2.2.1.2 Age. Age can affect the factor affected on learning outcomes. Kearsley (1995) points out that older people prefer less interaction while young people desire more. Vampola (2001) conducted a study of learner preferences for various adult training activities in a corporate training setting. Based on a sample of 281 adults with a mean age of 40, he found that older trainees preferred private implementation activities such as individual learning time and did not prefer coactive analysis activities such as small group discussions. Similarly, Lim, Morris & Yoon (2006) found that age was identified as an important mediating variable resulting in differences in course outcomes and the online learners' instructional perceptions about the quality of online course. Therefore, it is possible that age will have positive

correlation with preferences for learner-self interaction and will have negative correlation with preferences for learner-learner interactions. Since there is no empirical evidence that shows any relationship between age and preferences for learner-instructor interaction, it is difficult to predict the association direction between them. It is possible that age will not have any impact on learner preference for learner-instructor interactions since this type of interaction is desirable for all learners.

2.2.1.3 Online experience. The third concern of individual learner differences in this study is the prior online experience of the learners, specifically looking at the number of previous online courses they have completed. Based on survey research on 265 online students, Monson (2003) found that prior online experience was related to learner perceptions of interaction. His study showed that less experienced learners had a more positive perception of the importance of vicarious learner interaction than did those with greater amounts of online course experience. Lim, Morris & Yoon (2006) found that the online learners' prior experience with distance learning was identified as more influential variable explaining meaningful differences in learning motivation. Similarly, Contreras (2004) reported that previous computer experiences and the number of online courses taken previously better predicted the student's confidence in taking online learning. Although vicarious interaction is not an independent type of interaction that this dissertation study is interested in examining, there can be a substantial overlap on the instructional activities used to promote vicarious interaction and learner-self interaction. Thus, it is possible that the prior online experience of learners will negatively associate with learner preferences for learner-self interactions. Furthermore, it is logical to assume that a more experienced person would have a more advanced set of skills and thus would have different expectations and preferences on their daily study than a less experience person.

2.2.1.4 Learning style. Learning styles have garnered attention from researchers of online learning because of the potential of the Internet to deliver instruction that meets the specific needs of students' different learning styles. Previous studies of online students indicate that learning styles have a direct bearing on learners' motivation. Curry (1990) posits that a learner's motivation is influenced

by his or her learning style together with task engagement and information-processing habits. Several other studies also suggest the importance of matching instructional strategies with the individual's preferred learning style in order to have a positive influence on the online student's motivation (Cuneo & Harnish, 2002; Katz, 2002; Mitchell, 2000; Sankaran & Bui, 2001).

Previous studies are not conclusive about the effects of an individual's learning style preference on their satisfaction with and persistence in online learning. Terrel and Dringus (1999-2000) studied information science students in an online master's degree program and found that the effect of students' different learning styles on their dropout rates was not significant. Klingner (2003) also found in her study of adult learners enrolled in an online college course that the students' learning style preferences were not a significant factor in their success or satisfaction with online learning. Similarly, Stokes (2003) found in her study of college students in a Web-based module that the students' preference in learning styles did not have a significant impact on their satisfaction with the digital learning environment. In another study of adult learners who took e-learning courses in workplace learning settings, Mungania (2003) found that learning style preference was one of seven barriers to one's starting, continuing, and completing online training.

2.2.1.5 Cognitive style. Cognitive styles have been described as the consistent and enduring differences in individual cognitive organization and functioning. Kerla (1998) stated that field dependents are more likely to feel lost and disoriented in computer-mediated hypermedia environments. Ogle (2002) compared field-dependent/independent performance on a task of recall. The content was presented in two different treatments: a virtual environment and static images. A significant interaction was found between field dependents and treatment type favoring field independents in the virtual environment treatment. In addition, DeTure (2004) suggested that field independents have higher confidence with online technologies; they are not necessarily more likely to be successful in online distance education courses.

2.2.1.6 Intrinsic control. There is abundant research evidence that intrinsic motivation is more beneficial in promoting learning and achievement than extrinsic motivation (Pintrich & Schunk, 1996). Researchers have recognized that not

every human behavior is intrinsically motivated. Extrinsic motivators (e.g., extrinsic structures, controls, rewards) can also motivate human behaviors (Pintrich & Schunk, 1996). Thus, research evidence indicates that both intrinsic and extrinsic motivators contribute to some extent to enhancing motivation to learn (Park, 1996). Moshinskie (2001) also argues that the learner's motivation results from his or her intrinsic interest and from extrinsic efforts supported externally by the learning environment (e.g., motivational strategies in the instruction, social interactions, and positive climate). Therefore, the literature suggests that both intrinsic and extrinsic motivation need to be taken into consideration in order to understand motivational aspects of online learners.

2.2.1.7 Previous knowledge. Previous knowledge or experience has been found to relate to deep and surface approaches to study. Richardson et al (1999) found that learners with more academic experience were much more likely to adopt a deep approach than younger learner with less experience; the later are more likely to adopt a surface approach or a reproducing orientation. Both Ford and Chen (2000) and Richardson et al (1999) found that differences in age, which are often correlated with differences in previous experience, have also been found to relate to different learning approaches. Consequently, when measuring previous experience it is also important to control how participants' age interacts with different learning approaches.

2.2.1.8 Psychology traits. Psychology traits, or personality traits, have been acknowledged as an influential factor in how people learn (Lawrence, 1997). Understanding how psychology traits may affect online interaction can help practitioners seek guidelines for building conducive learning environments and designing effective learning activities (Chen & Caropreso, 2004; Sorensen, 2004).

Learners with different psychology traits may prefer different ways to interact and may respond differently to various instructional activities. Based on previous studies, Chen and Caropreson (2004) found that psychology did affect learner communication type, pattern and task engagement. For instance, they found that learners who were socially shy tended to prefer one-way communication in online discussions while extrovert learner actively engaged in two-way communication. Moreover, Soles, and Moller (2001) indicated that online instructors

should consider the learner psychologies related to their preferences for educational activities when designing online course. They further suggested a number of online learning activities for learners who have different types of psychology traits.

2.2.1.9 Self-directed learning. Self-directed online learning differs from traditional classroom instruction in several aspects. First, in most cases no human interaction takes place during self-directed online learning. Second, this type of learning is self-paced, which means learners interact with the content on their own schedule and at their own pace. Thus, learners in self-directed online learning environments are not given any pre-set course schedule, nor must every learner follow the same sequence of instruction as is the case for traditional classroom instruction. Because of its flexibility and convenience, self-directed online learning is particularly useful for adults who are busy with their jobs and may need classes related to the workplace (e.g. recertification or career advancement) or for personal development.

The self-directed learning approach can also be used in diverse instructional formats. Self-directed learning is often used for stand-alone instruction when an instructor is not available (Hannum, 2001). It can also be incorporated into a blended instruction format, where multiple delivery modes can maximize a class's effectiveness (Bonk & Graham, 2006). For instance, self-directed e-learning can be offered as a learning activity supplemental to instructor-led classroom instruction.

2.2.2. Pedagogy and instructional design factors. Pedagogy and instructional design factors are variables such as interactive design, content design, interface design, feedback and so on that can influence the online learning environment. The pedagogy and instructional design factors influencing online learning are described below.

2.2.2.1 Interactive design. Past studies of interaction in online learning environments suggest that interaction is an important factor for motivating online learners and letting them feel like it is a real class (Chem, 2005; Tu, 2000). Wagner (1997) suggested that the learner's intrinsic motivation can increase as an outcome of online interaction. Multimedia packages can provide highly interactive

learning, but, to be effective, the interactions need to be relevant and appropriate to the instructional purpose.

Likewise, some researchers contend that the use of interactive medium was significantly correlated with student satisfaction in distance learning environments and that the quality of interactive medium was significantly associated with learner motivation (Guzley & Avanzino, 2001; Firdyiwek, 1999; Plowman, 1996; Stoney & Wild, 1998). Studies have also been conducted about dimensions or levels of interactivity in various computer-mediated communications settings. Hence, social presence in the online environment was found to be the degree of feeling, perception and reaction of being connected to another person through a text-based encounter using computer-mediated communication (CMC).

Rowe and Gregor (1999) found that interactive features were what most motivated students to learn in online courses. In additional, Ha and James (1998) found that there were five dimensions of interactivity in the Web medium: 1) playfulness, 2) choice, 3) connectedness, 4) information collection, and 5) reciprocal communication. From an analysis of 110 commercial Websites, Ha and James (1998) found that some dimensions of interactivity were more prevalent in those Web sites than others; in particular they found that the Web sites were lacking in playfulness (i.e., curiosity or arousal) and information collection (i.e., presence of a monitoring mechanism). Kenney, Gorelik, and Mwangi (2000) adapted Heeter's (1989) six dimensions of interactivity for use with Websites. These are 1) complexity of choice available, 2) effort users must exert, 3) responsiveness to the user, 4) facilitation of interpersonal communication, 5) ease of adding information, and 6) monitoring system use.

However, previous research efforts showed that connection with other students and effective student-to-student communication ranked as unimportant with the students. This result is a surprising finding, since these factors seem to impact the community of learners. Technology-oriented students are typically not very chatty. They also are relatively familiar and comfortable with the technology and therefore may not need to reach out to their classmates for help with technological issues (Cohen & Ellis, 2004).

2.2.2.2 Interface design. In addition to cognitive, affective, and social influences on motivation for online learners, interface design also needs to be considered as an important influence on online learners' motivation. The human-computer interaction in computer-mediated learning is distinctive from face-to-face interaction (McIsaac & Gunawardena, 1996). Human-computer interaction has some influence on the perceptions and attitudes of individuals learning through the Web, and Khan (2002) argues that interface design is an important factor for creating effective electronic learning environments. Some researchers (Lee & Boling, 1999; Sales, 1999; Stoney & Wild, 1998) also underscore the need for user interface design of multimedia materials to be motivating to users. Researchers (Corry, Frick, & Hansen, 1997; Rubin, 1994) also suggest that user-centered design is an important factor for the motivational design of Web sites. Subjective satisfaction by the user is one of the goals of user-centered design (Shneiderman, 1992).

2.2.2.3 Content design. Using a variety of media (text, graphics, audio, and video) in online courses can help accommodate individual learning styles by providing approaches for both visual and auditory learners. All course content, whether text or multimedia, must be developed and presented without infringement of copyright.

The selection of hypermedia design for online learning depends on who and what is being taught. Jonassen, Mayes and McAleese (1993) provide a useful guide for selecting the form of hypermedia most suited to the nature of intended learning outcomes. For higher levels of knowledge and more sophisticated learners, such as understanding complex concepts and principles, less structured hierarchical and referential linking is more appropriate. When building on an existing knowledge base, learners can benefit from the freedom to browse and explore, to inquire and seek responses to their own questions rather than following a pre-determined path of instruction (Oliver et al, 1996).

2.2.2.4 Usability design. Usability is one part of the overall acceptability of a computer system. Software of any type should meet the basic standards for usability. Usability evaluation is important part of the overall evaluation of Web-based learning environments. The user interface of a Web-based application must be easy to use so the user can concentrate on the information rather than the

interface. Good software is easy to use, has few errors, and is subjectively pleasing (Nielsen 1993; Silius & Tervakari, n.d.).

2.2.2.5 Accessibility and responsiveness. An essential part of any Web design today is designing for individuals with disabilities. Many governments and institutions nowadays require that Web pages themselves should function with the assistive devices used by individuals with disabilities. Individuals with disabilities should also be able to access information and fundamental government services on the Web. Accessibility is an important step toward the equality of citizens and independence for individuals with disabilities. The World Wide Web Consortium (W3C) has established guidelines for the design of accessibility (Web Content Accessibility Guidelines) and checklists to evaluate the accessibility of Web pages (Foley & Reagan 2002; Silius & Tervakari, n.d.).

2.2.2.6 Feedback quality. Past studies suggest learners need good feedback in a timely fashion (Hiltz, 1986). When they don't get it. they tend to feel isolated. Moreover they prefer negative comments to be communicated privately via email or with a phone call (Cohen & Ellis, 2004).

After learners attempt any interactive exercise they should be given immediate and adequate feedback. A 'Yes,' for correct responses, and then generally there should be a chance for learners to review their answers or solutions. If a learner is incorrect then he/she should be told they are incorrect. This is a bare minimum. Better still, hint facilities can be built in so that, for instance, after one unsuccessful attempt a hint could come up. Eventually after a set number of unsuccessful attempts a learner should be shown the correct result. Proceeding in a trial and error manner is frustrating for learners and serves no useful purpose. Hints help avoid trial and error behavior of users.

2.2.2.7 Instructor experience. Anderson and Garrison (1995) found that in a virtual classroom it is desirable that instructors are able to provide learning activities tailored to learners' needs, to manage discussions, and to provide information that is useful to students. Berge (1995, cited in Bonk & Dennen, 2003) proposed four aspects of instructor roles for online learning: pedagogical, social, managerial, and technological. Besides providing guidance and facilitating discussion

(pedagogical), instructors should also create opportunities for social ice breaking (social), clarification of the rules (managerial), and technical support (technical).

2.2.2.8 Assessment. Wands and Blanc (2003) identified assessment as one of the critical factors for making online learning successful. Assessment is the process of collecting and making the judgment as to whether competency with respect to the identified standard has been achieved. Assessment tasks, methods and condition must be fully stated and clear to the learners and be relevant to the stated learning outcomes. Assessment methods must be valid, reliable, flexible and fair. Assessment must occur at the completion of a learning package and at the work place to determine the level of skill retention. In addition, McLellan (1993) points out that more reliable assessment can take the form of evaluation measures such as portfolios, summary statistics of learners' paths through instructional materials, diagnosis, reflection and self assessment.

2.2.2.9 Activities design. Activities design is an educational event that helps learners understand the content better and enhances their engagement in learning. Activities contained within the course that address course objectives and competencies are a critical component to be considered (Palloff & Pratt, 2007). Instructors have been adapted various activities on their own to enhance interaction and increase learning. Carr-Chellman and Duchastel (2001 cited in Palloff & Pratt, 2007) discuss the importance of the activities in an online learning and further note that a good online course does not teach but instead makes resources and activities that allow students to explore the content together in an effective manner. Branon and Essex (2001) pointed out that virtual office hours can help enhance the learner-instructor interactions and other typed of interactions in online education. In addition, Peters (2000) noted the importance of teamwork in learner-learner interactions. Similarly, Sutton (2001) encouraged students to read others' online discussion to learn through vicarious interactions.

2.2.3. Environment and community of learner factors. Environment and community of learner factors are variables such as community tools, online support, learning resources, availability of instructors, and so on that can influence

the online learning environment design. The environment and community of learner factors influencing online learning are described below.

2.2.3.1 Community tools. A number of researchers have pointed out that community tools can be a factor in determining the amount and pattern of interaction in online learning environments. Rovai (cited in Cohen & Ellis, 2004) found that community tools were stronger in the programs that provided learners more and diverse opportunities to interact with each other. The groups that had less opportunity of interaction had less spirit and trust. Synchronous chats and asynchronous discussion forums are two tools commonly used to create an online community. In the virtual world it seems that the online community does not end when the course ends. Often, especially in graduate programs, the community established in the course, continues throughout the program. A strong online community could help lower dropout rates, which seem to be higher in online courses.

2.2.3.2 Online learning support. Online learning support was another variable indicated as a significant factor affecting the quality of online education(Huett, Moller, & Young, 2004; LaPadula, 2003). So, Virtual classroom designers must set up methods of providing the support necessary to guide learners and to provide a feedback mechanism that is responsive and sensitive to their individual needs (Oliver & Herrington, n.d.) A number of studies have developed frameworks to describe the ideal forms of support required for online learning environments, and in each case there is usually a strong argument made for an active and involved teacher. Teachers' roles are similar to that of a coach and facilitator rather than the more didactic style most people assume. In contemporary settings, this form of learning support is called scaffolding in recognition of the way in which it helps to build knowledge and is then removed as the knowledge construction occurs.

2.2.3.3 Learning resources. In a learning environment based around learning tasks, learners will need to access many different forms of content. The materials needed will not necessarily all be online. The use of conventional materials along with electronic sources can provide the diversity often required.

Herrington and Oliver (1995) suggested designers create course materials where the content was rigidly organized and presented to the learners in a strict sequence. Today it is recognized that learners need to be able to access resources in a variety of ways and from a variety of perspectives.

2.2.3.4 Availability of instructor. Cohan and Ellis (2004) found online learners expect prompt feedback from instructors. In a traditional class, students have been raised to wait until office hours or the next class meeting to interact with instructor; in the online environment that maxim is ignored. It is not uncommon to have students write multiple email messages to the professor if they do not have a response within a few hours. Time zone boundaries seem to disappear, and students even start contacting the professor before the official start of class. Online students are seen as daring and confrontational regarding their expression of ideas. Students want to have individual access to the professor at all times of the day and/or night.

2.2.3.5 Quality technology. Prior to developing an online course, the computing environment should be analyzed to determine how users will be accessing the course. This is important for two reasons: connection speed and availability of access. Connection speeds will vary depending on whether students are accessing the online materials via network connections or through dial-in.

2.2.3.6 Orientation to course. It can be stated that online learning teams will not succeed automatically. Students need orientation to online teamwork for the successful conduct of team activities. For example, an essential concept of "teaming" orientation at UOP is "followership" (Lundin & Lancaster, 1990 cited in Betz, 2004). Students are introduced to this term in courses at the beginning of their online programs, so that they become capable in learning situations where they are not working autonomously and often are cast in subordinate roles to others in their groups (Betz, 2004).

Orientation is the means by which users are able to identify their current position in a course, how they achieved that position, and how they can to return to a previous position. The organizational structure should provide a clear route back to the starting point (Goldberg, 1997). For this reason, a site should

never include dead ends (Shotsberger, 1996). According to Cohen and Ellis (2004), instructors need to let the students know how the class is going, what is the flavor of the class, when class is in session, etc. It takes a lot of creativity and effort to capture this in online courses.

Although there is the flexibility of any time, any place learning in online courses, there still needs to be an establishment of the class culture and expectations It is up to the instructor to set the tone and establish the feel of the class. Expectations about the use of technology are also part of making the students feel comfortable and confident in the class.

2.2.3.7 Accessibility to hardware and software. Computer hardware and software need to be appropriate for online learning. If course access requires special browser add-ons, all the receiving workstations or home/office PCs must be properly configured before the course starts. The student's machine must meet a minimum set of hardware specifications. Operating systems and application software requirements must also be determined (Golas, 2000).

2.2.3.8 Clearly defined learning outcomes. The learning outcomes must be clearly presented at the start of each lesson/module. Learning outcomes are statements that answer the question: What does the learner have to be able to do at the end of the period of instruction? Learning outcomes are written from the learner's point of view. Learning outcomes could also be defined as being short range, measurable achievements by which a specified competency can be achieved. Wands and Blanc (2003) suggested that instructors or designers need to clearly define learning objectives that will lead to positive learning outcomes.

2.2.3.9 Positive interaction between instructor and learner. The use of collaborative activities has proven to be an important strategy for online learning (Bonk & Reynolds, 1997; Harasim, Calvert, & Groeneboer, 1997). Interaction among students is a critical variable in learning. To achieve learning outcomes, learners need to construct their knowledge by acting, reformulating, interpreting, sharing, and building on ideas and concepts through the reactions and responses of their peers (Harasim, 1990). Online education, with its computer mediated communications systems, offers a potentially rich social learning

environment that can support and facilitate active learning collaboration (Brown, 1997).

Heinemann's (2003) study showed that teacher-student interaction is an important factor in cognitive and affective learning. On the other hand, Tello's (2002) study of 760 adult students enrolled in online college courses showed that student perceptions and attitudes were positively correlated to the frequency of interaction between instructor and students.

2.2.3.10 Scaffolding. Scaffolding is an instructional technique whereby the teacher models the desired learning strategy or task, then gradually shifts responsibility to the students. Clay and Cazden (1992) point out two scaffolding strategies for teaching reading: working with new knowledge and accepting partially correct responses. In the first strategy, when an instructor suspects learners do not have the ideas or words needed for a particular text, he or she may explain some part of the story or contrast a feature presented with something the child already understands from another reading. In the second strategy, the instructor uses what is correct in the learner's response, but probes or cues the student so as to suggest good possibilities for active consideration.

2.2.4. Group dynamic and peer impact factors. Group dynamic and peer impact factors are variables such as team size, team interaction, task clarity, and so on that can influence the online learning environment design. The students working together are called a team. The group dynamic and peer impact factors influencing online learning are described below.

2.2.4.1 Team interaction. Online education has many features in common with traditional classrooms, but also has quite a few that are different. The use of discussion forums and chat tools for interaction with others in the class is an inherent part of most online courses (Lightner, Bobe, &Willi, 2007). One of previous research efforts showed that connection with other students and effective student-to student communication ranked rather low in importance with the students. This is a surprising finding since these factors seem to impact the community of learners. A different student population type may have had a different reaction to these factors. Technology-oriented students are typically not very chatty. They also are relatively

familiar and comfortable with the technology and therefore may not need to reach out to their classmates for help with technological issues.

2.2.4.2 Team leadership. A team leader in a virtual classroom is the student who keeps the team going and reminds members of important deadlines. Based on Johnson, Suriya, Yoon, Berrett and Fleur's (2002) study, in a virtual environment, the leadership role was not always defined clearly. Only two of the seven teams had a leaders emerge in the group. Most of the groups shared the leadership role, often rotating on a weekly basis. The team leader sometimes was identified as the same person as the assignment compiler. The team compiler would decide when other members should submit their work and set a timeline to finish assignments.

2.2.4.3 Task clarity. As with any collaborative learning project, the types of assignments in virtual team situations should be carefully considered (Johnson et al, 2002). Establishing clear objectives and benefits before assigning tasks is especially vital in a virtual environment. The majority of interviewees in Johnston's study suggested that if the task were too complex, it would be difficult to accomplish without the option of face-to-face interaction.

2.2.4.4 Strength of peer cooperation. As Hathorn and Ingram (2002) found in their study about small group work at a distance, putting learners in groups does not automatically result in collaboration. It is important to provide groups with guidelines for collaboration to increase the chances that they will actually work together. In addition, groups should be formed based on previous distance education experience, professional background, and previous knowledge (Bernard & Lundgren-Cayrol, 2001).

2.2.4.5 Group size. Group size is an important element in the success of online learning teams. Research with learning teams has indicated that four or five members is optimal (Learning Team Handbook, 2003). A study by Cosse, Ashworth, and Weisenberger (1999) conducted about optimal team size in undergraduate marketing courses returned findings that learning teams work best when all the teams are of equal size.

In summary, there are many factors affect the design of virtual classroom environment. The factors that were believed to be important toward predicting student success in virtual classroom environment can be classified into four main groups. The factors are following.

Table 3 List of factors affecting online learning environment design for project-based learning that will be focused on in this study

Factors	Sub-factors	Previous studies
Learner factors	Gender	Lim, Morris & Yoon, 2006; Rovai & Baker, 2005; Contreras, 2004; Monson, 2003; Nancy, 2002; Herring, 2000; James & Drakich, 1993; Ley & Klein, 1993
	Age	Lim, Morris & Yoon (2006); Vampola, 2001; Kearsley, 1995
	Online experience	Lim, Morris & Yoon (2006); Contreras, 2004; Monson, 2003
	Learning style	Klingner, 2003; Mungania 2003; Stokes, 2003; Cuneo & Harnish, 2002; Katz, 2002; Sankaran & Bui, 2001; Mitchell, 2000; Terrel & Dringus, 1999-2000; Curry, 1990
	Intrinsic control	Moshinskie, 2001; Pintrich & Schunk, 1996; Park, 1996
	Cognitive style	DeTure, 2004; Ogle, 2002; Kerla, 1998
	Previous knowledge	Ford & Chen, 2000; Richardson et al, 1999
	Psychology traits	Chen & Caropreso, 2004; Sorensen, 2004; Lawrence, 1997
	Self-directed learning	Bonk & Graham, 2006; Hannum, 2001

Table 3 List of factors affecting online learning environment design for project-based learning that will be focused on in this study

Factors	Sub-factors	Previous studies
Pedagogy and instructional design factors	Interactive design	Cohen & Ellis, 2004; Kenney, Gorelik, & Mwangi, 2000; Guzley & Avanzino, 2001; Rowe & Gregor, 1999; Firdyiwek, 1999; Ha &d James, 1998; Stoney & Wild, 1998; Wagner, 1997; Plowman, 1996
	Interface design	Lee & Boling, 1999; Sales, 1999; Stoney & Wild, 1998; Corry, Frick, & Hansen, 1997; McIsaac & Gunawardena, 1996; Rubin, 1994; Shneiderman, 1992
	Content design	Jonassen, Mayes and McAleese, 1993; Oliver et al, 1996
	Usability design	Nielsen, 1993; Silius & Tervakari, n.d.
	Accessibility and responsiveness	Foley & Reagan 2002; Silius & Tervakari, n.d.
	Feedback quality	Cohen & Ellis, 2004; Hiltz, 1986
	Instructor experience	Berge, 1995; Anderson & Garrison, 1995
	Assessment	Wands & Blanc, 2003; McLellan, 1993
	Activities design	Branon and Essex, 2001 ; Peters, 2000; Sutton (2001)

Table 3 List of factors affecting online learning environment design for project-based learning that will be focused on in this study

Factors	Sub-factors	Previous studies
Environment and community of learner factors	Community tools	Rovai (cited in Cohen & Ellis, 2004)
	Online learning support	Huett, Moller, & Young, 2004; LaPadula, 2003; Oliver & Herrington, n.d.
	Learning resources	Herrington & Oliver, 1995
	Availability of instructor	Cohan & Ellis, 2004
	Quality technology	Wands & Blanc, 2003
	Orientation to course	Cohen & Ellis, 2004; Betz, 2004; Goldberg, 1997; Shotsberger, 1996
	Accessibility to hardware and software	Golas, 2000
	Clearly defined learning outcomes	Wands & Blanc, 2003
	Positive interaction between instructor and learner	Heinemann, 2003; Tello, 2002; Bonk & Reynolds, 1997; Harasim, Calvert, & Groeneboer, 1997; Brown, 1997; Harasim, 1990
	Scaffolding	Clay & Cazden, 1992
Group dynamic and peer impact factors	Team interaction	Lightner, Bobe, &Willi, 2007
	Team leadership	Johnson, et al, 2002
	Task clarity	Johnson et al, 2002
	Strength of peer cooperation	Hathorn & Ingram, 2002; Bernard & Lundgren-Cayrol, 2001
	Group size	Learning Team Handbook, 2003 : Cosse, Ashworth &Weisenberger,1999

3. Project-based learning

There are four important points about project-based learning that concern this study: the concept of project-based learning, the components of project-based learning, the advantages of Web-based project-based learning, and the benefits of project-based learning.

3.1 Concept of project-based learning.

This topic begins with definitions of project-based learning. First, project based learning is in-depth learning focused on real world situations that engage teachers and students in a meaningful exploration process (Comtois, 2003).

Second, project-based learning is a model for classroom activity that shifts away from the classroom practices of short, isolated, teacher-centered lessons and instead emphasizes learning activities that are long-term, interdisciplinary, and student-centered (Whitehorse, 2004).

Third, project-based learning is a pedagogy that prepares students for new learning expectations by letting them perceive, develop, and implement projects relevant to the student's needs. This active learning process teaches critical thinking, problem solving, teamwork, negotiation skills, reaching consensus, using technology, and taking responsibility for one's own learning (Wolff, 2002).

Last, project-based learning is an instructional method centered on the learner. Instead of using a rigid lesson plan that directs a learner down a specific path of learning outcomes or objectives, project-based learning allows in-depth investigation of a topic worth learning more about (Harris & Katz, 2001; Grant, 2002).

In summary, project-based learning is a learner-centered instructional approach that aims to help learners acquire knowledge by using a series of artifacts or products.

While project-based learning has the same abbreviation ('PBL') as problem-based learning, the methods are somewhat different. The line between project-based learning and problem-based learning is often blurred, and the two terms are frequently used as synonyms. In fact, they are very similar in that both take a learner-centered approach and use authentic, real-world tasks; however, project-

based learning is different from problem-based learning in that it focuses more on end products (An, 2006; Lee & Tsai, 2004; Esch, 2000). The process of production is authentic and reflects real-world activities. The tasks on hand will be completed using the ideas and methods that students will later use in their jobs.

Project-based learning has two essential components: a driving question or problem and activities that result in a series of artifacts or products. These artifacts or products developed by the students drive and shape the learning process (Blumenfeld et al, 1991). In comparison, problem-based learning focuses on inquiry rather than the end product. The problem-based method regards solving one problem as its driving force, but may concentrate on answering questions to some extent. Some types of problem-based learning require students to define questions, set up hypotheses, collect materials, and describe answers clearly. Some types of problem-based learning are looked on as learning-embedded cases in which there is no definite answer; they are only used to prompt students to study and collect materials. Students may or may not deliver an end product, and teachers will provide enough time for self-questioning and self-assessment.

3.2 The components of project-based learning.

There are seven components of project-based learning models. According to Grant (2002), the seven project-based learning elements are as follows.

1) Introduction. Many projects use an introduction "to set the stage" for or anchor the project. This often contributes to motivating learners. Occupational skills, such as graphic arts or Webpage design, typically use the domain as the anchor, since the skills are authentic to the profession.

2) Task. The guiding question or driving question explains what will be accomplished in the task and embeds the content to be studied. The tasks should be engaging, challenging and doable.

3) Resources. Resources provide the data to be used by learners and can include computers, hypertext links, scientific probes, compasses, CD-ROMs, eyewitnesses, etc.

4) Process. The process is the steps necessary for learners to complete the task or answer the guiding or driving question. The process should include activities that require higher-level and critical thinking skills such as analysis, synthesis and evaluation of information.

5) Guidance and scaffolding. When learners need help, guidance and scaffolding must be provided. These can include student-teacher interactions, practice worksheets, peer counseling, guiding questions, job aides, project templates, etc.

6) Cooperative/Collaborative learning. Many projects include groups or teams, especially when learning resources are limited, but, cooperative learning may also employ rounds of peer review or group brainstorming sessions.

7) Reflection. The best examples of project-based learning offer an opportunity for closure, debriefing, or reflection. These may include relevant in-class discussions, journal entries or follow-up questionnaires about what students have learned.

In addition, the Challenge 2000 Multimedia Project specifically focuses on project-based learning supported by multimedia. Seven features for use in describing, assessing, and planning multimedia projects have been identified as key components of this project.

1) Curricular content is the project-based learning feature for which teachers and students may be held most accountable. Successful integration of content learning requires projects to be based on standards, to have clearly articulated goals, and to support and demonstrate content learning both in process and product.

2) The multimedia component gives students opportunities to use various technologies effectively as tools in the planning, development, or presentation of their projects. Though the technology can easily become the main focus of a given project, the real strength of the multimedia component lies in its integration with the curriculum and its authentic use in the production process.

3) The student direction component is designed to maximize student decision-making and initiative throughout the course of the project, from topic selection to design to presentation. Projects should include adequate structure and feedback to help students make thoughtful decisions and revisions. By documenting students' decisions, revisions, and initiative, teachers (and students) will capture valuable material for assessing student work and growth.

4) Project-based learning accommodates and promotes collaboration among students, between students and the teacher, and ideally between students and other community members as well. This component is intended to give students opportunities to learn collaborative skills such as group decision-making, relying on the work of peers, integrating peer and mentor feedback, providing thoughtful feedback to peers, and working with others as student researchers.

5) The real world connection component can take on many forms depending on the goal of the project. Project-based learning may connect to the real world because it addresses issues that are relevant to students' lives or communities. A project may be connected to real professions through use of authentic methods, practices, and audiences. Real world connections might also be made by communicating with the world outside the classroom via the Internet or collaboration with community members and mentors.

6) An extended time frame builds in opportunities for students to plan, revise and reflect on their learning. Though the time frame and scope of projects may vary widely, they should all include adequate time and materials to support meaningful doing and learning.

7) With its innovative approach to learning, project-based learning also requires an innovative approach to assessment. Just as learning is an ongoing process, assessment can be an ongoing process of documenting that learning. Project-based learning requires varied and frequent assessment including teacher assessment, peer assessment, self-assessment, and reflection. Assessment practices should also be inclusive and well understood by students, allowing them opportunities to participate in the assessment process in ways not typically supported by more traditional teacher-centered lessons.

Wolff's (2004) studied the components of project-based learning in the traditional classroom. As a brief example, he attempted to determine the design features of the physical learning environment that support and enhance project-based learning at the community college level and found the features resulted in 32 design features that were placed in the following six categories:

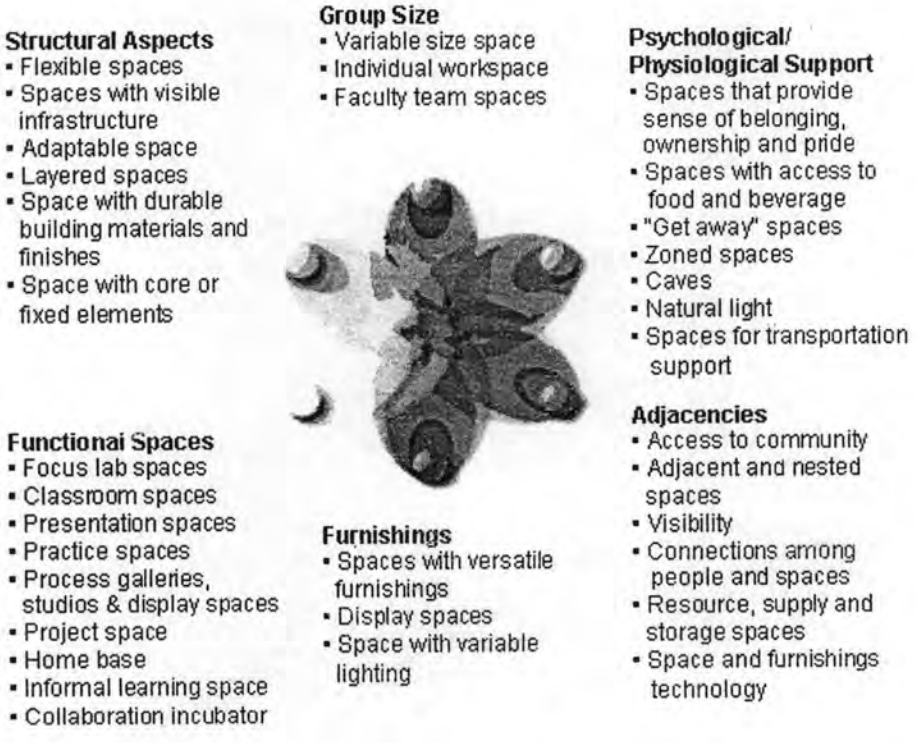

Figure 3 The features of the physical learning environment for project-based learning (Wolff, 2004)

1) Learning group size. The features are a) variable size space, b) individual workplace and, c) faculty team spaces.

2) Functional spaces for learning activities. The features are a) focus lab spaces, b) classroom spaces, c) presentation spaces, d) practice spaces, e) process galleries, studios, and display spaces, f) project space g) home base, h) informal learning spaces, and i) collaboration incubator.

3) Adjacencies. The features are a) access to community, b) adjacent and nested spaces, c) visibility, d) connections among people and spaces, e) resource, supply and storage spaces, and f) space and furnishings technology.

4) Furnishings. The features are a) spaces with versatile furnishings, b) display spaces, and c) space with variable lighting.

5) Psychological and physiological support for learners. The features are a) spaces that provide a sense of belonging, ownership and pride, b) spaces with access to food and beverage, c) "get away" spaces, d) zoned spaces, e) caves, f) natural light, and h) spaces for transportation support.

6) Structural aspects. The features are a) flexible spaces, b) spaces with visible infrastructure, c) adaptable space, d) layered space, e) space with durable building materials and finishes, and f) space with core or fixed element.

Like Wolff, Luehmann (2001) examined the perceptions of teachers as they appraised and considered the adoption of one innovative, technology-rich project-based curriculum. Six implicit factors were identified during this examination: trust, identity, self-efficacy, process goals, situational constraints, and contextual idiosyncrasies. This study reveals that factors affecting teachers' decision-making processes extend beyond those of which they are consciously aware. Additionally, there is no one set of factors important to all teachers. Instead, different groups of teachers have different concerns and therefore different needs.

In Thailand, Varaporn Tragoolsrid (2002) proposed a Web-based Instruction (WBI) model using project-based learning that will improve the students' team learning skills. The project-based learning model comprises five steps: 1) preliminary planning, 2) getting the project started, 3) putting the project in progress, 4) consolidating the project, and 5) presenting the project. From this study, the Web-based project activities the students used the most were chat and Web boards. Post-tests showed that the team learning abilities of the subjects increased considerably when her model was used.

3.3 Project-based learning in an online environment.

Web-based project-based learning is defined as problem-oriented learning within the framework of a small group, a whole class, or an individual project using Web support for the project activities. The model not only motivates students to participate in projects voluntarily and actively but also provides real-life context for successful collaborative learning (Marv, 2000 cited in Jung, Jun, & Gruenwald, n.d.).

Jung, Jun, and Gruenwald (n.d.) proposed a project-based learning model for the Web environment. The model was divided into the following six phases getting ready, deciding on a topic, planning activities, investigating and representation, finishing, and evaluating.

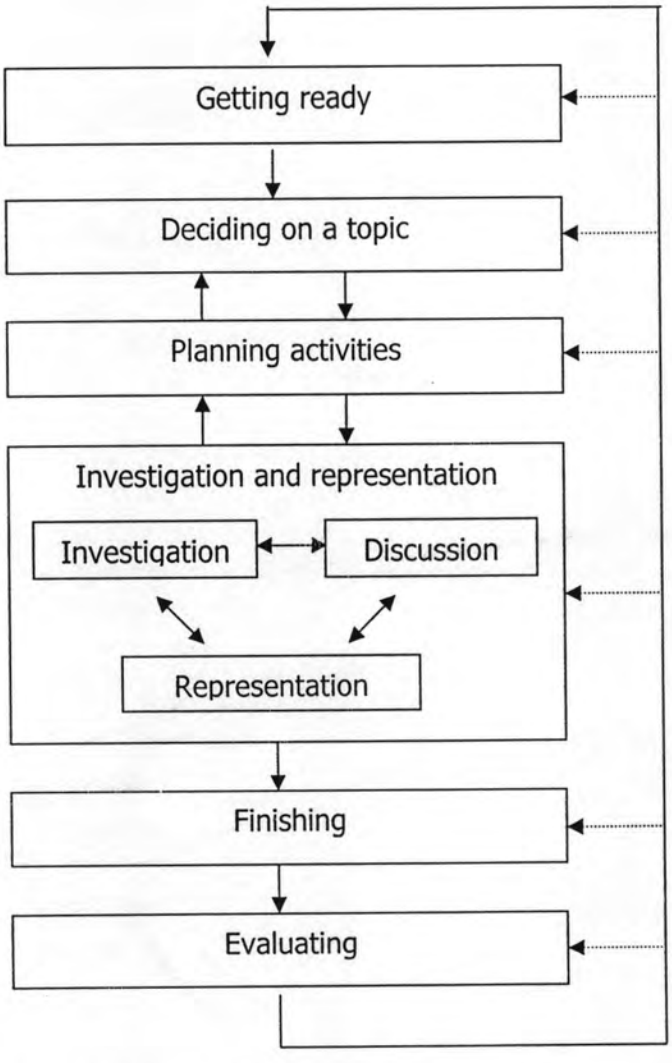

Figure 4 Project-based learning model for the Web environment model (Jung, Jun, and Gruenwald, n.d.))

3.3.1 Getting ready. First of all, a teacher designed a project outline. The outline's purpose was to provide the information necessary for students to envision their own project within the scope of the outline, and provide resources to help them carry it out. It must provided goals of the whole project for students, and sufficient guidance for students to choose appropriate questions, activities, and products. A

teacher analyzes and integrates curriculum, lists questions, researches Web sites or resources that can be helpful for students to investigate during the course of the project, and post on the Web.

3.3.2 Deciding on a topic. Students read the Web Project outline and search for resources. References to resources consist of URLs to relevant Web materials so that students can be directed immediately to high quality materials that match the project needs. Students recall their own past experiences related to the project, make topic map and exchange their ideas. During preliminary learning, the students decide subtopics of the project for themselves.

3.3.3 Planning activities. Students work on individual student projects, in-class collaborative projects, or class-to-class projects. They determine the activities and events that will take place at each stage of their subtopics, plan appropriate timelines for all their subtopics, and post on the Web. If they work on a collaborative learning project, each team member must have specific roles and responsibilities. Teachers communicate contents of project planning to parents so that they can help and support their children work on the projects.

3.3.4 Investigating and representation. Investigation includes activities such as interviewing experts through e-mail, investigating Web sites, and sharing exchange new experience and knowledge and doing a survey through the Web. In addition, it includes observations, experiments and field trips. Discussion includes both synchronous and asynchronous communication through the chatting or bulletin board system. Representation includes drawing, painting, writing, math diagrams, maps, etc. to represent new learning. Regularly, parents report the children's condition to teachers.

3.3.5 Finishing. Students produce reports, presentations, Web pages, images, pictures, construction, etc. as a result of the activity, share their end products, and celebrate them on the Web. Teachers have students write down their reflections on the project and things to remember for next time.

3.3.6 Evaluating. Teachers evaluate the whole process of the project and arrive at grades based on participation and products.

3.4 Benefits of project-based learning.

Based on the previous research, project-based learning appears to be an equivalent or slightly better model for producing academic achievement than the traditional teaching model; although results vary with the quality of the project and the level of student engagement. Project-based learning is not appropriate as a method for teaching certain basic skills such as reading or computation; however, it does provide an environment for the application of those skills (Buck Institute for Education, 2002).

Thomas (2002) gained insights into the interactions that occur in online communications in project-based learning activities. He found that the interactions that occurred online closely followed established steps in the problem solving process. The findings of this study also revealed that high and low achieving groups differ in frequency and temporal aspects of their online interactions. There was a general consensus that asynchronous and synchronous systems are best for certain types of tasks. Asynchronous systems are best for tasks that require reflection time and deeper thought and synchronous systems are best for brainstorming and as a forum for the free flow of ideas. The latter also seems to be more conducive to situations that require solidarity building and group social connection.

Likewise, Varaporn Tragoolsrid (2002) studied the WBI models with project-based learning for team learning at King Mongkut's University of Technology Thonburi. This study found that the subjects who learned using her WBI model with project-based learning had statistically significant (at .05 level) improvements in their team learning, team performance, and teamwork scores from pre-test to post-test.

More important, evidence shows that project-based learning enhances the quality of learning and leads to higher-level cognitive development through students' engagement with complex, novel problems. It is also clear that project-based learning teaches students complex processes and procedures such as planning and communicating. Accomplishing these goals, however, requires time for both teachers and students to master the behaviors strategies necessary for successful project-based learning. In addition to research, convincing reports from teachers show that project-based learning is a rigorous, relevant, and engaging instructional model that supports authentic inquiry and autonomous learning for students. Due to the fact

that project-based learning has positive effects on learning, the Ministry of Education in Thailand (2002) recommended project-based learning be implemented in classroom activities.

According to the Buck Institute for Education (2002) and Jung, Jun, and Gruenwald (n.d.) the main benefits of project-based learning are as follows.

1. Increased motivation. Accounts of project-based learning often report that students willingly devote extra time or effort to their tasks and those previously hard-to-reach students begin to participate in class. Teachers often report improvements in attendance and decreases in tardiness. Students often report that projects are more fun and more engaging than other components of the curriculum.

2. Increased problem-solving ability. Research on improving students' higher-order cognitive skills emphasizes the need for students to engage in problem-solving tasks and the need for specific instruction on how to attack and solve problems (Moursund, 1995; Perkins, 1992). Many articles describe project-based learning environments in which students become actively and successfully engaged in posing and solving complex problems.

3. Improved information literacy skills. These days most learning projects require students to move beyond easily available printed information sources such as textbooks, encyclopedias, and dictionaries and use information technology such as Websites. The project-based learning emphasis on independent research is in keeping with the American Library Association's (ALA) call for "information literacy" as a fundamental goal. Project-based learning can provide an authentic and motivating context in which to gain increased information literacy.

4. Increased collaboration. The necessity for group work in many projects requires students to develop and practice communication skills (Johnson & Johnson, 1989). Peer teaching, student evaluation, online information sharing, and cooperative learning groups are all aspects of the collaborative nature of projects. Current cognitive theories suggest that learning is a social phenomenon and that

students will learn more in a real world collaborative environment (Wiburg, 1994; Marv, 2000 cited in Jung, Jun & Gruenwald, n.d.).

5. Increased resource-management skills. Part of becoming an independent learner is taking responsibility for completing complex tasks. Well-implemented project-based learning gives students instruction and practice in organizing projects, and in allocating time and other resources, such as equipment, to complete tasks on schedule.

6. Increased opportunities for interdisciplinary learning. In project-based learning, students apply and integrate the content of different subject areas at authentic moments in the production process instead of in isolation or in an artificial setting.

7. Improved teacher-learner relationships. In the classroom, project-based learning provides many unique opportunities for teachers to build relationship with students. Teachers may fill the varied roles of coach, facilitator, and co-learner. Finished products, plans, drafts, and prototypes all make excellent "conversation pieces" around which teachers and students can discuss the learning that is taking place.

In summary, project-based learning is a learner-centered instructional approach that aims to help learners acquire knowledge by using a series of artifacts or products. The advance technology such as web technology can support the project activities. The project-based learning in an online learning will be motivating students to participate in project voluntarily and actively.

4. Team Learning.

The experienced approach to team learning has a long history. This section begins with definitions of team learning and then discusses the concept and development of team learning.

4.1 Definition of team learning.

The definitions of team learning vary. Senge (1990) calls team learning the process of aligning and developing the capacities of a team to create the results its

members truly desire. It builds on personal mastery and shared vision, and people need to be able to act together. Senge (1990) suggests that there can not only be good results for an organization but members will grow more rapidly than they could have otherwise. The discipline of team learning starts with "dialogue," which Senge (1990) says is the capacity of members of a team to suspend assumptions and enter into a genuine "thinking together" process. It also involves learning how to recognize the patterns of interaction in teams that undermine learning (Senge, 1990).

According to Marquardt (1996), teams must be able to think, create, and learn as an entity. They must learn how to better create and capture learning: in other words, they must learn to learn. A successful team learning system ensures that teams share their experiences with other groups in the organization. Team learning will occur more fully if teams are rewarded for the learning they contribute to the organization.

Mills (1967, refer in Adam & Kolb, n.d.) described team learning as a reconfiguring of a group's purpose to achieve a continually greater and more complex purpose.

In summary, team learning is a process of aligning and developing the capacities of a team to think, learn, and create the results they need. The results build on personal mastery, shared vision, and coordinated action.

4.2 Concept of team learning.

According to Senge (2006), team learning has three dimensions. First, there is the need to think insightfully about complex issues. Teams must learn how to tap the potential for many minds to be more intelligent than one mind. There are powerful forces at work in organizations that tend to make the intelligence of a team less than the intelligence of the sum of individual team members. Many of these forces are within the direct control of the team members.

Second, there is the need for innovative, coordinated action. Outstanding teams in organizations develop an operational trust where each team member remains conscious of other team members and can be counted on to act in ways that complement each other's actions.

Third, there is the role of team members on other teams. A learning team continually fosters the improvement of other learning teams by instill the practices and skills of team learning more broadly.

Though team learning involves individual skills and areas of understanding, it is a collective discipline. The discipline of team learning involves mastering the practices of dialogue and discussion, which are the two distinct ways that teams converse. In dialogue there is the free and creative exploration of complex and subtle issues, a deep 'listening' to one another, and suspension of one's own views. In contrast, discussion requires having different views to support decisions that must be made. Dialogue and discussion are potentially complementary, but most teams lack the ability to distinguish between the two and to move consciously between them.

4.3 Development of team learning.

Mills (1967, refer in Adam & Kolb, n.d.) described five levels of team development, which are as follows.

1) Immediate gratification. In the first level, members of the group seek to fulfill individual needs. They come together to meet some immediate individual needs, such as attending a concert to enjoy music. There is no sustained effort at gratification.

2) Sustained conditions for gratification. In the second level, individuals come together for gratification but develop ways to sustain the gratification. One example is a group that decides to attend concerts regularly or follow a musical group to various venues to recreate the experience. The effort to sustain gratification requires group learning because it involves developing informal strategies and implementing mechanisms to maintain the gratification over time.

3) Pursuit of a collective goal. The third-order purpose focuses on developing a collective goal. At the level, a group becomes a team. This stage requires development of more formal strategies and structures to meet the group purpose. Here the members of the group must transform individual learning to group learning, develop methods of coordination, develop adaptation mechanisms, and

respond to changing external demands. For example, an informal group may decide to create its own musical group and perform at various venues.

4) Self-determination. In the fourth level, the group no longer simply adapts to changes in the environment but makes self-directed changes directed by its stated desires. While external constraints are not completely eliminated, the group develops the freedom to set and pursue its own goals. An example is a musical group that sets its own progressive agenda and makes music that is seen as ground-breaking.

e). Growth. A group working at the fifth level can follow multiple goals, create high degrees of innovation, manage diverse and conflicting types of innovation, and influence a number of different domains. For example, a well-established musical group may influence several types of music, as the musical group The Beatles were able to do by creating rock, easy-listening, classical, and popular music. In addition, members of the group have been able to advance various causes, contribute to the development of new groups, and engage in other artistic endeavors such as painting and drawing.

In addition to Mills' five levels of team development, Darlington (2006) has suggested how to build a good team for effective team learning.

1) A team needs a good leader. Usually, in a work situation, the leader is chosen by people outside the team. In more social contexts, the team may choose the leader.

2) A team needs to be the right size. There is no precise figure here, but generally speaking one would expect a team to be around 8-12 members; smaller and supervision runs the danger of being excessive, larger and it is difficult for the leader to exercise effective control.

3) A team needs members with a variety of skills. The nature of these skills will depend on the organization and the task. However, typically one might want someone good with figures as well as someone good with words, someone who is effective at getting things done as well someone who can think creatively. It is important to avoid the temptation to choose too many like-minded members, and team members need to know and respect the skills of others in the team.

4) A team needs members with a variety of personalities. Again, the nature of these personalities will depend on the organization and the task. One might want an introvert as well as an extrovert and a mature person as well as a younger one. Gender and ethnic differences can also make a creative contribution to an effective team.

5) A team needs to bond. Some of this can be in done in the course of carrying out team tasks; however, it is good to create more specific opportunities for bonding that are outside the normal work schedule such as strategy sessions, training courses, and social events. Teams should take opportunities to celebrate successes, such as winning new contracts or fulfilling particular projects, and to celebrate occasions like the birthdays of team members.

6) A team needs to be able to resolve internal conflicts. No matter well a team bonds, it is likely that from time to time there will be differences within the team. This should not be unexpected, or even always avoided; it is an inevitable feature of creative people having different ideas.

7) A team needs good communication. People need to know what is expected of them, what is happening in the organization, and how all this affects them as individuals and as a team. In many ways the best communication is face-to-face, but this can be time-consuming and may not always be practical. These days e-mail is an efficient means of communication, provided that it is not overdone or used as a way of avoiding difficult encounters.

8) A team needs shared values and a shared vision. All team members need to know and agree how the team is going to work and what it is trying to do. This might involve having some sort of strategy session, maybe facilitated by someone outside the team, with exercises to ensure that the values and the vision are embraced by all.

9) A team needs clear objectives. Ideally these objectives ought to be SMART: that is, Specific, Measurable, Achievable, Resourced, and Timed.

10) A team needs to be empowered. There are two elements to this. First, the team collectively needs to be given the resources and the authority to achieve the objectives set for it. Second, each individual needs to know what is

expected of him or her but left to work out by him or herself how best to achieve this on a day to day basis.

11) A team needs trust. Members need to trust each other; especially the team leader. This requires open and honest communication, acceptance of a "no blame" culture, and recognition that every mistake is an occasion for learning and not an excuse to criticize.

12) A team needs to be flexible. There are two elements to this. First, roles in the team should not be rigid. It is the team's success that matters, not who exactly does what. Second, the composition and existence of the team needs to be flexible so that if a new skill is needed one might add a new member to the team; but, conversely, if the team's project is satisfactorily completed, there might no longer be a need for the team.

In summary, team learning is the process of aligning and developing the capacities of a team to think, learn, and create the results they desire. Team learning cannot develop by themselves. They need to build a good team for effective team learning.

Chapter summary

A review of the literature related to a design of virtual classroom environment for project-based learning has been provided in this chapter, including the virtual classroom, online learning environment and factor affected learning outcome in online learning environment, project-based learning in general and in online learning environment, and team learning skills.