COGNITIVE ENGAGEMENT IN A COMPUTER-SUPPORTED COLLABORATIVE LEARNING ENVIRONMENT

NURBIHA A SHUKOR

UNIVERSITI TEKNOLOGI MALAYSIA

COGNITIVE ENGAGEMENT IN A COMPUTER-SUPPORTED COLLABORATIVE LEARNING ENVIRONMENT

NURBIHA A SHUKOR

A thesis submitted to the fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy (Educational Technology)

Faculty of Education
Universiti Teknologi Malaysia

NOVEMBER 2012

Al-Fatihah, A. Shukor A. Majid. Father, this is for you.

For your patience, understanding and infinite love,

Abdul Wafi Yahaya

ACKNOWLEDGEMENT

My heartiest thanks to my supervisor, Assoc. Prof. Dr. Zaidatun Tasir; for all the guidance, patience, and care. Thank you for everything that you've put me through, making me realize that the world is not round and it takes two people to have things work.

A teacher, and a friend, Dr Henny van der Meijden who came all the way from the other part of the world, the Netherlands. Thank you for believing me and I am nothing but honoured to be one of your students.

Pictures can also never be put together without a mom in it. To my mother, Aminah Ma'arof, I believe for every of your du'a, you have me in it. I can never repay your thoughts and faith that you have in me. My big sister, dear brother, in-laws, thank you.

To Siti Khadijah Mohamed, you inspires me. Thanks to you. To my friends, dearest and close to my heart, Noor Dayana and Nabila, well things won't be the same without both of you. Thank you for the moments that we had, for lending me your ears and hearts so that we are bonded to this wonderful relationship.

Also, to the rest of them which might be you. Thank you for making things work. For the tiniest thing that you have ever done for me, I appreciate them all. Only Allah knows it well.

Thank you Allah.

–Nijmegen, 19 April 2012

ABSTRACT

The quality of online learning is determined by students' cognitive engagement. Recent research reported that students are cognitively engaged but mostly at the low-level of cognitive engagement (CE). High-level of CE is more beneficial as it shows that new knowledge is constructed. This research is proposing the usage of online computer-supported collaborative learning (CSCL) environment to promote students' CE to the higher-level. Samples were undergraduate students from two different cohorts who enrolled in the Web-based Multimedia Development subject. Cohort I ($n = 61$) consists of students who involved in earlier investigation on students' CE in online learning environment and cohort II ($n = 20$) consists of students who learned in CSCL environment. Through pre-experimental research design, students from cohort II answered the pre and post performance tests. Next, they were asked to solve CSCL tasks through online discussions in CSCL environment. Their online discussion scripts were collected and analyzed using content analysis method to obtain CE codes. The students' server log files, CE codes and performance test score were gathered to structure a performance predictive model using WEKA data mining software. Findings show that 34.04% of students from cohort I contributions in online discussion were at the low level. As for students in cohort II, they shows 70.23% cognitive contributions in nature but the percentages of low-level CE remains higher than the high-level CE. However, the CSCL environment was found to provide positive impact on students' performance in test ($p < 0.05$). Meta analysis (Cohen's $d = 1.858$) of t-test shows that the effect size of CSCL environment towards students' performance in test is significant. Even if this experiment is repeated, the power value (0.970) implies that the same result will be obtained. The performance predictive model predicts 'argumentation' as important for better performance in test. Conclusively, CE can be nurtured in CSCL environment but it is influenced by factors such as the group functions, the instructor's role, and the type of CSCL task. For better future performance in test, this research suggests that students should be encouraged to provide more arguments on statements while solving CSCL tasks such as justifying statements and giving critics with elaboration.

ABSTRAK

Kualiti pembelajaran atas talian ditentukan oleh penglibatan kognitif (PK) pelajar. Kajian terkini mendapati bahawa pelajar terlibat secara kognitif, namun kebanyakan PK pelajar berada di aras yang rendah. PK di aras yang tinggi adalah lebih bermakna kerana ia menunjukkan terdapatnya pembinaan pengetahuan baru. Kajian ini mencadangkan penggunaan persekitaran pembelajaran kolaboratif berbantukan komputer (PKBK) untuk menggalakkan PK pelajar di aras yang lebih tinggi. Sampel terdiri daripada pelajar pra siswazah daripada dua kohort yang berlainan yang mendaftar subjek Pembangunan Multimedia berasaskan Web. Kohort I (n = 61) terdiri daripada pelajar yang terlibat dalam kajian awal tentang PK pelajar dalam persekitaran pembelajaran atas talian dan kohort II (n = 20) terdiri daripada pelajar yang belajar di persekitaran PKBK. Melalui reka bentuk kajian pra eksperimental, pelajar kohort II menjawab ujian pencapaian pra dan pos. Seterusnya mereka diminta untuk menyelesaikan tugasan PKBK melalui perbincangan atas talian dalam persekitaran PKBK. Skrip hasil perbincangan mereka dikumpulkan dan dianalisis menggunakan teknik analisis kandungan untuk memperoleh kod PK. Rekod log data pelajar, kod PK dan markah ujian pencapaian pelajar dikumpul dan digunakan untuk membentuk model peramal pencapaian menggunakan perisian perlombongan data WEKA. Dapatan kajian mendapati 34.04% catatan pelajar kohort I dalam perbincangan atas talian adalah di aras yang rendah. Bagi pelajar kohort II, mereka menunjukkan 70.23% catatan secara semulajadinya berbentuk kognitif walaupun peratusan PK aras rendah tetap melebihi PK aras tinggi. Walau bagaimanapun, persekitaran PKBK didapati memberi impak positif terhadap pencapaian pelajar dalam ujian ($p < 0.05$). Meta analisis (Cohen $d = 1.858$) ujian t mendapati kesan persekitaran PKBK terhadap pencapaian pelajar dalam ujian adalah signifikan. Walaupun jika kajian ini diulangi, nilai kuasa (0.970) menunjukkan dapatan yang sama akan diperoleh. Model peramal pencapaian menjangkakan ‘perdebatan’ sebagai aspek penting untuk memperoleh pencapaian ujian yang lebih baik. Kesimpulannya, PK boleh dibentuk dalam persekitaran PKBK tetapi dipengaruhi oleh faktor seperti fungsi kumpulan, peranan pengajar dan jenis tugasan PKBK. Bagi pencapaian yang lebih baik dalam ujian di masa hadapan, kajian ini mencadangkan pelajar harus digalakkan untuk memberikan perdebatan dalam pernyataan semasa menyelesaikan tugasan PKBK seperti mengeluarkan pendapat yang beralasan dan memberikan kritikan dengan penerangan.

NEDERLANDSE SAMENVATTING

De kwaliteit van online leren is afhankelijk in de mate waarin studenten cognitief betrokken zijn bij het onderwerp dat zij bestuderen. Deze betrokkenheid wordt ook wel “cognitive engagement” genoemd. Men maakt een onderscheid in hoog niveau van cognitive engagement (CE) waar nieuwe kennis wordt geconstrueerd en van een laag niveau, waar kennis gereproduceerd wordt. Bij online leren, zo heeft recent onderzoek uitgewezen, is de CE meestal van een laag niveau. In deze studie wordt een computer supported collaborative learning (CSCL) omgeving gebruikt om het niveau van CE te verhogen. De deelnemers aan het onderzoek waren bachelor studenten van twee verschillende Cohorten die een cursus volgden in Web-based Multimedia Development. Cohort I bestond uit 61 studenten die de cursus deden in een online leeromgeving (individueel) en Cohort II bestond uit 20 studenten die de cursus deden in een CSCL omgeving. Er werd gewerkt met een quasi-experimenteel design met een cognitieve toets als pre-test en post-test. Cohort II loste een aantal problemen op door met elkaar te discussiëren in de CSCL omgeving. De discussies werden online verzameld en inhoudelijk geanalyseerd met behulp van een codeerschema, om de mate van CE te bepalen. De logfiles van de studenten, de CE codes en de resultaten van de cognitieve test werden met een datamining techniek geanalyseerd (WEKA software) om te komen tot een model met voorspellende waarde. De resultaten lieten zien dat 34.04% van de bijdragen van Cohort I van een laag CE-niveau was. Ook de studenten in Cohort II produceerden meer bijdragen van een laag niveau dan van een hoog niveau. Daar staat tegenover dat 70.23% van de bijdragen van cognitieve aard was. De CSCL omgeving had een positieve invloed op de cognitieve test ($p < 0.05$). De effect size gemeten met Cohen’s d was 1.858. De power value van 0.970 geeft aan dat dezelfde resultaten behaald zullen worden bij herhaling van het experiment. Uit het predictive model kan afgeleid worden dat het geven van argumenten in de discussie leidt tot betere resultaten in de cognitieve test. We kunnen concluderen dat CE gestimuleerd kan worden in een CSCL omgeving, maar dat de CE beïnvloed wordt door een aantal factoren zoals de samenstelling van de groep, de rol van de online docent en het type taak. Om beter te presteren zouden studenten uitgedaagd moeten worden om meer te argumenteren en meer te elaboraren op de aangeboden stof.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CE	-	Cognitive engagement
CSCL	-	Computer-supported Collaborative Learning Environment
H	-	High-level of cognitive engagement
HL	-	High-low level of cognitive engagement
L	-	Low-level of cognitive engagement
P_1	-	Poor performance during pretest
W_1	-	Weak performance during pretest
$L\text{-}A_1$	-	Low-achiever during pretest
$M\text{-}A_1$		Medium-achiever during pretest
$H\text{-}A_1$	-	High-achiever during pretest
O_1	-	Outstanding performance during pretest
P_2	-	Poor performance during post test
W_2	-	Weak performance during post test
$L\text{-}A_2$	-	Low-achiever during post test
$M\text{-}A_2$		Medium-achiever during post test
$H\text{-}A_2$	-	High-achiever during post test
O_2	-	Outstanding performance during post test

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

The current learning situation proves that surfing the internet (which is relatively considered ‘online’, will have the following benefits. It will: get people connected, share information (Kwisnek, 2005), make life more cost effective (Twigg, 2003), provide flexibility (O’Leary, 2005) and render distance is no longer a factor (Bonanno, 2005; Goldsmith, 2002). For some time, online learning has been a learning option, Whether or not online learning is efficient for training, distance learning, or in-class supporting teaching and learning systems (Cavanaugh, 2009; Kwisnek, 2005), it is apparently useful to support and enhance learning processes (O’Leary, 2005; Zhang et al., 2004). Therefore, the purpose of online learning should deploy the advantages of being online.

Curran (2001) cited that it is undeniable that technology can enhance the quality of education and open up more opportunities for learning, however, to what extent? Reviewing the perception that learning is possible when students are actively constructing knowledge, it implies that the cognitive tools can be anything as long as they engage learning processes (Jonassen, 1991). Furthermore, there remain mixed results about the effectiveness of online learning despite world-wide implementation some years. Results vary with respect to educational tasks, as well as student populations (Curran, 2001). Variations in results being obtained with respect to students’ learning outcomes in online learning situations have led current researchers to proceed to investigate the process of learning, rather than determining the success of learning outcomes in particular (Dennen & Paulus, 2005; Sieber, 2005; Van der Meijden, 2005). For effective online learning, the 'product' of learning is now regarded as something that will be obtained at the end of learning. It is now the 'process' of learning that that appears to matter (Sieber, 2005).

The quality of online learning was regularly recognized through students' satisfaction and perception towards their experiences in learning through this method (Ituma, 2011; Palmer & Holt, 2009), however, the transparency of this method remains an issue (Shank, 2010). It would be more well-founded if quality validation was made pedagogically throughout the online learning activity, such as investigating their cognitive engagement in an online learning environment. Cognitive engagement has been an area under discussion for authenticating students' learning in traditional classrooms for quite some time until the present (Rotgans and Schmidt, 2011b; Helme and Clarke, 2001; Corno & Mandinach, 1983).

Various perspectives were chosen to evaluate cognitive engagement in online learning, such as taking the view of knowledge construction (Schellens et al., 2008; Van der Meijden, 2005; Flynn, 2004). Knowledge construction can vary from a low to a high level, where deep engagement is reached at the higher level. This occurs when students can finally manipulate the knowledge that they have and be able to come up with new concepts about same (Van Aalst, 2009). It involves a variety of cognitive processes (Van Aalst, 2009; Beers et al., 2005). As such, on-going research is being carried out to boost students' levels of knowledge construction, and aim towards a higher level for harmonyin meaningful online learning (Schellens et al., 2008; Van der Meijden, 2005).

In a collaborative learning environment, it was found that students' cognitive engagement can be potentially increased since interaction with peers promotes sharing of ideasresulting in knowledge construction (Veerman and Veldhuis-Diermanse, 2001). Studies found that collaborative learning provides opportunities for sharing information, which in turn will encourage self-reflection on their own learning (Mukama, 2010). Also, collaborative learning increases students' acquisition of knowledge and encourages their cognitive development accordingly (Nyikos and Hashimoto, 1997). In fact, Valcke et al (2009) found that students learning in a collaborative learning environment are able to reach a higher level of cognitive processing and metacognitive regulations. Researchers suggest that higher cognitive engagement in a collaborative learning environment is attributed to arguments, critiques and idea generations evolving through a series of discussions among group members during collaborative learning. This results in increased involvement of students' thinking, which subsequently leads to higher cognitive engagement (McLoughlin and Luca, 2000).

1.2 Background of Problem

Despite the blessings of learning online, do the students actually learn while studying online? The quality of online learning remains questionable, particularly with regard to the effectiveness of online learning (Chen, Lambert & Guidry, 2010). The rapid growth of online learning triggers the need to have quality online programmes (Kim & Bonk, 2006). It is important to note that learning online is significantly more complex than in traditional settings. Sixty percent of the students in a study reported that online learning is more challenging than face-to-face learning (Kim, Liu & Bonk, 2005). As such, online learning should function as a way to learn new skills rather than simply being regarded as a luxury (Kwisnek, 2005). It requires students to be highly responsible for their learning (Nedelko, 2008; Sieber, 2005), as online learning is often learner-centred, active learning, independent learning, and requires a degree of self-motivation (Nedelko, 2008; Kerr et al., 2006).

In fact, compare with face-to-face communication, Kim, Liu and Bonk (2005) reported that students communicating online are not able to perceive gestures, tones, and body languages while interacting as in face-to-face interaction. Thus, this could conceivably cause misunderstanding. Text-dependency in most online learning environments can trigger misinterpretation or worse, misconception. As indicated by Stahl and Hesse (2009), it is necessary for both readers and writers to be at the same level for knowledge to be shared in an online learning environment. Accordingly, Savery (2005) also mentioned that the absence of verbal communication in online learning environments can be unpleasant for both students and instructors who are unfamiliar with this scenario.

As such, successful online learning demands dynamic students with highly-developed dimensions of cognitive and communicative aspects (Bai, 2003). It is also important to note that online learning might bring about effects where students feel isolated due to the difficulty of building up close interaction between learners in online settings (Graff, 2006). Thus, it is important that students are indeed learning in online learning settings. This goal can be achieved through observation of students' cognitive engagement in online discussions (Zhu, 2006).

1.2.1 Cognitive Engagement in Online Learning

Due to the complexity and diversity of learning online, students' online learning processes should be monitored closely to ensure that learning, and indeed meaningful learning, does in fact occur. For learning to be truly meaningful, students need to be cognitively engaged (Solis, 2008). Cognitive engagement is an indication of the learning process taking place where students exert an amount of mental effort to become engaged with the learning material (Richardson & Newby, 2006; Walker, Greene and Mansell, 2006). Research explaining cognitive engagement in online learning is plentiful (see works by Wysocki (2007) and Zhu (2006)), as cognitive engagement is a prerequisite for students' meaningful learning (Solis, 2008; Bai, 2003). It is also critical for the creation of new knowledge and understanding (Zhu, 2006).

In a face-to-face learning environment, cognitive engagement is visible when students give sustained attention toa given task requiring mental effort (Corno & Mandinach, 1983). Typically, cognitive engagement is measured from the dimension of, namely: students' time on task (Nystrand & Gamoran, 1991), students' participation (Sparkes, 2007), students' control and relevance of schoolwork, and future aspirations and goals (Appleton et al., 2006). There are also few research works associating cognitive engagement with motivational constructs such as self-efficacy (Scott & Walczak, 2009; Walker, Greene & Mansell, 2006; Greene et al., 2004). Students will then assess themselves by answering surveys and questionnaires, such as the Student Engagement Instrument (Spanjers, 2007; Appleton et al., 2006), National Survey of Student Engagement (Chen, Lambert & Guidry, 2010) and Student Engagement Questionnaire (Coates, 2005).

However, due to the complexity of the online learning context, cognitive engagement seeks for an innovative method of evaluation where different ways of observing cognitive engagement in online learning are necessary. Beer, Clark and Jones (2010) argue that using such a method does not reflect the quality of engagement. Zhu (2006) further explains that it is almost impossible to observe cognitive engagement in an online learning environment but it can be understood from the richness of discussion messages. Regarding online learning context, Zhu (2006, p. 454) clarifies cognitive engagement as:

> "*.. attention to related readings and effort in analyzing and synthesizing readings demonstrated in discussion messages. Cognitive engagement, as defined, involves seeking, interpreting, analyzing, and summarizing information; critiquing and reasoning through various opinions and arguments; and making decisions*. "

Discussion messages in online learning are text-based and computer-mediated. Warschauer (1995) described writings as the intersection between interaction and reflection. By this tenet, several researchers are found to measure cognitive engagement through different lenses for an online learning context based on students' written discourse (Janssen et al., 2010; Oriogun, 2006; Veerman & Veldhuis-Diermanse, 2001). For example, students' cognitive engagement is explored through their argumentations in discussion (Weinberger & Fischer, 2006; Veerman, 2000) and higher order thinking and critical thinking (McLoughlin & Luca, 2000; Stoney & Oliver, 1999). It is also investigated through students' knowledge construction in asynchronous or synchronous communication (Schellens et al., 2008; Beers et al., 2005; Van der Meijden, 2005; Veerman & Veldhuis-Diermanse, 2001; Gunawardena et al., 1997). The emerging trends indicated that previous researches utilized students' written discourses to reflect their cognitive engagement in online learning. By collecting students' online learning written discourses, they infer that:

> *".. by externalising thinking processes, students make statements and counter statements, defend and challenge each other's assumptions .."* (McLoughlin & Luca, 2000, p. 3).

By this proposition, investigating cognitive engagement through knowledge construction has gained the greatest attention. Several analyzing coding schemes have been developed to analyze students' knowledge construction in online learning. However, previous studies found that students' level of cognitive engagement (or knowledge construction) were at the low-level (McLoughlin and Luca, 2000; Zhu, 2006; Schellens et al., 2008). For example, Zhu (2012) found that despite the variety of cultural backgrounds involved in the online discussion (Chinese and Flemish students), similar results were observed; that is, fewer messages that reached a high level of knowledge construction.

A low level of cognitive engagement signifies that students were only externalising their thinking processes using their existing knowledge, for example, by sharing and comparing information (Zhu, 2012). Learning at a low level of cognitive engagement is only beneficial to sustain the discussion and online interaction (Zhu, 2012). Constructing knowledge at a higher level is more important for students' learning, particularly online, because it ensures students are experiencing meaningful learning (Rahman et al., 2011). At the high-level of cognitive engagement, students externalise thoughts that involve arguments, justification, or decision making. Those are the attributes that help students to becritical thinkers and thereby able to construct new knowledge (McLoughlin and Luca, 2000).

As such, what can be done to increase students' level of cognitive engagement in online learning? Students have to be positioned at the level where they are able to construct new knowledge by arguing, justifying or asking and answering questions. A specific environment has to be designed to nurture these behaviours that enable the construction of new knowledge.

1.2.2 Knowledge Construction and Computer-supported Collaborative Learning

Knowledge construction develops in a collaborative learning environment where students communicate by sharing information in groups for solving given tasks (Dillenbourg & Fischer, 2007; Alavi & Dufner, 2005; Crook, 1998). Knowledge construction per se, is the vivid evidence of collaborative learning taking place (Alavi & Dufner, 2005; Veerman & Veldhuis-Diermanse, 2001; Crook, 1998), as students learning in a collaborative learning environment have to make their thoughts clear (Ding, 2009; van Boxtel, 2000).

With the growing usage of computers and technological affordances, computer-supported collaborative learning has become an emerging educational technology paradigm (Gros et al., 2005; Lipponen, 2002; Koschmann, 1996) that provides principles to design effective online learning environments. Originating from collaborative learning, computer-supported collaborative learning (CSCL) occurs where the processes of peer interaction, working in groups, sharing and distribution of knowledge are supported by technology (i.e computers) (Lipponen, 2002). CSCL highlights methods whereby technology-assisted collaborative learning increases interaction with peers and cooperativeness in group. The purpose of collaborative learning is to enable students to learn by working together to solve learning tasks (Gros, 2001; Kumar, 1996). This occurs where students are found to possess knowledge sharing behavior in a CSCL environment through the implemented peer-assisted learning (Auttawutikul & Natakuatoong, 2008).

Thus, students were exposed to the CSCL environment to trigger knowledge construction among students learning online. Previous records of students' knowledge construction in online learning indicated that, for some period, most of the students' online discourses were information-sharing statements which fell into the lower degree of cognitive engagement (Ma, 2009; Schellens et al., 2008; Zhu, 2006; Schellens & Valcke, 2005; McLoughlin & Luca, 2000). There was no empirical remark that a higher order learning process such as construction of new knowledge and critical analysis of peer interaction had taken place in their discussions (Van der Meijden, 2005; Veerman & Veldhuis-Diermanse, 2001; McLoughlin & Luca, 2000).

Recent studies also reported that interaction in the CSCL environment is of high density (Leon et al., 2010; Rimor, Rosen & Naser, 2010; Lipponen et al., 2003). However, students tend to interact at the level of 'rapid consensus', where students tend to accept peers' opinions not necessarily because they agree with each other, but merely to hasten the discussion (Rimor, Rosen & Naser, 2010). A great number of students also entered the collaborative learning space for the main purpose of downloading materials (Leon et al., 2010). Although messages were posted, the contents related to social regulations rather than task-related activities (Janssen et al., 2010). Stoney and Oliver (1999) previously noted that off-task activities usually signify that students are deviating from the programme. Also, even though students are highly motivated, they are found not to be reaching deep cognitive engagement (Blumenfeld, Kempler and Krajcik, 2006).

The addressed issues are due to several influencing factors. The first is the use of communication media during the collaboration process. Researches indicate that students communicating in asynchronous medium posted more messages of a higher-level of knowledge construction compared to messages in synchronous communication (Schellens & Valcke, 2005; Van der Meijden, 2005; Veerman & Veldhuis-Diermanse, 2001). This is because asynchronous communication provides retention time for: self-reflection (such as the time to provide opinions and reflecting information) (Veerman & Veldhuis-Diermanse, 2001), processing information (Kim, Liu & Bonk, 2005) and being aware of how group dynamics evolve (Solimeno et al., 2008). It also allows the students to review the threaded discussion to gain better insights about the discussion topic (Kim, Liu & Bonk, 2005).

Another influencing factor is related to the structure of the collaborative tasks. Several studies reported that the collaborative tasks should be structured to initiate social interaction (Dixon, Dixon & Axmann, 2008; Van der Meijden, 2005; Blake & Rapanotti, 2001). Veerman and Veldhuis-Diermanse (2001) mentioned that a structured task is a task which is very complex, requiring students to regulate their activities in order to solve a given task. Dixon, Dixon and Axmann (2008) reported that discussion can cause confusion and that the collaborative exercises must be structured so that the students are aware of the expected interactions. Furthermore, most findings reported that interacting in the CSCL environment, mainly in asynchronous mode of communication, is time-consuming. This is due to the time that the students have to spend on reading, reflecting, and responding to the threaded discussion (Dixon, Dixon & Axmann, 2008). This is supported by Blake and Rapanotti (2001) who reported that the structured collaborative tasks will prepare students for a comfortable environment to work with (Blake & Rapanotti, 2001). Hence they will be more aware of the key centres of their activities (Lipponen et al., 2003).

Above all, Garrison (1993) and Kreijns, Kirschner and Jochems (2003) emphasized that, despite the numerous variables associated with the effectiveness of a CSCL environment, they all led to a similar conclusion, namely; social interaction. Through the perspective of socio-cultural theory, social interaction plays a central role for individual cognitive development (Dillenbourg et al., 1996). Later, knowledge is internalized by an individual at the individual plane (Dillenbourg et al., 1996). "Social" and "individual" are perceived as unity rather than being dichotomous (John-Steiner & Mahn, 1996). Thus, the psychological tools useful for internalization are not individually constructed, but are "a product of socio-cultural evolution to which individuals have access by being actively engaged in the practice of their communities" (John-Steiner & Mahn, 1996). Placing students in an environment where social interaction is possible technologically is insufficient to drive social interaction. Dillenbourg (1999) mentioned that something has to be done in order for the desired interaction to occur.

This is equally agreed upon by Chung et al., (2008) who mentioned that simply positioning students in a group does not guarantee that their learning skills will improve. Dillenbourg and Fischer (2007) indicated that the success of collaborative learning is subject to productive interactions. They cited that interaction in a collaborative learning environment has to be designed (Dillenbourg & Fischer, 2007). Most CSCL environments that have been developed can function very well, but they are lacking in terms of the sociability of the environments (Kreijns & Kirschner, 2004). It is therefore important to design the CSCL environment in a way that triggers interactions, particularly towards achieving learning outcomes and considers constraints that may inhibit interactions. Strijbos, Martens and Jochems (2004) suggest six considerations to design interaction in a CSCL environment. These consider:

i. determining the type of learning objective to be achieved,

ii. determining the expected interaction,

iii. selecting the task-type with respect to the learning objective and the expected interaction,

iv. determining whether structure is necessary with respect to the learning objective, expected interaction and the task-type,

v. determining the group size that suits the learning objectives, expected interaction, task-type and level of pre-structuring, and

vi. determining how a computer will be utilized to support learning and expected interaction.

Upon defining the interaction for CSCL environment in a productive interaction, it is then useful to assess students’ learning processes in online learning. The success of learning processes can be measured in various ways. The most common way of assessing students’ learning gain would be through their performance in achievement tests.

1.2.3 Performance Predictive Model to illustrate students' cognitive engagement in CSCL environment

Crook (1998) stated that the typical method of assessing the effectiveness of a collaborative learning environment is by assessing students' learning outcomes in performance tests (post-performance test scores). Subsequently, research methodology emerged where researchers tended to investigate whether collaborative learning can predict better academic performances. Crook (1998) added that what 'is lacking is how collaborative learning is 'resourced'. This is true for the fact that the existing researches in collaborative learning tend to test on different influencing factors that enable collaborative learning to be successful. Dillenbourg (1999) pointed out that this is meaningless as there are too many variables involved and it all depends on the context of investigation.

In a case where collaborative learning is assessed to determine the quality of learning through students' cognitive engagement, a performance predictive model is useful to illustrate such a case. Other than assessing students' performance tests, by using a decision tree algorithm, researchers will be able to understand the processes that took place that finally point to the obtained results (Witten, Frank and Hall, 2011). From the performance predictive model, the researcher would be able to see the actual factors that caused certain specific outcomes. Different performance outcomes might be caused by different cognitive engagement behaviours, or it may be resourced from the same cognitive engagement behaviour.

The available performance predictive model did not capture the importance of illustrating students' cognitive engagement in online learning. Instead, the common variables used to construct students' performance predictive model are variables that are readily retrieved from online learning databases such as: students' login frequency, number of messages posted, number of read messages or the frequency of viewing resources (Macfadyen and Dawson, 2010; Hung and Zhang, 2008). What is lacking are the variables to determine the quality of the discussion messages (in this case cognitive engagement), since those are often assessed separately where instead both should be investigated simultaneously. Researchers subsequently found that students' participation in online learning is plentiful, the students were found to be actively learning in an online learning environment and the density of interaction is high (Leon et al., 2010; Rimor, Rosen & Naser, 2010). However, it can not necessarily be concluded that students' are indeed 'learning' because most of them result from social regulations rather than on-task discussions (Janssen et al., 2010). By analyzing the variables that include both cognitive engagement and students' participation in online learning, a two-dimensional performance predictive model can be constructed which considers both qualitative and quantitative aspects of students' learning online.

Research needs to be carried out to investigate how to increase students' level of cognitive engagement, particularly in online learning. Using a performance predictive model, researchers as well as educators will know which cognitive contribution is important for online learning success. In the future, educators will be able to encourage specific cognitive contributions (emerging from a performance predictive model) to enable students' better cognitive engagement, as well as their academic performances.

1.3 Problem Statement

Online learning has been cited as one of the emerging methods of learning possessing multiple learning approaches. Evaluation of online learning has been carried out in several ways and one of them evaluates students' discourses in online learning to investigate their respective cognitive engagement (Zhu, 2006). Students' cognitive engagement is vivid evidence of the learning process taken place. Through analysis of students' discourse, students' cognitive engagement can then be measured from a knowledge construction point of view (Rotgans & Schmidt, 2011a).

Knowledge construction which develops in a collaborative learning environment is useful in understanding students' cognitive engagement in online learning. However, previous researches indicated that students' knowledge construction in online learning remains at the lower level (McLoughlin and Luca, 2000; Van der Meijden, 2005; Schellens et al., 2008). Interaction has been found to be of high density, but tends to focus on social regulations (Janssen et al., 2010). These are due to several influencing factors such as the use of communication mode, the structure of the collaborative tasks and lack of interactions. A properly designed CSCL environment is proposed to be able to enhance students' level of knowledge construction towards the higher degree and thus be able to address the aforementioned influencing factors.

Therefore, the purpose of this research is to first, analyse students' levels of cognitive engagement without having to go through a systematic group learning activity. Next, this research developed an online CSCL environment with the aim of increasing students' cognitive engagement, as well as their academic performances. Upon implementation, it is important to evaluate the effectiveness of the developed CSCL environment towards students' academic performances. A performance predictive model is a useful illustration by which to provide the overall picture that leads us to the conclusion of the research. It will provide the interaction route that the students took to achieve specific levels of engagement and academic performances.

1.4 Research Objectives

The objectives of this research are, namely:

i. To analyze students' level of cognitive engagement in online learning,
ii. To develop a computer-supported collaborative learning environment,
iii. To investigate the influence of CSCL environment on:
    a. level of cognitive engagement,
    b. students' performance in tests.
iv. To investigate students' attainment of a higher level of cognitive engagement in the CSCL environment,
v. To construct a performance predictive model of students' cognitive engagement in the CSCL environment.

1.5 Research Questions

The research questions are, namely:

i. What are the students' levels of cognitive engagement in online learning?
ii. What are the influences of the CSCL environment in regard to:
    a. levels of cognitive engagement?
    b. performance in tests?
iii. How do students reach higher levels of cognitive engagement in the CSCL environment?
iv. What is the performance predictive model of students' cognitive engagement in a CSCL environment?

1.6 Theoretical Framework

The theoretical framework of this research is presented in Figure 1.1. Initially, the term 'cognitive engagement' is made transparent for future reference. Prior analysis works have explained that computer-supported collaborative learning (CSCL) can support both co-construction of knowledge (Lipponen, 2002; Lehtinen et al., 1999) and greater social interaction (Lehtinen et al., 1999; Paavola et al., 2002). Thus, the CSCL environment is developed for the purpose of enhancing students' cognitive engagement in online learning, which accords with the principles of CSCL by Bonk and Cunningham (1998) and the CSCL interaction principles of Jochems, Marten and Strijbos (2004).

For the development of a CSCL environment, a systematic approach has to be used. The Three-Phase Design (3PD) instructional design model (Sims & Jones, 2003) is used for developing the CSCL environment. The model, as according to Sims (2003, p. 6), is shown in Figure 1.1:

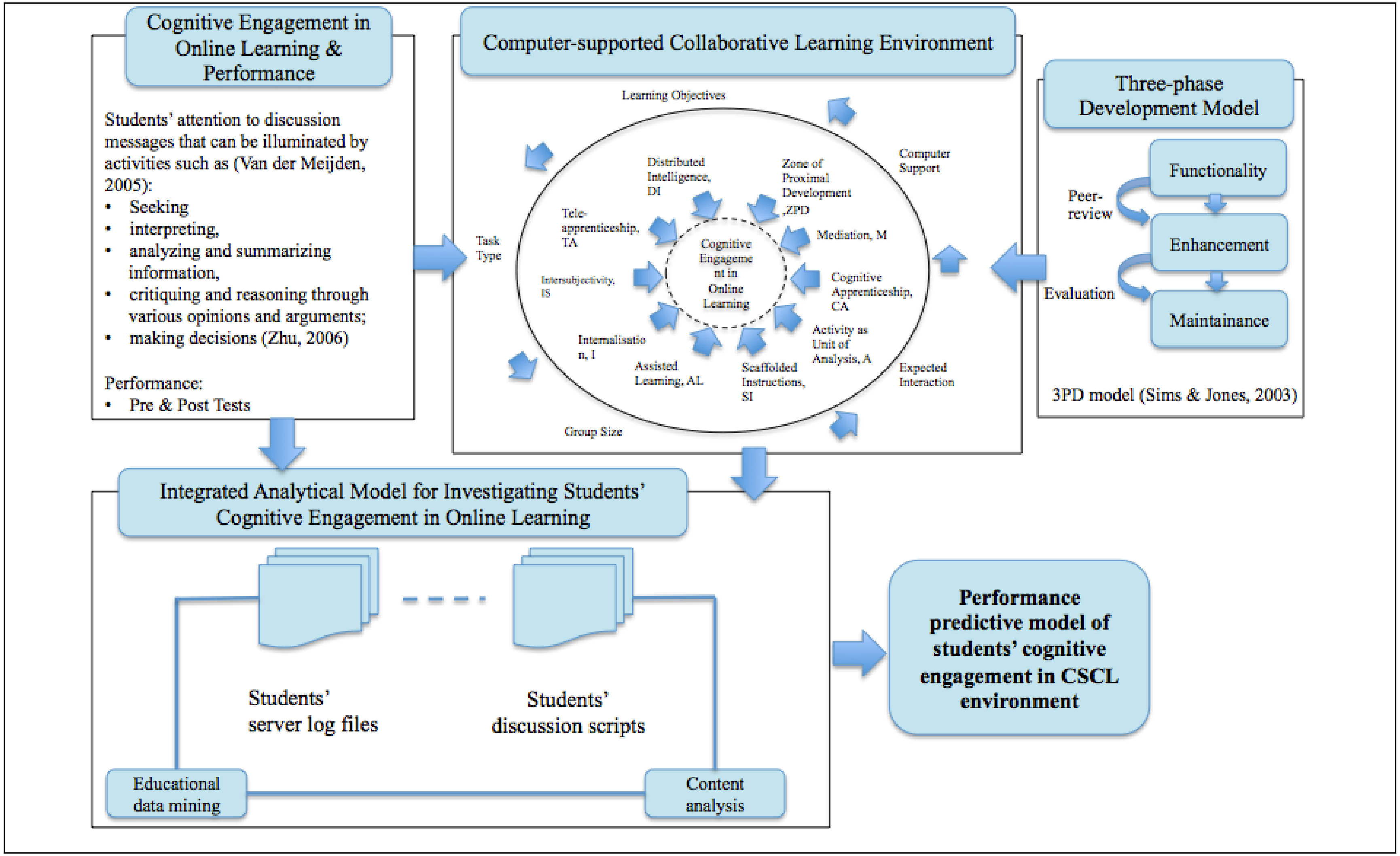

Figure 1.6: Research Theoretical Framework.

> "*The implication of applying the 3PD model is that the original functional system will always be subject to change, and that development environments need to schedule resources for the life-time of that course. The continual process of gathering and incorporating evaluation data caters for the sustainability of the course*".

Upon implementation of the CSCL environment, the data obtained from students' server log files and students' discussion scripts is analysed using an integrated analytical model. From these processes, this research hopes to ascertain the levels of students' cognitive engagement in the CSCL environment, how students were cognitively engaged and how they performed in performance tests based on the construction of a performance predictive model. The following sub-topics will provide greater insight on each element of the proposed theoretical framework.

1.6.1 Cognitive Engagement in Online Learning

The definition of cognitive engagement is adapted from Zhu's (Zhu, 2006) previous work. His definition of cognitive engagement relates to the students' attention to discussion messages, which can be observed from behaviour seen in several postings (Zhu, 2006). According to Zhu (2006), students' mental efforts can be translated into activities such as seeking, interpreting, analyzing and summarizing information, critiquing and reasoning through various opinions and arguments, and, finally, making decisions. The related activities are respectively the characteristics of collaborative co-construction of knowledge (Van der Meijden, 2005). Hence, cognitive engagement in this respect can also be understood as being students' sustained mental efforts towards co-construction of knowledge while solving a given task.

Addressing cognitive engagement as being students' "sustained mental effort for co-construction of knowledge" will be useful particularly in an online learning context where observation is almost impossible to be carried out Students' textual material being produced during discussions can serve as a representative of their mental activities and interactivity (Muirhead, 2000).

1.6.2 Computer-supported Collaborative Learning Environment

The proposed CSCL environment in this research integrates both CSCL principles (Bonk and Cunningham, 1998) and CSCL interaction design principles by Jochems, Marten and Strijbos (2004). The following discussions will provide detailed descriptions on how both principles are integrated to boost cognitive engagement in online learning.

1.6.2.1 CSCL principles based on Socio-cultural Theory

Socio-cultural theory views learning as a process that should occur in a social context (Jeon, 2000). The social context is the primary dimension in this theory, where Vygotsky (1978) asserts that a child's development appears between people (social plane) (that is, the inter-psychological category) and between a child (individual plane) (that is, intra-psychological category). Nevertheless, individual learning remains applicable in this theory, but as a secondary dimension (Jeon, 2000).

For the development of educational tools, Bonk and Cunningham (1998) are convinced that specific learning theory should be the basis so that the educational tools function respectively. They further elaborated the theoretical foundations of CSCL environments with respect to socio-cultural theory. They discussed the principles for a CSCL environment as indicated in Table 1.1.

Table 1.1: Socio-cultural Theory and Principles for CSCL Environments (Bonk & Cunningham, 1998)

Principles	Explanation
Mediation	Mediated tools are used to assist individual psychological activities.
Zones of Proximal Development (ZPD)	Collaborative learning is monitored by Zone of Proximal Development where it indicates the distance between the actual developmental level and the potential developmental level (Vygotsky, 1978).
Internalisation	Internalisation is successful if an individual is able to perform the collaborative task independently.
Cognitive Apprenticeship	The more capable peers help the less capable so that the less capable can carry out tasks independently.
Assisted Learning	Learning is assisted by specific teaching strategies.
Tele apprenticeship	Technologies are used to aid collaborative learning.
Scaffolded Instruction	More capable or expert peers assist the less capable whenever necessary by giving hints, elaborations, guidance, questions, prompting and other similar techniques.
Inter subjectivity	Collaborative group members shared temporary understanding about certain concepts or facts.
Activity Setting as Unit of Analysis	Activity has to be the central of collaborative learning where collaborative group members understood their roles for collaborating.
Distributed Intelligence in Learning Community	The knowledge gained from collaboration should be spread around the learning community.

1.6.2.2 The designing principles of CSCL environment for interaction

To tackle interaction issues that have previously been described, interaction in a CSCL environment has to be properly designed so that it triggers communication leading to knowledge sharing, and thus knowledge is constructed (Strijbos, Martens and Jochems, 2004). Veerman and Treasure-Jones (1999) quoted that for students to argue in a collaborative problem-solving environment, task characteristics and structured interaction play an interconnected role. Strijbos, Martens and Jochems (2004) proposed a process-oriented methodology for which the influence of interaction factors is composed of six designing steps. These are, namely:

i. learning objectives,
ii. type of interaction
iii. task-type
iv. level of pre-structuring,
v. group size, and
vi. computer support.

For designing the CSCL environment to foster interaction, questions should be addressed with respect to the six designing steps which are discussed clearly in Chapter 5 (Strijbos, Jochems & Martens, 2004).

1.6.3 Three-phase Development Instructional Design Model

According to Beach (2008), the Three-phase Design (3PD) model is based on Weaver's Emergence theory (Weaver, 1948). The model, which is developed by Sims and Jones (2003), supports revision, enhancement and adaptability. The model emphasized collaboration and ongoing works of the team over various phases. It allows analysis of instructional problems and immediate accurate solutions (Beach, 2008).

In relation to the instructional design, the model considers the following issues with respect to online learners, namely:

i. learners have the potential to advance and define their own essential knowledge base,
ii. the very uncertainty and lack of predictability of learning outcomes will be the key factors that add value to a learning community,
iii. emergent systems will provide the necessary triggers to enhance knowledge and understanding, and
iv. emergent learning will be one of the critical triggers by which individual creativity will be unleashed (Kays & Sims, 2006).

1.6.4 Integrated Analytical Model for Analyzing Students' Cognitive Engagement in Online Learning

In this research, an integrated approach model is suggested to assess both aspects of students' online learning. To investigate the quality of online learning, students' cognitive engagement is assessed through their written messages in online discussions using the content analysis technique. A specific coding scheme by Van der Meijden (2005) is used to code the messages.

On the other hand, the data on students' participation in online learning for quantitative assessment is retrieved from the available Learning Management System (LMS) databases (students' server log files) and is further analyzed using the data mining technique.

Students' scores in performance tests, coded messages and students' server log files formed a complete data set that was used to construct a performance predictive model for students' cognitive engagement during online learning.

1.6.5 Students' performance predictive model

A students' performance predictive model will illustrate the overall activities occurring within the CSCL environment. The model will be able to predict which cognitive attribute(s) is/are beneficial for students' attainment of a higher degree of cognitive engagement.

1.7 Research Rationale

The rapid and continuous growth of online learning provides the reason for conducting the present research. There are plenty of instructional designs, as well as pedagogical aspects, being incorporated within online learning websites. Evaluations of the effectiveness of developed websites are also studied. However, research on the pedagogical aspects, such as students' cognitive engagement in the learning processes, will provide a greater insight into online learning. The relevance of cognitive engagement being narrowed down as the main scope of this research is due to several reasons.

Firstly, online learning is widely applied, but the quality of such learning context on students' knowledge gains remain dubious. Although several efforts have been made to investigate students' level of cognitive engagement in online learning, it was found that, for some time, students' cognitive engagement remains at the low level. This scenario is worth researching, for online learning should be able to trigger students to achieve a higher level of cognitive engagement. Additionally, previous researches were also unable to fill the empty gap about the way in which students' cognitive engagement in online learning can be related to their academic performances.

Overall, online learning that provides support for cognitive engagement will facilitate students' learning and enhances academic performances even more. The idea of using the CSCL approach to promote cognitive engagement in online learning is based on the premise that it might enable an increase in students' academic performances and social skills by providing a set of guiding principles for learning and interacting.

1.8 Relevance of Research

The findings from this research are very useful to illustrate the current degree of students' cognitive engagement in online learning settings. Upon recognising the degree of students' cognitive engagement in online learning discussion, this research provides the framework for elevating the students' lower degree of cognitive engagement in online learning context to the higher degree. The research would also examine varying impacts of a collaborative learning environment on students with differing levels of performance in tests.

1.8.1 Relevance of Research to Students

Students can benefit from the present research by being able to ascertain their degree of cognitive engagement in online learning. Being at a low-level, students can further propose self-intervention to enhance their learning performance. Similarly, students at the higher-level will be encouraged to maintain their current performance. Other than that, the students will be able to discover the important aspects of learning that should be emphasized for better future learning performance (for example, the importance of either sharing information or arguing). From the knowledge discovered in this research, students are able to maximize their mental efforts in an engaged learning environment, so that they can excel in the learning course, together with the skills that will be refined in this research.

1.8.2 Relevance of Research to the Educators

As noted by Tu and Yen (2007), it is important to investigate individuals' reactions towards the mediated environment. Thus, the findings of the research would suggest to academicians and educators the domains of collaborative learning that most affectstudents' performances. It would be comprised of either the scaffolding instructions, the group composition or a result from other domains.

Also, educators will be able to ascertain important aspects that contributed to better cognitive engagement in online learning and thus enhance learning performances. It would be by way of either encouragingstudents to share information and elaborate on it, arguing on facts, asking and answering questions or due to other aspects. From the knowledge gained in this research, the educators can put in more emphasis to specific areas that can contribute to better cognitive engagement among the students.

Other than that, this research will explain the factors that either contribute to or might inhibit students' cognitive engagement and learning performances in online learning. Thus, educators can benefit by proposing early planning, mediation or intervention to their students at hand.

1.8.3 Relevance of Research to Ministry of Higher Education, MOHE

Online learning has been widely applied in higher education institutions throughout Malaysia with the aimof aiding students' learning at any time and in any place. In this research, the Ministry of Higher Education, MOHE, will be informed on how cognitive engagement can predict students' future performance. MOHE will be informed on the effects of instilling cognitive engagement for students' learning online. In the near future, MOHE should spread awareness of observing students' cognitive engagement while learning online through activities involving collaborative learning, CSCL.

1.8.4 Relevance of Research to Society

To a greater extent, the culture of building knowledge within a community, as is being applied in this research, will be able to produce valuable human resources. These resources will possess a variety of skills such as; being socially interactive, problem-solvers, and decision-makers, rather than simply being academically outshined.

1.9 Scope and Limitation of Research

This section provides information on the area being covered by this research. The limitations are also clearly stated to provide useful guidance for future research.

1.9.1 The Context

The research focuses on the students' cognitive engagement in the online learning context, specifically through their online learning discussions under the influence of a collaborative learning environment. Cognitive engagement in this research's context is reflected from students' construction of knowledge in discussion messages while solving the given tasks.

The tasks are problem-solving tasks for the subject of Web-based Multimedia Development, as being taught in the Faculty of Education, Universiti Teknologi Malaysia.

1.9.2 The Samples

Samples in the present research are Malaysian undergraduate students who have basic computer skills, such as ability to operate Microsoft Word, PowerPoint, and Excel. The samples have also learned several computer subjects such as Basic Computer Programming and Digital Video and Animation. Simply said, they are computer literate, and thus, skills for learning online are not discussed but rather their cognitive engagement while completing the given task. However, limitations consisting of their differences in basic computer skills, as well as gender factors, are not being considered in this research.

1.10 Operational Definition

Following is a description of how different terminologies are used in the research.

1.10.1 Knowledge Construction

Van Aalst (2009, p. 11) defined knowledge construction as involving a variety of cognitive processes such as:

> *".. explanation-seeking questions and problems, interpreting and evaluating new information, sharing, critiquing, and testing ideas at different levels and efforts to rise above current levels of explanation, including summarization, synthesis and the creation of new concepts*".

From the quotation, Van Aalst (2009) stated that during the process of knowledge construction, there is 'effort' to move to a higher degree from current levels. Van der Meijden (2005) further explained that students' knowledge construction can be categorized into low and high levels. A low level of knowledge construction generally does not involve students making significant cognitive efforts when elaborating facts or arguments. However, a high level of knowledge construction involves cognitive efforts of elaborating facts and arguments (Van der Meijden, 2005).

Students are cognitively engaged whenever knowledge is constructed through the variety of cognitive processes (for example, explanation-seeking questions and problems, interpreting and evaluating new information, sharing, critiquing, etc.). These cognitive processes are observed from students' written messages and thus students are cognitively engaged from the emergence of these behaviours (Zhu, 2006).

1.10.2 Cognitive Engagement

The term 'cognitive engagement' in this research is defined by the employment of mental effort that students exert to solve a given task (Scott & Walczak, 2009; Blumenfeld, Kempler and Krajcik, 2006; Connell & Wellborn, 1991; Corno & Mandinach, 1983).

As in an online learning context, cognitive engagement is visible in this research through the perspective of Zhu (2006, p.454). He mentions that, in order to be cognitively engaged, students should be observed as being able to seek, interpret, analyze and summarize information. Other than that, they are able to critique and rationalise statements by giving opinions, arguments and making decisions.

The availability of such behaviours as described by Zhu (2006) in online discussions indicates that students are able to construct knowledge and thus become cognitively engaged. In a more specific manner, Van der Meijden (2005) describes knowledge construction as the ability to elaborate discussion messages in the form of:

i. asking comprehensive questions requiring explanations,
ii. presenting answers with arguments or justification,
iii. presenting new ideas with explanations,
iv. acceptance or rejection of others' ideas with justification.

With respect to these behaviours, cognitive engagement is used interchangeably with knowledge construction on the understanding that when knowledge is constructed through provision of these behaviours in discussion messages, students are cognitively engaged in online learning (at low or high level).

1.10.3 Online Learning and Learning

For the purposes of this research, online learning is clearly defined as the platform of delivering instructions, learning and assessing through the web and hence utilizing various media and intra/internet resources to achieve the desired educational goals (Michigan Virtual University, 2005).

Learning, on the other hand is viewed as:

> *".. a process, demonstrated through conversation, in which learners reflect upon what they currently know and negotiate meaning and knowledge creation with others through conversation"* (Dennen & Paulus, 2005, p. 97).

As such, learning is said to be the product of students' mental knowledge (re)construction (de Jong, Veldhuis-Diermanse and Lutgens, 2002). This research will investigate the learning processes that underlylearning outcomes, that is, to what extent are students cognitively engaged in their learning discussions for knowledge construction.

1.10.4 Collaborative Learning

Collaborative learning in this research entails the following properties:

i. a small group working together (Gol & Nafalski, 2007; Barkeley, Cross & Major, 2005; Smith & MacGregor, 1992),
ii. having specific learning activities or tasks (Barkeley, Cross & Major, 2005; Dillenbourg et al., 1996),
iii. knowledge being created upon collaboration (Dillenbourg & Fischer, 2007; Alavi & Dufner, 2005; Crook, 1998;Blumenfeld et al., 1996).

1.10.5 Computer-supported Collaborative Learning

Computer-supported collaborative learning (CSCL), as termed in this research, emerged from socio-cultural theory and socio-cognitive theory. The present research applies CSCL from the view of socio-cultural theory. It is a learning approach designed with the goal of putting students in a group to learn together to solve deliberate tasks in a computer-mediated environment (Lipponen, 2002). Each group member holds a role in order to accomplish the groups' learning goal. The absence of one of the roles will cause the group to malfunction. This is one of the elements that differentiates collaborative learning from cooperative learning (Roschelle & Teasley, 1995).

1.10.6 Social Interaction

The term "social interaction" is inseparable from the CSCL environment, where CSCL itself is a "special form of social interaction" (Lipponen, 2002). Although there are many factors that might influence collaborative learning, Garrison

(1993) asserts that social interaction happens to be the fundamental principle of collaboration (Garrison, 1993). In this research, social interaction is defined according to Bornstein and Bruner (1989) as follows:

> "*Social interaction is the transmission of ideas, thoughts, emotions, knowledge, or processes between at least two people, where the learner and tutor interact with each other in a crucially patterned manner*".

Three main forms of interactions are: the student-student interaction, student-content interaction and student-teacher interaction (Moore, 1969). However, student-student interaction (peer interaction) will be the focus of this research. As indicated by Dillenbourg (1999), CSCL values all types of interactions, however, peer interaction should be emphasized as it is the type of interaction that results in collaborative knowledge building.

1.11 Summary

The need to evaluate the quality of online learning has brought forward the extent of students' cognitive engagement in online settings. The ability to educatestudents for higher order learning in an online learning context is an important indicator that online learning does enhance the learning processes as compared to the traditional settings. To the best of our knowledge, few studies are conducted on the students' degree of cognitive participation in online learning. Therefore, it is hoped that research would report on the degree of students' cognitive engagement in online learning and to provide ways to increase it to a higher degree.

REFERENCES

Abdullah, S., Md Noor, N. & Aris, B. (2007). Pembangunan dan Penilaian Pembelajaran Menerusi Web bagi sub topik "Membina Laman Web" berasaskan pendekatan kolaboratif. *1st International Malaysian Educational Technology Convention*, 735-743.

Andre, T. (1986). Problem Solving and Education. In Phye, G. D. and Andre, T. (Eds.) *Cognitive Classroom Learning*. (169-200). USA: Academic Press Inc.

Andresen, M.A. (2009). Asynchronous Discussion forums: success factors, outcomes, assessments, and limitations. *Educational Technology & Society*. 12(1), 249-257.

Anjewierden, A., Kollöffel, B., and Hulshof, C. (2007). Towards educational data mining: Using data mining methods for automated chat analysis to understand and support inquiry learning processes. In *Proceedings of International Workshop on Applying Data Mining in e- Learning (ADML 2007)* as part of the 2nd European Conference on Technology Enhanced Learning (EC- TEL 2007), Crete, Greece.

Alavi, M. and Dufner, D. (2005). Technology-mediated collaborative learning: a research perspective. In S. R. Hiltz and R. Goldman (Eds.). *Learning Together Online: Research on Asynchronous Learning Networks*,.(pp. 191–213). Mahwah, NJ: Lawrence Erlbaum Associates.

Allen, E., & Seaman, J. (2004). *Entering the Mainstream: The Quality and Extent of Online Education in the United States, 2003 and 2004.* Needham, Mass.: Sloan-Consortium, 2004.

Annetta, L. A., Minogue, J., Holmes, S. Y. and Cheng, M. (2009). Investigating the impact of video games on high school students' engagement and learning about genetics, *Computers & Education*.53, pp. 74–85.

Archambault, I., Janosz, M., Fallu, J., and Pagani, L. (2009). Student engagement and its relationship with early high school dropout. *J. Adolesc*. 32, 651–670.

Arend, B. (2009). Encouraging critical thinking in online threaded discussions. *The Journal of Educators Online*, 6 (1), 1-23.

Artino, A. R. (2010). Online or face-to-face learning? Exploring the personal factors that predict students' choice of instructional format. *Internet & Higher Education*. 13, pp. 272-276.

Appleton, J. J., Christenson, S. L., Kim, D., & Reschly, A. L. (2006). Measuring cognitive and psychological engagement: Validation of the Student Engagement Instrument. *Journal of School Psychology*. 44, 427 – 445.

Auttawutikul S., Na–Songkla, J., & Natakuatoong, O. (2008). Developmentof a Knowledge Sharing Process using CSCL based on PAL Approach to Enhance Knowledge Creation Behaviors of Graduate Students. *E-Journal of Thailand Cyber University*. 1(1).

Azizi Yahaya, Shahrin Hashim, Jamaludin Ramli, Yusof Boon, Abdul Rahim Hamdan (2007). *Menguasai Penyelidikan dalam Pendidikan Teori, Analisis & Interpretasi Data*. Kuala Lumpur: PTS Professional Publishing Sdn. Bhd.

Bagnato, A.R. (1973). Teaching College Mathematics by Question-and-Answer.*Educational Studies in Mathematics*, 185-192.

Bai, H. (2003). SocialPresence and CognitiveEngagement in Online Learning Environments. In A. Rossett (Ed.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2003*. (pp.1483-1486). VA: AACE.

Bandura, A. (1977). *Social Learning Theory*. New York: General Learning Press.

Barron , B. (2003). When smart groups fail. *The Journal of the Learning Sciences*, 12(3), 307-359.

Barkatsas, A. N., Kasimatis K., & Gialamas, V. (2009). Learning secondary mathematics with technology: Exploring the complex interrelationship between students' attitudes, engagement, gender and achievement. *Computers & Education*,52, 562-570.

Barkley, E. F., Cross, K.P. & Major, C. H. (2005). *Collaborative learning techniques: A handbook for college faculty*. San Francisco: Jossey-Bass.

Beach, D. (2008). *Emerging ID models*. Unpublished manuscript.

Beasley, N. & Smyth, K. (2004). Expected and Actual Student Use of an Online Learning Environment: A Critical Analysis. *Electronic Journal on e-Learning*, 2(1), 43-50.

Beeland Jr., W. D. (2002). Student Engagement, Visual Learning and Technology: Can Interactive Whiteboards Help?. *Action Research Exchange,* Retrieved September 13, 2009, from http://chiron.valdosta.edu/are/Artmanscrpt/vol1no1/beeland_am.pdf

Beers, P. J., Boshuizen, H. P. A., Kirschner, P. A., & Gijselaers, W. H. (2005). Computer support for knowledge construction in collaborative learning environments. *Computers in Human Behavior*, 21, 623–643.

Beer, C. Clark, K., & Jones, D. (2010). Indicators of engagement. In C.H. Steel, M.J. Keppell, P. Gerbic & S. Housego (Eds.), Curriculum, technology & transformation for an unknown future. *Proceedings ascilite Sydney 2010,* 75-86.

Berry, R. G. (2006). Can Computer-Mediated Asynchronous Communication Improve Team Processes and Decision Making? Learning From the Management Literature. *Journal of Business Communication*, 43 (4). Pp. 344-366.

Betts, K. S. (2009). Lost in translation: Importance of effective communication in online education. *Online Journal of Distance Education Administrators*, 12(2).

Blake, C.T., & Rapanotti, L. (2001). Mapping interactions in a computer conferencing environment. In P. Dillenbourg, A. Eurelings, & K. Hakkarinen. (Eds.), *Learning Conference*, Euro-CSCL 2001, University of Maastricht.

Blumenfeld, C. P., Kempler, M. T., & Krajcik, S. J. (2006). Motivation and Cognitive Engagement in Learning Environements. In Sawyer, R. K (Ed.), *Cambridge Handbook of Learning Sciences*, pp 475-488.

Blumenfeld, P. C., Marx, R. W., Soloway, E. & Krajcik, J. (1996). Learning with peers: From small group cooperation to collaborative communities. *Educational Researcher*, 25(8), 37-40.

Bogdan, C. R. & Biklen, K. S. (2003). *Qualitative Research for Education: An introduction to theories and methods*. (4th edn), USA: Pearson Education Group.

Bonanno, K. (2005). Online Learning: The Good, The Bad, and The Ugly. *Australian School Library Association XIX Biennial Conference – Meeting the challenge – April 2005*.

Bonk, C. J. & Cunningham, D. J. (1998). Searching for learner-centered, constructivist, and sociocultural components of collaborative educational learning tools. In C. J. Bonk & K. S. King (Eds.), *Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse* (pp. 25-50). Mahwah, NJ: Erlbaum.

Borhan, L. (2005). The Development of children's cognition through social interaction. *Masalah Pendidikan 2005*, 13-20.

Bornstein, M. H., & Bruner, J. S. (Eds.). (1989). *Interaction in human development*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Bradford, G. & Wyatt, S. (2010). Online learning and student satisfaction: Academic standing, ethnicity and their influence on facilitated learning, engagement, and information fluency. *Internet & Higher Education*, 13, 108-114.

Bromme, R. (2000). Beyond one's own Perspective - The Psychology of Cognitive Interdisciplinarity. In: Weingart, PeterStehr, Nico, eds. *Practising Interdisciplinarity*. Toronto, 115-133.

Brown, A., & Palincsar, A. (1989). Guided, cooperative learning and individual knowledge acquisition. In L. B. Resnick (Ed.), *Knowing, learning and* *instruction: Essays in honor of Robert Glaser*. (pp. 393-451). Hillsdale, NJ: Lawrence Erlbaum.

Burrows, Peter L. (2010). *An examination of the relationship among affective, cognitive, behavioral, and academic factors of student engagement of 9th grade students*. Thesis. University of Oregon.

Cameron, L. (2006). Teaching with Technology: Using Online Chat to Promote Effective In-Class Discussions. Paper presented at the *Proceedings of the 23rd Annual ASCILITE Conference: Who's learning? Whose technology?*.3-6 December, 2006, Sydney.

Campbell, D. & Stanley, J. (1963). *Experimental and quasi-experimental designs for research*. Chicago, IL: Rand-McNally.

Capozzoli, M., McSweeney, L., and Sinha, D. (1999). Beyond Kappa: A review of interrater agreement measures. *The Canadian Journal of Statistics, 27*(1), 3 – 23.

Carini, R. M., Kuh, G. D. & Klein, S. P. (2006) Student engagement and student learning: Testing the linkages. *Research in Higher Education*, 47(1), pp. 1-31.

Carter, J. & Boyle, R. (2002). Teaching Delivery Issues- Lessons from Computer Science. *Journal of Information Technology Education*, 1(2), pp. 77-89.

Cavanaugh, C. (2009). *Distance Education in Support of Expanded Learning Time in Schools*. Washington, DC: Center for American Progress. Scheduled for May 18 release at http://www.americanprogress.org/issues/domestic/education

Centre of Assessment and Evaluation of Student Learning. (2004). *Why Test Students?*. Assessment Brief, 7.

Chaiklin, S. (2003). The Zone of Proximal Development in Vygotsky's analysis of learning and instruction. In Kozulin, A., Gindis, B., Ageyev, V. & Miller, S. (Eds.) *Vygotsky's educational theory and practice in cultural context*. 39-64. Cambridge: Cambridge University.

Chen, P. D., Lambert, A. D., & Guidry, K. R. (2010). Engaging online learners: The impact of Web-based learning technology on student engagement. *Computers & Education*, 54(4), 1222-1232.

Chen, P. D., Guidry, K. R., & Lambert, A. D. (2009). Engaging online learners: A quantitative study of postsecondary student engagement in the online learning environment. Paper presented at the *2009 American Educational Research Association Annual Conference*, San Diego, CA.

Cheung, S.W., Tan, C.S. & Hung, D. (2004). Investigating Problem Solving with Computer-supported Collaborative Learning. *AARE International Education Research Conference*.

Chou, P. -N. & Chen, H. -H. (2008). Engagement in online collaborative learning: A case study using a web 2.0 tool. *MERLOTJournal of Online Learning and Teaching*, 4 (4), 574-582.

Chuah, C.K. (2007). Experience Redesign: A Conceptual Framework for Moving Teaching and Learning into a Flexible E-learning Environment. In Tsang, P. Kwan, R. and Fox, R (Eds.) *Enhancing Learning through Technology*.

Chung, W-T., Stump, G., Hilpert, J., Husman, J., Wonsik Kim & Ji Eun Lee. (2008). Addressing engineering educators' concerns: Collaborative learning and achievement.*38th AnnualFrontiers in Education Conference, 2008. FIE 2008.*

Clark, D. R. (2004), *Types of Evaluations in Instructional Design*. Retrieved March 1, 2011 from http://www.nwlink.com/~donclark/hrd/isd/types_of_evaluations.html

Coates, H. (2005). Leveraging Online Learning to Enhance Campus-based Student Engagement. *EDUCAUSE Quarterly,* vol. 1, pp. 66-68.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Second Edition. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the craft of reading, writing, and mathematics. In L. B. Resnick

(Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 453–494). Hillsdale, NJ: Lawrence Erlbaum Associates.

Connell, J. (1990). Context, self, and action: A motivational analysis of self-system processes across the life-span. In D. Cicchetti & M. Beeghly (Eds.), The self in transition: From infancy to childhood (pp. 61–67). Chicago: University of Chicago Press.

Connell, J.P. & Wellborn, J.G. (1991). Competence, autonomy, and relatedness: A motivational analysis of self-esteem processes. In M. Gunnar and L.A. Sroufe (eds.), Minnessota Symposium on Child Psychology. Chicago: University of Chicago Press.

Cook, T. D. & Campbell, D. T. (1979). *Quasi-experimentation: Design and analysis issues for field settings.* Boston, MA: Houghton Mifflin Company.

Corno, L., & Mandinach, E. B. (1983). The Role of Cognitive Engagement in Classroom Learning and Motivation. *Educational Psychology*. 18(2), 88-108.

Cotton, D. & Yorke, J. (2006). Analyzing online discussions: What are the students learning? In *Proceedings of the 23rd Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education: "Who's learning? Whose technology?"* December, 2006, Sydney, Australia.

Creswell, J. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage Publications.

Creswell, J. W. (2004). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*. USA: Sage Publication.

Crook, C.K. (1998) Young children as users of new technology. *Computers and Education*, 30, 237-247.

Curran, C. (2001). The Phenomenon of On-line Learning.*European Journal of Education*. 36 (2), pp. 113-132.

Davidson, N. C. & Goldberg, D. T. (2010). The Future of Learning Institutions in a Digital Age. *The John D. and Catherine T. MacArthur Foundation Reports on Digital Media and Learning*, March, 2010.

Dennen, V. P. & Paulus, T. M. (2005). Researching “collaborative knowledge building” in formal distance learning environments. *Proceedings of CSCL 2005*. Taipei: International Society of the Learning Sciences.

de Jong, F., Veldhuis-Diermanse, E., & Lutgens, G. (2002). Computer-supported collaborative learning in university and vocational education. In T. Koschmann, R. Hall, & N. Miyake (Eds.) *CSCL2: Carrying forward the conversation*. Mahwah, NJ: Lawrence Erlbaum, 111-128.

De Vaus, D.A. (2001). *Research Design in Social Research*, London: SAGE Publications.

Dick, W. & Cary, L. (1990). *The Systematic Design of Instruction*, Third Edition, Harper Collins.

Dillenbourg, P. (1999). What do you mean by "collaborative learning"? In P. Dillenbourg (Ed.), *Collaborative learning: Cognitive and computational approaches*. Amsterdam, NL: Pergamon, Elsevier Science, 1-16.

Dillenbourg, P., & Schneider, D.K. (1995). Collaborative learning and the internet. In *Proceedings of the ICCAI 95 University of Geneva, Switzerland*. http://tecfa.unige.ch/tecfa/research/CMC/colla/iccai95_20.html

Dillenbourg, P., Baker, M., Blaye, A. & O'Malley, C.(1996) The evolution of research on collaborative learning. In E. Spada & P. Reiman (Eds) *Learning in Humans and Machine: Towards an interdisciplinary learning science*. Oxford: Elsevier, 189-211.

Dillenbourg, P. & Fischer, F. (2007). Basics of Computer-Supported Collaborative Learning. *Zeitschrift fur berufs-und Wirtschaftspadagogik*. 21, 111-130.

Dillenbourg, P., Järvelä, S., & Fischer, F. (2009). The evolution of research on computer- supported collaborative learning: from design to orchestration. In N. Balacheff, S. Ludvigsen, T. de Jong, T., A. Lazonder & S. Barnes (Eds), *Technology-Enhanced Learning. Principles and products* (p. 3-19). Heidelberg: Springer.

Ding, N. (2009). Visualizing the sequential process of knowledge elaboration in computer-supportedcollaborative problem solving. *Computers & Education*, 52, 509-519.

Dixon, R., Dixon, K. & Axmann, M. (2008). Online student centred discussion: Creating a collaborative learning environment. In *Hello! Where are you in the landscape of educational technology? Proceedings ascilite Melbourne 2008*.http://ascilite.org.au/conferences/melbourne08/procs/dixon.pdf

Dringus, L.P. & Ellis, T. (2005). Using data mining as a strategy for assessing asynchronous discussion forums. *Computers & Education*, 45(1), 141 – 160.

Duffy, T., Korkmaz, A. Dennis, A., Bichelmeyer, B. Bunnage, J., Cakir, H. & Oncu, S. (2005). Engagement in Learning and student success: Findings from the CCNA2 course. *Cisco Networking Academy Evaluation Project White Paper*. Indiana University, Dec 2005. 1-13.

Earnshaw, R. (2007). Developing Quality Online Courses: A Three-phase Model Approach at Georgia Virtual School. Paper presented at *23rd Annual Conference on Distance Teaching and Learning*, pp. 1-3.

Ellis, R., Goodyear, P., Prosser, M., & O'Hara, A. (2006). How and what university students learn through online and face-to-face discussion: conceptions, intentions and approaches. *Journal of Computer Assisted Learning*, 22(4), 244-25

Eskin and Ogan-Bekiroglu, H. (2009). Investigation of a pattern between students' engagement and their science content knowledge: A case study., *Eurasia Journal of Mathematics, Science & Technology Education*,5 (1), pp. 63–70.

Farahiza, A. (2010). Blended Learning In Higher Education Institution In Malaysia. *Regional Conference on Knowledge Integration in ICT*, Putrajaya, 1 June 2010.

Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research*, 59, 117-142.

Finn, J. D. (1993). *School engagement and student at risk*. Washington D.C.: National Centre for Education Statistics.

Fjermestad, J. Hiltz, R. S. & Zhang, Y. (2005). Effectiveness for students: Comparisons of 'In-seat' and ALN Courses. In *Learning Together Online: Research on Asynchronous Learning Networks*. USA.

Fleiss, J. L. (1981). *Statistical methods for rates and proportions*. 2nd ed. (New York: John Wiley) pp. 38–46.

Flowerday, T., & Schraw, G. (2003). Effect of choice on cognitive and affective engagement. *Journal of Educational Research*, 96, 207–215.

Flynn, T. (2003). Making Sense of Online Lerning: Frames, Rubrics, Tools & Coding systems for analyzing asynchronous online discourse. *AERA 2003*, Chicago, pp. 1-37.

Flynn, T. (2004). *Cognitive engagement in online discourse: A phenomenological study of knowledge construction in asynchronous dialogic community of practice*. Doctoral Thesis. Pepperdine University.

Fredericks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, 74, 59-109.

Garrison, D. R. (1993). Quality and Theory in Distance Education: Theoretical Consideration. In Keegan, D. (Ed.), *Theoretical Principles of Distance Education*, Routledge, New York: USA.

Garrison, D. R., & Anderson, T. (2003). *E-learning in the 21st century: A framework for research and practice*. London: RoutledgeFalmer.

Garrison, D. R., Anderson, T., & Archer, W. (2001). Critical thinking and computer conferencing: A model and tool to assess cognitive presence. *American Journal of Distance Education*, 15(1), 7-23.

Gerlach, J. M. (1994). Is this collaboration?. In Bosworth, K. and Hamilton, S. J. (Eds.), *Collaborative Learning: Underlying Processes and Effective Techniques*, New Directions for Teaching and Learning No. 59.

Ghani, R. and Soares, C. (2006) *Proc. Workshop on Data Mining for Business Applications, Joint in KDD2006*, Philadephia, USA.

Ginns, P. & Ellis, R. (2007). Quality in blended learning: Exploring the relationships between on-line and face-to-face teaching and learning. *Internet and Higher Education*, 10, pp. 53-64.

Greer, T (2002). Critical Success Factors in Developimg, Implementing, and Teaching a Web Development Course. *Journal of Information Systems Education*, 13(1), 17-20.

Gress, C. L.Z., Fior, M., Allyson, F. H. & Philip, H.W. (2010). Measurement and assessment in computer-supported collaborative learning. *Computers in Human Behavior*, 26(5), p. 806-814.

Gros, B. (2001). Instructional design for computer-supported collaborative learning in primary and secondary school. *Computers in Human Behavior*, 17, 439–451.

Gros, B. Guerra, V. & Sanchez, J. (2005). The Design of Computer-Supported Collaborative Learning Environments in Higher Education. *Encounters on Education*. 6(Fall 2005), 23-42.

Gros, B., Guerra, V., and Sanchez, J. (2005). The Design of Computer-Supported Collaborative Learning Environments in Higher Education. *Encounters on Education*. 6 (Fall 2005), pp 23-42.

Gokhale, A. A. (1995). Collaborative Learning enhances critical thinking. *Journal of Technology Education*, 7(1).

Göl, Ö.& Nafalski, A. (2007). Collaborative Learning in Engineering Education. *Proc UICEE 10th Annual Conference On Engineering Education*. Bangkok: Thailand, 2007.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *TheQualitative Report*, 8(4), 597-606.

Goldsmith, D. (2002). Communication, humor and personality: student's attitude to online learning. *Connecticut Distance* Learning *Consortium*.

Gonzalez, C., & Quesada, J. (2003). Learning in dynamic decision making: The recognition process. *Computational and Mathematical Organization Theory, 9*(4), 287-304.

Graff, M. (2006). The Importance of Online Community in Student Academic Performance. *The Electronic Journal of e-learning*, 4(2), 127-132.

Greene, A. B., Miller, B. R., Crowson, H. M., Duke, L. B. & Akey, L. K. (2004). Predicting High-school students' cognitive engagement and achievement: Contributions of classroom perceptions and motivation. *Contemporary Educational Psychology*, 29, 462-482.

Gros, B. (2001). Instructional design for computer-supported collaborative learning in primary and secondary school. *Computers in Human Behaviour*. 17(5-6), 439-451.

Guan, J., Xiang, P., McBride, R., & Bruene, A. (2006). Achievement goals, social goals, and students' reported persistence and effort in high school physical education. *Journal of Teaching in Physical Education*, 25(*1*), 58–74.

Guerra, L & Grimon, F. (2009). Virtual Conversations and Academic Performances' Students. Proceedings of the *8th WSEAS International Conference on Education and Educational Technology*, 88-92.

Gunawardena, C.N., Lowe, C.A. & Anderson, T. (1997). Analysis of a global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. *Journal Educational Computing Research*, 17(4), 397-431.

Gunawardena, C. (1999). The Challenge of Designing and Evaluating 'Interaction', *in Web-basedDistance Education, in Proceedings of WebNet 99 – World Conference on the WWW and Internet*, P. de Bra& J. Leggett (Eds.), Hawaii, 451-456.

Hanrahan, M. (1998). The Effect of Learning environment Factors on Students' Motivation and Learning. *International Journal of Science Education*, 20 (6), 737-753.

Hansen, J. F. (1979). *Sociocultural Perspectives on Human Learning: An Introduction to Educational Anthropology*. Prentice Hall Inc.

Harasim, L. Ed. 1990. *On-Line Education: Perspectives on a new medium*. New York: Praeger/Greenwood.

Helme, S., & Clarke, D. (2001). Identifying Cognitive Engagement in the Mathematics Classroom. *Mathematics Education Research Journal*. 13(2), 133-153.

Henri, F. (1992). Computer conferencing and content analysis. In A.R. Kaye (Ed). *Collaborative learning through computer conferencing*: The Najaden papers, 117-136. Berlin: Springer-Verlag.

Hillman, D., D. Willis, and C. N. Gunawardena. 1994. Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *American Journal of Distance Education*, 8 (2). Pp. 30-42.

Hong, K-S and Lee, J.A.C. (2008). Postgraduate students' knowledge construction during asynchronous computer conferences in a blended learning environment: A Malaysian experience, *Australasian Journal of Educational Technology*, 24(1), 91-107.

Hou, H. T. (2011). A case study of online instructional collaborative discussion activities for problem solving using situatedscenarios: An examination of content and behavior cluster analysis, *Computers & Education*, *56*(3), 712-719.

Hou, H., & Wu, S. (2011). Analyzing the social knowledge construction behavioural patterns of an online synchronous collaborative discussion instructional activity using an instant messaging tool: A case study. *Computers & Education*, 57(2), 1459-1468.

Hou, H.-T., Chang, K.-E., & Sung, Y.-T. (2008). Analysis of Problem-Solving-Based Online Asynchronous Discussion Pattern. *Educational Technology & Society*, *11* (1), 17-28.

Howard, B. C. (1996). *Cognitive Engagement in Cooperative Learning. Paper presented at the Annual Meeting of the Eastern Educational Research Association*. Boston: MA.

Hung, M-L., Chou, C., Chen, C-H., & Own, J-Y. (2010). Learner readiness for online learning: Scale development and student perceptions. *Computers & Education, 55,* 1080-1090.

Hunter, J. & Anthony, G. (2008). The development of students' justification srategies. *Proceedings of the 31st Annual Conference of the Mathematics Education Research Group of Australasia*, M. Goos, R. Brown, & K. Makar (Eds.), 265- 272.

Hussein, A. (2009). The use of triangulation in social sciences research: Can qualitative and quantitative be combined?.*Journal of Comparative Social Work*, 1, 1-12.

Huizenga, J., Admiraal, W., Akkerman, S., & Dam, G. T. (2009). Mobile game-based learning in secondary education: engagement, motivation and learning in a mobile city game. *Journal of Computer Assisted Learning*, Vol. 25, No 4, 332-344.

Hung, J-L., & Zhang, K. (2008). Revealing Online Learning Behaviours and Activity Patterns and Making Predictions with Data Mining Techniques in Online Teaching. *MERLOT Journal of Online Learning and Teaching*, 4(4), pp. 426-437.

Hrastinski, S. (2008). Asynchronous and Synhronous e-learning. *Educause Quarterly*, Number 4, 51-55.

Idris, H. and Abdul Ghani, R. (2012). Construction of knowledge on facebook. *3L; Language, Linguistics and Literature*, *The Southeast Asian Journal of English Language Studies*, 18 (3). pp. 61-72. ISSN 0128-5157

Ismail, M.N., Ngah, N.A. & Umar, N. I. (2010). Instructional Strategy in the Teaching of Computer Programming: A need Assessment Analyses. *TOJET*. 9(2), 125-131.

Ituma, A. (2011). An evaluation of students' perceptions and engagement with e-learning components in a campus based university. *Active Learning in Higher Education*, 12 (1), 57-68.

Iqbal, A., Kankaanranta, M. &Neittaanmäki, P. (2010). Engaging learners through virtual worlds. *Procedia - Social and Behavioral Sciences*, 2 (2), 3198-3205.

Janssen, J., Erkens, G., Kirschner, P.A., Kanselaar, G. (2010)Task-related and social regulation during online collaborative learning. *Metacognition and Learning*. 7, 25–43.

Jeon, K. (2000). Vygotsky's Socio-cultural Theory and its Implications to the Role of Teachers in Students' Learning of Mathematics. *Journal of the Korea Society of Mathematical Education Series D: Research in Mathematical Education*, 4(1), 33-43.

Jeong, H.(1997). Knowledge co-construction during collaborative learning,*1997 CSCL Doctoral Consortium*.

Jill, F-W. & K. Makar. (2008). Student (dis)engagement in mathematics. In: P. L. Jeffery, *Annual Conference of the Australian Association for Research in Education (AARE).*AARE 2008 International Education Conference Brisbane: Changing Climates: Education for Sustainable Futures, Brisbane, Australia, (1-10). 30 November-4 December 2008.

John-Steiner, V. & Mahn, H. (1996). Sociocultural approaches to learning and development: A Vygotskian framework. *Educational Psychologist*, 31, 191 - 206.

Johnson D. W. and Johnson, R. T. 1994. *Learning together and alone: cooperative, competitive and individualistic learning*, 5th ed., Allyn & Bacon, Boston, MA, USA, 1994.

Johnson, D. W., Johnson, R., & Holubec, E. (2008). *Cooperation in the classroom*. 8th ed. Edina, MN: Interaction Book Company.

Johnson, B. & Christensen, L. (2000).*Educational Research: Qualitative and Quantitative Approaches*. Needham Heights, MA: Allyn and Bacon.

Joppe, M. (2000). *The Research Process*. Retrieved Nov 4, 2010 from http://www.ryerson.ca/`mjoppe/rp.htm

Jonassen, D., Davidson, M., Collins, M., Campbell, J., & Haag, B. B. (1995). Constructivism and computer-mediated communication in distance education. *American Journal of Distance Education*, (9), 7-26.

Jonassen, D.H. (1993). Designing constructivist learning environments. In Duffy, T.M., Lowyck, J., and Jonassen, D.H. (Eds). *The Design of Constructivistic Learning Environments: Implications for Instructional Design and the Use of Technology*. Heidelburg, FRG: Springer-Verlag.

Jonassen, D. H. (1994). *Technology as cognitive tools: Learners as designers*. IT Forums Paper. Retrieved on June 23, 2001 from http://itech1.coe.uga.edu/itforum/paper1/paper1.html.

Jonassen, D.H. (1997). Instructional design model for well-structured and ill-structured problem-solving learning outcomes. *Educational Technology: Research and Development 45* (1), 65-95.

Jonassen, D.H., Howland, J., Moore, J., Marra, M. R. (2003). *Learning to solve problems with technology: A constructivist perspective*. Upper Saddle River: Merrill Prentice Hall.

Jones, B., Valdez, G., Nowakowski, J., & Rasmussen, C. (1994). *Designing Learning and Technology for Educational Reform*. Oak Brook, IL: North Central Regional Educational Laboratory.

Joung, S. (2005). Product-based computer skill training to reduce learner's cognitive load. In C. Crawford et al. (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2005*. Cheasapeake, VA: AACE,3249-3250.

Jump, L. & Jump, R. (2006). Learning Academic Skills Online: Student perceptions of the learning process. In *Proceedings of the First International LAMS Conference 2006: Designing the Future of E-Learning*, pp. 45-54.

Kalkman, D. (2003). *Website Evaluation Rubric*. Integrating Technology into the Curriculum course handout. Northern Illinois University. Retrieved from http://goo.gl/EoC3J

Kays, E, & Sims, R. (2006). Reinventing and reinvigorating instructional design:A theory for emergent learning. *Proceedings of the 23rd annual ascilite conference: Who's learning? Whose technology?*Available from: http://www.ascilite.org.au/conferences/sydney06/proceeding/pdf_papers/p197.pd

Kerr, S. M., Rynearson, K. & Kerr, C. M. (2006). Students' Characteristics for Online Learning Success. *Internet and Higher Education*. 9, 91-105.

Kim, K-J., Liu, S. & Bonk, J. C. (2005). Online MBA students' perceptions of online learning: Benefits, challenges and suggestions. *Internet & Higher Education*. 8, 335-344.

Kim, K.-J., & Bonk, C. J. (2006). The future of online teaching and learning in higher education: The survey says.*Educause Quarterly*, *29*(4), pp. 22-30.

Kim, K., Bonk, C.J., & Oh, E. (2008). The present and future state of blended learning in workplace learning settings in the United States. *Performance Improvement*, 47(8), 5-16.

Kim, W. (2007). Towards A Definition And Methodology For Blended Learning. In J. Fong & F.L. Wang (Eds), *Proceedings of Workshop on Blended Learning*. pp. 1- 8.

Kirk, J., & Miller, M. L. (1986). *Reliability and validity in qualitative research*. Beverly Hills: Sage Publication.

Kirkpatrick, D. (2011).The Future of e-Learning? Directions. Keynote Speaker in International e-Learning Conference. Bangkok, Thailand.

Kirschner, P.A., Beers. P.J., Boshuizen, H.P.A., & Gijselaers, W.H. (2008). Coercing shared knowledge in collaborative learning environments. *Computers in Human Behavior*, 24, 403-420.

Kirschner, P. A., Strijbos, J-W., Kreijns, K. & Beers, P. J. (2004). Designing Electronic Collaborative Learning Environments. *ETR & D*. 52 (3), pp. 47-66.

Kirschner, P.A., Kreijns, K., & Jochems, W. (2003). Measuring the perceived quality of social space in distributed learning groups. In *B. Wasson, S. Ludvigsen, & U. Hoppe. (Eds.). Designing for change in networked learning environment* (pp. 323-332). Dordrecht: Kluwer Academic Publishers.

Kirschner, P. A., Marten, R. L. & Strijbos, J-W. (2004). CSCL in Higher Education? A framework for designing multiple collaborative environments. In *What we know about CSCL and Implementing it in Higher Education*. Kirschner, P. A., Martens, R. L. (Eds.). (pp. 3-30). Boston, MA: Kluwer Academic Publishers.

Kleine Staarman, J., Krol, K., & Van der Meijden, H. (2005). Peer interaction in three collaborative learning environments. *Journal of Classroom Interaction*, 40(1), 29-39.

Klemm, W. R. (2005). Use and mis-use of technology for online, asynchronous collaborative learning. In Tim S. Roberts (Ed.), *Computer-supported Collaborative Learning in Higher Education*, Hershey, PA, USA: Idea Group Publishing, 172-200.

Klemm, W.R. and Snell, J. R. (1996). Enriching computer-mediated group learning by coupling constructivism with collaborative learning. *Journal of Instructional Science and Technology*, 1(2) 1-11.

Koch, J. Andrew, S. Salamonson, Y. Everett, B. & Davidson, P. M. (2010). Nursing student perception of a web-based intervention to support learning. *Nurse Education Today*, 30, pp. 584-590.

Kohlberg, L. (1968). Early Education: A Cognitive-Developmental View. *Child Develoment*, 39(4), pp. 1013-1062.

Kong, Q., Wong, N., & Lam, C. (2003). Student engagement in mathematics: Development of instrument and validation of construct. *Mathematics Education Research Journal*, 15(1), 4-21.

Koljatic, M. & Kuh, G. (2001). A longitudinal assessment of college student engagement in good practices in undergraduate education. *Higher Education*, 42, 351-371.

Koschmann, T. (1994). Toward a theory of computer-support for collaborative learning. *Journal of the Learning Sciences*, 3, 218—224.

Koschmann, T. (1996). Paradigm shifts and instructional technology: An introduction. In T. Koschmann (Ed.), *CSCL : theory and practice of an emerging paradigm*Mahwah N.J.: L. Erlbaum, pp. 268-305.

Koo, A. C. (2006). Online Collaborative Learning for Malaysian Secondary Schools: Issues and Challenges. *Malaysian Journal of Educational Technology*, 6(1), 29-38.

Kreijns, K. & Kirschner, P. A., (2004). Determining sociability, social space and social presence in (a)synchronous collaborating teams. *Cyberpsychology and Behavior*, 7, 155-172.

Kreijns, K., Kirschner, P. A., & Jochems, W. (2003). Identifying the pitfalls for social interaction incomputer-supported collaborative learning environments: A review of the research. *Computers inHuman Behavior*, 19(3), 335–353.

Kroop, S., Nussbaumer, A., Fruhmann, K. (2010). Motivating Collaborative Learning Activities by Using Existing Web 2.0 Tools. *Motivational and Affective Aspects of Technology Enhanced Learning and Web 2.0 (MATEL 2010)*, Workshop at EC-TEL 2010, Barcelona, Spain, 28-29 September 2010.

Kudrik, Y, Lahn, L.C. & Mørch, A.I. (2009). Technology-Enhanced Workplace Learning: Blended Learning in Insurance Company. Paper presented at *17th International Conference on Computers in Education*. Hong Kong: Asia-Pacific Society for Computers in Education.

Kumar V., (1996). Computer-Supported Collaborative Learning: Issues for Research. Paper presented at *Graduate Symposium*, University of Saskatchewan.

Kwisnek, F.V., (2005) Assessing the Effectiveness of E-Learning. In Darbyshire, P. *Instructional Technologies: Cognitive Aspects of Online Programs*. USA (pp 192- 220).

Lantolf, J. P. (Ed.). (2000). *Sociocultural theory and second language Learning*. Oxford:Oxford University Press.

Lee, J. (2010). Online support service quality, online learning acceptance, and student satisfaction. *Internet and Higher Education*, 13, 277–283.

Lee, S. W-Y. & Tsai, C-C. (2010). Students' Perception of collaboration, self-regulated learning and information seeking in the context of internet-based learning and traditional learning. *Computers in Human Behaviour*, 1249-1257

Lee, E. Y. C., Chan, C. K. K., & van Aalst, J. (2006). Students assessing their own knowledge building. *International Journal of Computer-Supported Collaborative Learning, 1*, 277-307.

Leech, N. L., Barrett, K. C. & Morgan, G. A. (2011). *IBM SPSS for Intermediate Statistics: Use and Interpretation*, 4th ed. Routledge: New York.

Lehtinen, E., Hakkarainen, K., Lipponen, L., Rahikainen, M., & Muukkonen, H. (1999). Computer Supported Collaborative Learning: A review of research and development. *The J.H.G.I Giesbers Reports on Education*, 10. Netherlands: University of Nijmegen.

Li, Y., Liao, J., Wang, J. & Huang, R. (2007). CSCL Interaction Analysis for Assessing Knowledge Building Outcomes: Method and Tool. *CSCL 2007*.

Lihanna, B. (2005). The Development of Children's Cognition through Social Interaction. *Masalah Pendidikan 2005*, Universiti Malaya, pp. 13-20.

Lin, J. D. Sinha, Q. V., Bakshi, K. D., Katz, H. B. and Karger, D. R. (2003). What makes a good answer? The role of context in question answering, *Proc. of the ninth IFIP TC13 International Conference on Human-Computer Interaction*.

Lipponen, L. (2002). Exploring foundations for computer-supported collaborative learning. *Proceedings of the conference of Computer Support for collaborative Learning: Foundations for a CSCL community*, pp. 72-81.

Lipponen, L., Rahikainen, M., Lallimo, J. & Hakkarainen, K. (2001). Analyzing pattern of participation and discourse in elementary students' online science discussion. *Proceedings of European Perspectives on Computer-supported Collaborative Learning*, 22-24 March, 2001: the Netherlands.

Lipponen, L., Rahikainen, M., Lallimo, J. & Hakkarainen, K. (2003). Patterns of participation and discourse in elementary students' computer-supported collaborative learning. *Learning & Instruction*, 13, p. 487-509.

Lockhorst, D. (2004). *Design principles for a CSCL environment in teacher training.* Utrecht: Utrecht university.

Lou, Y., Abrami, P. C., & d'Apollonia, S. (2001). Small group and individual learning with technology: A meta-analysis. *Review of Educational Research, 71*(3), 449-521.

Lu, J., Chiu, M. M., & Law, W. Y. N. (2011). Collaborative argumentation and justification: A statisticaldiscourse analysis of online discussions. *Human Behavior*, *27*, 946-955.

Luan, J. (2006). Data Mining Applications in Higher Education. *Retrieved from*www.spss.com on March,3, 2011.

Ludvigsen, S.R. & Mørch, A.I. (2010).Computer-Supported Collaborative Learning: Basic Concepts, Multiple Perspectives, and Emerging Trends. *International Encyclopedia of Education*, pp. 290-296.

Ma, W.W.A. (2009). Computer-supported Collaborative Learning and Higher Order Thinking Skills: A Case Study of Textile Studies. *Interdisciplinary Journal of E-learning and Learning Objects*, 5, 145-167.

Macfadyen, L. P., & Dawson, S. (2010). Mining LMS data to develop an , An early warning system for educators: A proof of concept. *Computers & Education*, 54(2), 588-599.

Makitalo-Siegl, K., Kohnle, C. & Fischer, F. (2011). Computer-Supported Collaborative Inquiry Learning and Classroom Scripts: Effects on Help-Seeking Processes and Learning Outcomes. *Learning and Instruction*, 21 (2). Pp. 257-266.

Mandinach, E.B. & Corno, L. (1985). Cognitive engagement Variations among Students of Different Ability Level and Sex in a Computer Problem Solving Game. *Sex Roles*. 13(¾).

Mansor, N. and Abd Rahim, N. (2009). Online Collaboration via Email: Analyzing Students' Knowledge Construction in the ESL Classroom, *Journal of the World Universities Forum,* Volume 2, Issue 3, pp.101-112.

Marold, K.A., & Haga, W. (2004). Measuring Online Students' Ability To Apply Programming Theory: Are Web Courses Really Working?.*Journal of International Technology and Information Management*. 13(1).

Marsh, G. E., & Ketterer, J.J. (2005). Situating the Zone of Proximal Development. *Online Journal of Distance Learning,*8(2), Available online: http://www.westga.edu/%7Edistance/ojdla/summer82/marsh82.htm.

Maurino, P.S. (2007). Looking for critical thinking in online threaded discussions. *Journal ofEducational Technology Systems, 35*(3), 241-260.

McLaughlin, M., McGrath, D.J., Burian-Fitzgerald, M.A., Lanahan, L., Scotchmer, M., Enyeart, and C., Salganik, L. (2005). *Student Content Engagement as a Construct for the Measurement of Effective Classroom Instruction and Teacher Knowledge*. American Institutes for Research: Washington, D.C.

McLoughlin, C. & Luca, J. (2000). Cognitive Engagement and Higher Order Thinking through Computer Conferencing: We Know Why but Do We Know How?. In A. Herrmann and M.M. Kulski (Eds), *Flexible Futures in Tertiary Teaching. Proceedings of the 9th Annual Teaching Learning Forum,* 2-4 February 2000. Perth: Curtin University of Technology.

McMillan, H. J. (1996). *Educational Research: Fundamentals for the Consumer*. (2nd Edn.). USA: Harper Collins Publishers.

Meece, J.L., Blumenfeld, P.C., & Hoyle, R.H. (1988). Students' goal orientations and cognitive engagement in classroom activities. *Journal of Educational Psychology*, 80, 514-523.

Meyer, K. (2004). Evaluating online discussions: four different frames of analysis. *Journal of Asynchronous Learning Networks*, 8(2), 101–114.

Michigan Virtual University. (2005). *Report to the Michigan Department of Education on the development and growth of the Michigan Virtual High School: 1995-2005*. Lansing, MI: Michigan Virtual University.

Miles, M. B. & Huberman, A. M. (1994). *Qualitative Data Analysis*. Thousand Oaks, CA: Sage.

Moore, M. (1969). Three types of Interaction. *American Journal of Distance Education*, 3(2), 1-6.

Moran-Ellies, J., Alexander, V. D., Cronin, A., Dickinson, M., Fielding, J., Slney, J., & Thomas, H. (2006). Triangulation and integration: processes, claims and implications. *Qualitative Research*, 6(1) pp. 45- 58, Sage Publications.

Morris, L. V., Finnegan, C., & Wu, S. (2005). Tracking student behavior, persistence, and achievement in online courses. *Internet and Higher Education*, 8, 221-231. doi: 10.1016/j.iheduc.2005.06.009

Muhammad B.K., Aris, B., Bilal Ali, M., (2001). WebELE: Sebuah Prototaip Persekitaran Pembelajaran Elektrostatik Sekolah Menengah berasaskan Web dan Internet. Paper presented at *Malaysian Science and Technology Congress*, USM, Penang.

Muirhead, B. (2000). Enhancing Social Interaction in Computer-mediated Distance Education. *Educational Technology & Society*. 3(4). 1-11.

Mukama, E. (2010). Strategizing computer-supported collaborative learning toward knowledge building. *International Journal of Educational Research*, 49 (1). Pp. 1-9.

Nedelko, Z. (2008). Participants' Characteristics for E-Learning. *E-Leader Conference*, Krakow.

Nesbit, J.C. & Leacock, T.L. (2009). Collaborative argumentation in learning resourceevalutation in L. Lockyer, S. Bennet, S. Agostinho, & B. Harper (Eds.) *Handbook of Research on Learning Design and Learning Objects: Issues, Applications and Technologies* (pp. 574-588). Hershey, PA: Idea Group.

Nevgi, A., Virtanen, P. Niemi, H. (2006). Supporting students to develop collaborative learning skills in technology-based environments. *British Journal of Educational Technology*, 37(6), 937-947.

Newman, F. (1991).*Student Engagement and Achievement in American Secondary Schools*. New York: Teachers College Press.

Northrup, P. T. and Rasmussen, L. K. (2000). Designing a Web-Based Program: Theory to Design. Paper presented at the *Annual conference of the Association for Educational Communications and Technology*, Long Beach, CA: February 2000.

Nor Aniza A., Zalizan M.J. & Manisah M. A. (2010). Understanding students performance based on gender and types of schooling using SEM. *Procedia - Social and Behavioral Sciences*, 7, 425-429.

Nurbiha, A.S., Jamalludin, H. & Zaidatun, T. (2011). Investigating Students' Cognitive Engagement in e-Learning. Paper presented in *International e-Learning Conference*, Thailand: Bangkok.

Nussbaum, E. M. (2008). Collaborative discourse, argumentation, and learning: Preface and literature review. *Contemporary Educational Psychology*, 33(3), 345–359.

Nyikos, M., & Hashimoto, R. (1997). Constructivist theory applied to collaborative learning in teacher education: In search of ZPD. *Modern Language Journal*, 81(4), 506-517.

Nystrand, M. & Gamoran, A. (1991). Instructional discourse, student engagement, and literature achievement. *Research in the Teaching of English*, 25(3), 261-290.

O'Leary, R. (2005).Online Communication using Discussion Boards. In *The Handbook for Economics Lecturers in the Economic Networks*. University of Bristol.

O'Neil, F.H. & Chuang, S-H. (2008). Measuring Collaborative Problem Solving in Low-Stakes Tasks. In Baker, E., Dickieson, J., Wulfeck, W., O'Neil, F. H. (Eds.) *Assessment of Problem Solving Using Simulations*. USA: Lawrence Erlbaum Associates.

Olson, T. M., & Wisher, R. A. (2002). The effectiveness of web-based instruction: An initial inquiry. *International Review of Research in Open and Distance Learning*, 3(2), 1-17.

Onrubia, J. & Engel, A. (2009). Strategies for Collaborative Writing and Phases of Knowledge Construction in CSCL Environments. *Computers & Education*, 53(4), 1256-1265.

Oriogun, P. K. (2006). Content analysis of online transcripts: Measuring quality of interaction, participation, and cognitive engagement within CMC Groups by cleaning of transcripts. *International Journal of Instructional Technology & Distance Learning*, 3(3), 39-54.

Paavola, S., Lipponen, L. & Hakkarainen, K. (2002). Epistemological Foundations for CSCL: A Comparison of Three Models of Innovative Knowledge Communities. *Proceedings of the Computer-supported Collaborative Learning 2002 Conference*, Hillsdale, N.J.; Erlbaum.

Paechter, M. & Maier, B. (2010). Online or face-to-face? Students experiences and preferences in e-learning. *Internet and Higher Education*, 13, pp. 292-297.

Palmer, S. R. and Holt, D. M. (2009). Examining student satisfaction with wholly online learning. *Journal of computer assisted learning*, 25(2), pp. 101-113.

Panitz, T. (1996). *A Definition of Collaborative vs. Cooperative Learning*. Retrieved from from: http://www.collaborative learningversus cooperative learning.htm. on 16 August 2010.

Park, H.M. (2008). *Univariate Analysis and Normality Test Using SAS, Stata, and SPSS*. Technical Working Paper. The University Information Technology Services (UITS) Center for Statistical and Mathematical Computing, Indiana University.

Paulus, T. M. (2009). Online but off-topic: negotiating common ground in small learning groups. *Instructional Science, 37*, 227-245.

Persell, C.H. (2004). Using Focused Web-based Discussions to Enhance Student Engagement and Deep Understanding. *Teaching Sociology*, *32*(1), 61-78.

Pérez, P. R. J., Ruiz, M. P. P., Gayo, J. E. (2006). Building a collaborative learning environment based in Wiki. *Current Developments in Technology-Assisted Education,* pp. 1413-1416.

Pilkington, R.M. & Walker, A. (2003), Facilitating debate in networked learning: Reflecting on online synchronous discussion in higher education, *Instructional Science,* vol. 31, nos. 1–2, pp. 41–63.

Pintrich, P. R., & Schrauben, B. (1992). Students' motivational beliefs and their cognitive engagement in classroom academic tasks. In D. H. Schunk & J. Meece (Eds.), *Students perceptions in classroom* (pp. 149-179). Hillsdale, NJ: Lawrence Erlbaum.

Piskurich, M. G. (2000).*Rapid Instructional Design. Learning ID fast and Right*. San Francsico: Jossey.

Postleithwaite, T. N. (2005). *Educational Research: Some basic concepts and terminology*. Paris, France: International Institute for Educational Planning.

Prata, & Lopes, (2004). Online Multimedia Educational Application for Teaching Multimedia Contents: An Experiment with students in Higher Education. In P. Darbyshire (Ed.), *Instructional Technologies: Cognitive aspects of online program* (pp. 31-72). Hershey, PA: Idea Group Publishing.

Puntambekar, S. (2006). Analyzing collaborative interactions: Divergence, shared understanding and construction of knowledge. *Computers and Education*. 47(3), 332-351.

Rae, J., Roberts, C. & Taylor, G. (2006). Collaborative Learning: A Connected Community Approach. Issues in Informing Science and Information Technology, 3.

Rahikainen, R. (2002). *Learning Through Cognitive and Collaborative Problem-Solving Processes in Technological Product Development.* Unpublished Academic Dissertation, Universtiy of Tampere, Finland.

Rastegar, A. Reza Ghorban Jahromi, R. G. Haghighi, A. S. & Akbari, A. R. (2010). The relation of epistemological beliefs and mathematics achievement: the mediating role of achievement goals, mathematics self-efficacy, and cognitive engagement, Procedia - Social and Behavioral Sciences, 5, pp. 791-797.

Rathswohl, J. E. (2002). A Technique for Teaching Website Effectiveness in Undergraduate I.S. Classes. Informing Science and IT Education Conference, June 19-21, Cork, Ireland.

Reingold, R., & Rimor, R. (2008). Instructor's scaffolding in support of student's metacognition through ateacher education online course - A case study. *Journal of Online Interactive Learning*, *7*(2), 139-151.

Richardson, J. C., & Newby, T. (2006). The Role of Students' Cognitive Engagement in Online Learning. American Journal of Distance Education. 20(1), 23-37.

Rimor, R., Rosen, Y, & Naser, K. (2010). Complexity of social interactions in collaborative learning: The case of online database environment. *Interdisciplinary Journal of E-Learning and Learning Objects*, *6,* 355-365.

Rizopoulos, L. A. & McCarthy, P. (2009). Using online threaded discussions: Best practices for the digital learner. *Journal of Educational Technology Systems*, *37*(4), 373-383.

Rocco, S. T., Bliss, A. L., Gallagher, S., & Perez-Prado, A. (2003). Taking the Next Step: Mixed-methods Research in Organizational Systems. Information Technology, Learning, and Performance Journal. 21(1), 19-29.

Romanov, K. and Nevgi, A. (2006). Learning outcomes in medical informatics: Comparison of a Webct course with ordinary web site learning material, *International Journal of Medical Informatics*, 75, pp. 156–162.

Roschelle, J. (1992). Learning by collaborating: Convergent conceptual change. The *Journal of the Learning Sciences*, 2(3), 235-276.

Roschelle, J and Teasley, S. D. (1995). The construction of shared knowledge in collaborative problem solving. In C.E. O'Malley (Ed), *Computer-Supported Collaborative Learning*. Springer-Verlag, Berlin.

Rotgans, J. I., Schmidt, H.G. (2011a). Situational interest and academic achievement in the active-learning classroom. *Learning and Instruction*. 21. Pp. 58-67.

Rotgans, J.I. & Schmidt, H.G. (2011b). Cognitive engagement in the problem-based learning classroom. *Adv in Health Sci Edu*, 14,(4), 465- 479.

Rourke, L., Anderson, T., Garrison, D. R., & Archer, W. (2001). Assessing social presence in screen text-based computer conferencing. *Journal of Distance Education*, 14 from http://cade.athabascau.ca/vol14.2/rourke_et_al.html

Sahu, C. (2008). An evaluation of selected pedagogical attributes of online discussion boards. In *Hello! Where are you in the landscape of educational technology? Proceedings ascilite Melbourne 2008*. http://www.ascilite.org.au/conferences/melbourne08/procs/sahu.pdf

Sanchez, J. & Miranda, J. (2006). Meaning Making through E-Learning. In *Education for the 21st Century — Impact of ICT and Digital Resources*, 185-194.

Savery, J.R. (2005). BE VOCAL: Characteristics of Successful Online Instructors. *Journal of Interactive Online Learning*, 2 (4).

Schellens, T., Keer, V. H., Wever, D. B., Valcke, M. (2008). Student elaborations and knowledge construction in asynchronous discussion groups in secondary education. *Proceedings of the 8th international conference on International conference for the learning sciences* - Volume 3 International Conference on Learning Sciences,Utrecht: The Netherlands,413-415.

Schellens, T., Keer, V. H., & Wever, D. B. (2007). Scripting by assigning roles: Does it improve knowledge construction in asynchronous discussion groups?. *International Journal of Computer-supported Collaborative Learning*, 2, 225-246.

Schellens, T. & Valcke, M. (2005). Collaborative Learning in asynchronous discussion groups: What about the impact on cognitive processing? *Computers in Human Behaviour*, 21, 957-975.

Schellens, T., Van Keer, H., Valcke, M., & De Wever, B. (2005). The Impact of Role Assignment as Scripting Tool on Knowledge Construction in Asynchronous Discussion Groups. *Proceedings of CSCL 2005*.

Scott, E. J. & Walczak, S. (2009). Cognitive Engagement with a multimedia ERP tool: Assessing computer self-efficacy and technology acceptance. *Information & Management*, 46, 221-232.

Shank, P (2010). The importance of intuitive navigation in online course design. In Robert Kelly, (Ed.) *Online course design: Thirteen strategies for teaching in a web-based distance learning environment (Online Classroom Newsletter),* pp. 20-21. Madison, Wisconsin: MagnaPublications Inc.

Sharp, J.B and Huett, J. B. (2005). Importance of Learner-Learner Interaction in Distance Education. In *The Proceedings of the Information Systems Education Conference 2005*, v 22.

Shernoff, M. Csikszentmihalyi, B. S. and Shernoff, E.S. (2003). Student engagement in high school classrooms from the perspective of flow theory. *School Psychology Quarterly*18, pp. 158–176.

Sherry, L. (2000). *The WEB Project 2000 Evaluation: Student Performance*. Denver, CO: RMC Research Corporation.

Shi, S. (2010). Teacher Moderating and Student Engagement in Synchronous Computer Conferences, *MERLOT Journal of Online Learning and Teaching*, 6(2), p. 431- 445.

Sieber, E. J. (2005). Misconceptions and Realities about Teaching Online. *Science and Engineering Ethics*. 11, 329-340.

Sims, R., & Jones, D. (2003). Where practice informs theory: Reshaping instructional design for academic communities of practice in online teaching and learning. Information Technology, *Education and Society,* 4(1), 3-20.

Sims, R. (2008). From three-phase to proactive learning design: Creating effective online teaching and learning environments, In J. Willis (Ed), *Constructivist Instructional Design (C-ID): Foundations, Models, and Practical Examples*.

Singh, K. Granville, M. & Dika, S. (2002). Mathematics and Science Achievement: Effects of Motivation, Interest, and Academic Engagement. *Journal of Educational Research*. 95 (6). Pp. 323-331.

Slavin, R. E. (1995). *Cooperative learning: Theory, research, and practice* (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.

Slavin, R. (1997). *Educational psychology: Theory and practice*. 5th ed. Needham Heights, MA: Allyn and Bacon.

Smart, K.L. and Cappel, J.J.(2006). Students' Perceptions of Online Learning: A Comparative Study.*Journal of Information Technology Education*, 5, 201-219.

Smet, M. D. van Keer, H. &Valcke, M. (2008). Blending asynchronous discussion groups and peer tutoring in higher education: An exploratory study of online peer tutoring behaviour. *Computers & Education.* 50(1), pp. 207-223.

Smith, B. L., and MacGregor, J. T. (1992). What is collaborative learning?. In Goodsell, A. S., Maher, M. R., and Tinto, V., Eds. (1992), *Collaborative Learning: A Sourcebook for Higher Education*. National Center on Postsecondary Teaching, Learning, & Assessment, Syracuse University.

Soller, A., and Lesgold, A. (2003). A Computational Approach to Analyzing Online Knowledge Sharing Interaction. *Proceedings of Artificial Intelligence in Education 2003*, Sydney, Australia. Pp. 253-260.

Solimeno, A., Minou, E. M., Tomai, M. Francescato, D. (2008). The influence of students and teachers characteristics on the efficacy of face-to-face and computer supported collaborative learning. *Computers & Education*, 51(1), p.109-128.

Solis, A. (2008). Teaching for Cognitive Engagement: Materializing the Promise of Sheltered Instruction. IDRA Newsletter. *School Engagement: Potential of the Concept*, State of the Evidence.

Sotillo, S. (2006). Using instant messaging for collaborative learning: A Case study. Innovate 2 (3). Retrieved from: http://innovateonline.info/pdf/vol2_issue3/Using_Instant_Messaging_for_Collaborative_Learning-__A_Case_Study.pdf

Stoney, S. & Oliver, R. (1999). Can HigherOrder Thinking and Cognitive Engagement be Enhanced withMultimedia?. *InteractiveMultimedia Electronic Journal of Computer Enhanced Learning*. 1, 2.

Spanjers, D. M. (2007). *Cognitive engagement as a predictor of achievement.* Dissertation.University of Minnesota.

Sparkes, S. C. (2007).*Moving Into the Dance: Exploring Facets of Student Engagement In Learning Landscapes: Student Engagement in the 21st Century*, 1 (1), 79-93.

Stahl, G., & Hesse, F.W. (2009). Paradigms of shared knowledge. *International Journal of Computer-Supported Collaborative Learning*, 4(4), 365-369.

Stegmann, K., Wecker, C., Harrer, A., Ronen, M., Kohen-Vacs, D., Dimitriadis, Y., Hernandez-Leo, D., Fernandez, E., Asensio-Perez, J. & Fischer, F. (2011). How can current approaches to the transfer of technology-based collaboration script for research and practice be integrated? In H. Spada, G. Stahl, N. Miyake, & N. Law (Eds.), *Connecting computer-supported collaborative learning to policy and practice: CSCL2011 Conference proceedings volume III — Community events proceedings* (pp. 1103-1110). International Society of the Learning Sciences.

Stremmel, J. A. (1993). *Implications of Vygotsky's Sociocultural Theory for Child and Youth Care Practice*. Child & Youth Care Forum, 22 (5).

Strijbos, J. W., & Martens, R. L. (2001). Structuring group-based learning. Paper presented at the *9th European Conference of the European Association for Research on Learning and Instruction*. Switzerland: Fribourg.

Strijbos, J. W., Martens, R. L., & Jochems, W. M. G. (2004). Designing for interaction: Six steps todesigning computer-supported group-based learning. *Computers & Education*, 42, 403-424.

Sutton, L. A. (2001). The Principle of Vicarious Interaction in Computer-Mediated Communications. *International Journal of Educational Telecommunications*, 7(3), 223–242.

Tan, P-N., Steinbach, M. & Kumar, V. (2006). *Introduction in Data Mining*. Boston: Addison Wesley.

Tashakkari, A., & Teddlie, C. (1998). Mixed methodology: Combining qualitative and quantitative approaches. *Applied Social Research Methods*, No 46, Thousand Oaks, CA: Sage.

Treleaven, L. & Cecez-Kecmanovic, D. (2001). Collaborative Learning in a Web-Mediated Environment: A Study of Communication Practices. *Studies in Continuing Education*, (23)2, 169-182.

Topcu, A. and Ubuz, B. (2008). Effects of the asynchronous web-based course: Preservice teachers' achievement, metacognition, and attitudes towards the course.*Educational Technology & Society*, 11 (3), pp. 181–197.

Topping, K.J. Ehly, S.(1998). *Peer-assisted learning*. Mahwah, NJ; London, Lawrence Erlbaum Associates.

Tu, C-H., & Yen, C-J. (2007). Online socio-cultural learning. *Int. J. Continuing Engineering Education and Life-Long Learning*, 17(2/3), pp. 99-120.

Twigg, C. A. (2003). New Models for Online Learning. *EDUCAUSE Review*. September/October 2003. 29- 38.

Valcke, M., De Wever, B., Zhu, C., & Deed, C. (2009). Supporting active cognitive processing in collaborative groups: The potential of Bloom's taxonomy as a labeling tool. *Internet and Higher Education*, 12, 165-172.

Van Aalst, J. (2009). Distinguishing knowledge-sharing, knowledge-construction, and knowledge-creation discourses. *International Journal of Computer-Supported Collaborative Learning*. 4 (3), 259-287.

Van Aalst, J., & Chan, C.K..K. (2007). Student-directed assessment of knowledge building using electronic portfolios in Knowledge Forum. *The Journal of the Learning Sciences*, 16, 175-220.

Van Boxtel, C. (2000). *Collaborative Concept Learning: Collaborative Learning Tasks. Student Interaction, and the Learning of Physics Concept*. Doctoral Thesis, Uthrect: The Netherlands.

Van der Meijden, H. (2005). *Knowledge Construction through CSCL: Student Elaborations in synchronous, asynchronous, and three-dimensional learning environments*. Doctoral Thesis. Nijmegen: Radboud University.

Veerman, A. (2000). *Computer-supported Collaborative Learning through Argumentation*. Unpublished thesis. University of Uthrecht.

Veerman, A.L. & Treasure-Jones, T. (1999). Software for problem solving through collaborative argumentation. In P. Coirier & J.E.B. Andriessen (Eds.), *Foundations of argumentative text processing*. Amsterdam University Press, the Netherlands.

Veerman, A. & Veldhuis-Diermanse, E. (2001). Collaborative learning through computer-mediated communication in academic education. *Proceedings of European Perspectives on Computer-supported Collaborative Learning*, 22-24 March, 2001: the Netherlands.

Veldhuis-Diermanse, A. E. (2002). *CSCLearning? Participation, learning activities and knowledge construction in computer-supported collaborative learning in higher education*, Doctoral Thesis, Veenendaal, Wageringen University.

Vermunt, J. (1992). *Learning styles and regulation of learning in higher education: Toward process-oriented instruction in autonomous thinking*. Amsterdam/Lisse: Swets and Zeitlinger.

Vygotsky, L. S. (1978). *Mind in Society: The Development of higher psychological processes*. Cambridge. MA: Harvard University Press.

Wade, J.M. & Zorwick, L. W. (2009). Assigned advocacy, argumentation, and debate in high school classrooms. *Rostrum, 83*(8), 13-15.

Walker, O. C., Greene, A. B. & Mansell, A. R. (2006). Identification with academics, intrinsic/extrinsic motivation, and self-efficacy as predictors of cognitive engagement. *Learning and Individual Differences*. (16), 1-12.

Wang, H. (2005). A Qualitative Exploration of the Social Interaction in Online Learning Community. *International Journal of Technology in Teaching and Learning*, 1(2), 79-88.

Warschauer, M. (1995). *Virtual connections: Online activities and projects for networking language learners*. Honolulu, HI: University of Hawai'i, Second Language Teaching and Curriculum Center.

Weaver, W. (1948). Science and complexity. *American Scientist*, 36, 536.

Weinberger, A. & Fischer, F. (2006). A Framework to Analyze Argumentative Knowledge Construction in Computer-supported Collaborative Learning. *Computers & Education*. 46, 71-95.

Weinstein, C. E. & Mayer, R. E. (1986). The Teaching of Learning Strategies. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd edn.). New York: Macmillan.

Weiss, G.: Data Mining in the Telecommunications Industry. (2009). In Wang J. (ed.), 5. *Encyclopedia of Data Warehousing and Mining*, Second Edition, Information Science Publishing, Volume 1, pp.486-491

White, G. and Sivitanides, M. (2002). A theory of the relationships between cognitive requirements of computer programming languages and programmers' cognitive characteristics, *Journal of Information Systems Education*. 13(1), 59-66.

Willms, J.D., Friesen, S., & Milton, P. (2009). *What did you do in school today? Transforming classrooms through social, academic and intellectual engagement.* Toronto, ON: Canadian Education Association.

Witten, I. H., Frank, E., &Hall, M. A. (2011). *Data Mining: Practical Machine Learning Tools and Techniques*. 3rd Edition. Burlington, M.A.:Morgan Kaufmann.

Wittrock, M. C. (1992). Generative learning processes of the brain.*Educational Psychologist*, 27(4), 531-541.

Wright, T. & Cockburn, A. (2005). Solo, Together, Apart: Evaluating Modes of CSCL for Learning a Problem Solving Task. Proceedings of CSCL 2002. 552-553.

Wright, E.R. & Lawson, A. H. (2005). Computer-Mediated Communication and Student Learning in Large Introductory Sociology Courses. Teaching Sociology, 33(2). Pp. 122-135.

Wysocki, C.D. (2007). A Study of Cognitive Engagement in Online Learning. Dissertation, Washington State University, USA.

Yeo, T. M. & Quek, C. L. (2008). Investigating design & technology students' participation in a technology- mediated learning environment. *Australasian Journal of Educational Technology,* 24(5), 540-555

Yildirim, Z., Ozden, Y. M. & Aksu, M. (2001). Comparison of Hypermedia Learning and Traditional Instruction on Knowledge Acquisition and retention. The Journal of Educational Research, 94 (4), 207-214.

Yoder, J.D., & Hochevar, C. M. (2005). Encouraging active learning can improve students' performance on examinations. *Teaching of Psychology, 32*(2), 91-95. http://dx.doi.org/10.1207/s15328023top3202_2

Yoon, S. (2003). In search of meaningful online learning experiences. *New Directions for Adult and Continuing Education,* 100, Winter, 19-30.

Yue, K. &Ding, W. (2004). Design and Evolution of an Undergraduate Course on Web Application Development. In Proc. of the 9th Annual SIGCSE Conference on Innovation and Technology in Computer Science Education (ACM ITiCSE’04) held on June, 2004 at Leeds, UK (pp. 22-26). Leeds: UK.

Yum, C-W. (2008). *Learning Strategies and Cognitive Engagement*. Master Thesis. University of Hong Kong.

Yuqing, C. (2010). Creating opportunities for students in active learning: Lessons learnt from an Electronic Design Contest. Education Technology and Computer (ICETC), 2010 2nd International Conference. 22-24 June 2010. Shanghai, V1-521 - V1-524.

Zhang, X. Y., Luo, N. L., Jiang, D. X., Liu, H. F., &Zhang, W. Y. (2004). Web-based collaborative learning focused on the study of interaction and human communication. *Advances in* Web-based *learning—ICWL* 2004, 113–119.

Zhu, C. (2012). Student Satisfaction, Performance, and Knowledge Construction in Online Collaborative Learning. *Educational Technology & Society*, *15* (1), 127–136.

Zhu, E. (2006). Interaction and cognitive engagement: An analysis of four asynchronous online discussions. *Instructional Science*, 34(6), 451-480.

Zhu, X., Chen, A., Ennis, C., Sun, H., Hopple, C., Bonello, M., Bae, M., & Kim, S. (2009). Situational Interest, Cognitive Engagement, and Achievement in Physical Education. *Contemporary Educational Psychology*, 34, 221-229.

Zyngier, D. (2008). (Re) Conceptualising Student Engagement Doing education not doing time. *Teaching and Teacher Education: an International Journal of Research and Studies*.