A FRAMEWORK OF METACOGNITIVE SCAFFOLDING IN LEARNING THROUGH FACEBOOK

NURUL FARHANA BINTI JUMAAT

UNIVERSITI TEKNOLOGI MALAYSIA

A FRAMEWORK OF METACOGNITIVE SCAFFOLDING IN LEARNING THROUGH FACEBOOK

NURUL FARHANA JUMAAT

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

Faculty of Education
Universiti Teknologi Malaysia

OCTOBER 2014

To My Family

ACKNOWLEDGEMENT

Alhamdulillah. All praises to Allah the Almighty, the Most Gracious and the Most Merciful, for granting me the strength to complete this thesis.

My extreme gratitude goes to my supervisor, Prof. Dr. Zaidatun Tasir for her unwavering dedication, critical observations, continuous support and encouragement. She has inspired me in so many ways throughout my PhD journey. Only Allah can repay her kindness. I wish her all the best in her future endeavours, Insha'Allah.

Special thanks to my dear friends, especially Danakorn, Sham, Hisyamuddin, Khadijah, Hidayah, Suhaizal, Siti Nazleen, Mastura, Shima, Norazlina, Dr. Nurbiha and Dr. Dayana for their thoughtful suggestions and perceptive feedbacks.

Lastly, it is with sincere appreciation that I acknowledge my dearest parents, my dad, Jumaat Misman and my mom, Norridah Abd. Rahman, my lovely fiancé Mohammad Nabil, my brother, Amirul Afham, Zharif Zuhair, my youngest sister, Ili Nadirah and the entire family for their prayers, love and countless support. Thank you for believing in me. To my late grandmother who raised me up for 25 years, our memories together remain in my heart forever. This would have been impossible without them being as part of this meaningful life accomplishment.

Nurul Farhana Jumaat

22nd of Ramadhan, 1435H.

ABSTRACT

The purpose of this study is to develop a framework of metacognitive scaffolding in learning through Facebook. A quantitative research design of a multiple-case study method was adopted in this research. Initially, a survey was conducted to identify student's metacognitive abilities. 80 master degree students from the Educational Technology Program were randomly selected to answer the survey. Next, 37 students from the earlier survey were selected as respondents, which further contributed to the development of the framework. These 37 students comprised three cohorts of students from three subsequent semesters. The study identified the dominant mechanism of metacognitive scaffolding prompted by the instructor, along with the dominant types of online interaction triggered by the students in an online discussion. The data was analyzed by using content analysis technique. Besides that, 4 mobile applications or apps were developed by the researcher as the technological tool used in the learning. The mobile apps as well as the learning activities used in the current study follow the project-based learning approach. Data was collected from a General Metacognition Questionnaire (GMQ) survey, observation through Facebook discussions and through a performance test. The results show that the students' metacognitive abilities in learning are high (μ=*3.86*). Besides that, this study points out that the instructor often guides the students to focus on their learning process. The findings also demonstrate that students often give opinions rather than giving examples from their existing ideas; they are also unlikely to compare similarities and differentiate facts. Pearson correlation analysis shows a significant correlation between metacognitive scaffolding and students' types of online interaction with the students' learning performance. A data mining analysis using a decision tree technique was used to project a predictive model in order to suggest the mechanisms of metacognitive scaffolding appropriate to be used by the instructor; such a technique must be able to contribute to students' performance in learning. Finally, the proposed framework recommends a series of rules that serves as a shortcut for the instructor to produce meaningful learning among students through metacognitive scaffolding. These rules were derived from data mining, i.e, association rule analysis. These rules also mentioned the types of student online interactions that actually represent their learning process, particularly in terms of their interactivity in Facebook discussions.

ABSTRAK

Tujuan kajian ini dijalankan adalah untuk membangunkan satu rangka kerja *metacognitive scaffolding* dalam pembelajaran melalui Facebook. Kajian ini adalah berbentuk kuantitatif dengan menggunakan kaedah kajian pelbagai kes. Pada mulanya, satu kaji selidik telah dijalankan untuk mengenal pasti kebolehan metakognitif pelajar. 80 orang pelajar Ijazah Sarjana daripada program Teknologi Pendidikan telah dipilih secara rawak untuk menjawab kaji selidik ini. Seterusnya, seramai 37 orang pelajar yang menjawab kaji selidik ini telah dipilih sebagai responden yang telah menyumbang kepada pembangunan rangka kerja *metacognitive scaffolding*. 37 orang pelajar ini terdiri daripada tiga kumpulan pelajar dari tiga semester yang berlainan. Kajian ini telah mengenalpasti mekanisme *metacognitive scaffolding* yang dominan yang digunakan oleh pengajar, beserta dengan jenis interaksi yang dominan yang dihasilkan oleh pelajar semasa sesi perbincangan diatas talian. Data telah dianalisis menggunakan teknik analisis kandungan. Selain itu, sebanyak 4 aplikasi mudah alih telah dibangunkan oleh penyelidik sebagai alat teknologi yang digunakan dalam pembelajaran. Aplikasi mudah alih ini serta aktiviti yang dilaksanakan semasa kajian adalah berpandukan kepada pendekatan pembelajaran berasaskan projek. Data telah diperolehi dari *General Metacognition Questionnaire (GMQ),* pemerhatian melalui perbincangan di Facebook serta ujian prestasi pelajar. Hasil kajian menunjukkan bahawa kebolehan metakognitif pelajar adalah tinggi ($\mu = 3.86$). Selain itu, dapatan kajian menunjukkan bahawa pengajar sering membantu pelajar untuk memberi tumpuan kepada proses pembelajaran. Kajian juga mengenalpasti bahawa pelajar sering memberikan pandangan berbanding memberikan contoh daripada idea mereka yang telah wujud. Mereka juga jarang sekali membandingkan persamaan dan menyatakan perbezaan sesuatu fakta. Analisis korelasi Pearson menunjukkan terdapatnya hubungan yang signifikan antara *metacognitive scaffolding* dan jenis interaksi pelajar atas talian dengan prestasi pembelajaran mereka. Analisis perlombongan data dengan menggunakan teknik *decision tree* telah digunakan untuk menghasilkan model ramalan yang mencadangkan mekanisme *metacognitive scaffolding* yang sesuai untuk digunakan oleh pengajar; dimana teknik ini haruslah berupaya untuk menyumbang kepada prestasi pembelajaran pelajar. Akhir sekali, rangka kerja yang dicadangkan mengesyorkan beberapa siri peraturan yang bertindak sebagai jalan pintas untuk pengajar bagi menghasilkan pengajaran yang bermakna di kalangan pelajar menggunakan *metacognitive scaffolding.* Siri peraturan ini dihasilkan daripada perlombongan data iaitu *association rule.* Siri peraturan ini juga menyebut beberapa jenis interaksi pelajar atas talian yang benar-benar mewakili proses pembelajaran mereka, terutamanya dari segi interaktiviti mereka dalam perbincangan di Facebook.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

MS	-	Metacognitive Scaffolding
MOE	-	Ministry of Education
GMQ	-	General Metacognition Questionnaire
ISD	-	Instructional System Design
R2D2	-	Recursive, Reflective, Design and Development

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

A research conducted by Barg *et al.* (2000) has identified several problems among students who are learning computer-based subjects; the problems include dealing with technical issues, problems in the individual's learning process and the need of basic concepts especially for students who are new in learning the subjects. Accordingly, Faessler (2006) suggested that students garner the capability of combining both concepts and skills while learning computer-based subjects. These students probably need guidance from instructors or more skillful peers in order to complete a particular task. Such guidance is actually part of scaffolding mechanisms, and this guidance nowadays can also be offered in discussions and interactions among instructors and knowledgeable peers.

In education, scaffolding refers to a strategy or guidance that helps learners during their learning sessions whereby the method makes learning easier for them (Azevedo and Hadwin, 2005). Yun-Ho (2010) has identified scaffolding in various forms including in guidance through resources, tools, question prompts, expert modeling and expert advices. Scaffolding no longer refers to a guidance that is literally given by a teacher to a student; rather, it can also exist when there is a computer or other technology-mediated learning tools that are used to support students throughout their learning process. Scaffolding can also be referred as a guidance that comes either from human, tutors, computers or software tools that are

intended to support learners in developing their knowledge and skills (Graesser *et al.,* 2000; Reiser, 2002).

A few types of scaffolding exist in education and they are generally known as instructional scaffolding. Hannafin, Land and Oliver (1999) have identified four types of instructional scaffolding: conceptual, procedural, strategic and metacognitive scaffolding. Out of this four, metacognitive scaffolding is considered important as it serves to help students control their own learning (Azevedo *et al.,* 2008). In fact, the concept of metacognition itself is often defined as "thinking about your own thinking." Researchers recommend metacognitive scaffolding to be conducted in a technology-rich environment through various approaches (Herbert, 2003), but the field has yet to uncover the use of metacognitive scaffolding in learning computer-based subjects.

As technology extends learning beyond the classroom setting, the concept of scaffolding becomes more diverse. No longer is the method confined to face-to-face interaction; it now implies to students thousands of kilometers away from their colleges as well. Granted, scaffolding can now be mediated by technology. A technology that captures interests among university's students nowadays includes the social networking tools. Today, these tools have attracted millions of users from all around the globe (Boyd and Ellison, 2008). Lucas and Moreira (2009) have found that social networking tools can foster informal learning dialogues among students and this encourages students' participation and determination in sharing knowledge. A social networking tool such as Facebook ignites online interactions as it allows users to interact within their bounded network. According to Shambare and Mvula (2011), Facebook offers many opportunities that can facilitate teaching and learning since it promotes students-instructor interactions.

With this regard, there is a need of proper guidance by instructors to trigger students' discussions in the learning of computer-based subjects through the online medium, including through social networking tools. It is possible that the discussions triggered by the network can initiate different types of online interactions in which the students can interact with instructors and peers throughout their

learning. Previous studies have reported how the social network has promoted interactions and participations among instructors and learners in supporting their teaching and learning (Santos *et al.,* 2009; Minocha, Schroeder and Schneider, 2010; Shiu, Fong and Lam, 2010). It is important to understand that long before the existence of technology-mediated learning environment, Moore (1989) had defined three types of interactions in distance education, including the interaction between i) instructor- learner, ii) learner-learner and iii) learner-content. In the present study, the researcher had focused on learner-learner and instructor-learner interaction in which an instructor scaffolds learner and learners discussed with their peers throughout a discussion session.

Since scaffolding is best implemented through an authentic learning environment which includes reality-centered activities, a project-based learning seems to be the best learning approach to trigger a discussion. A project-based learning is a combination of both subject-matter objectives and an authentic learning environment (Eskrootchi and Oskrochi, 2010). It is based on learning activities that construct knowledge in an authentic context (Papanikolou and Boubouka, 2010). This approach is the best to facilitate learners in having full control throughout their learning process. The project-based learning approach was delivered through mobile applications or apps that installed on the iPad and other mobile tablets, such as a Samsung tablet in order to trigger the discussion in Facebook, as well as to elicit student's learning process. In this study, the mobile apps act as the learning tools and technology-supported devices.

Therefore, this study expected to develop a framework of metacognitive scaffolding in learning computer-based subjects through a social networking tool which is Facebook. By having the framework, the researcher intended to study students' learning processes that are based not only on their communications, but also on their thinking about their own thinking. Integrating metacognitive scaffolding will trigger different types of students' online interactions, which will represent their learning process (Farahani, 2003). In addition, this framework assumes that students who are lack of metacognitive skills and knowledge can be scaffolded through interaction on Facebook, in which their instructors inject

questions that will result in the instructor-learner interactions. It is hoped that a proper framework of metacognitive scaffolding in learning can successfully facilitate learners' metacognition and interactions in learning computer-based subjects.

1.2 Background of the Problem

Several studies have provided evidence that learning without proper guidance from instructors will result in the students' feeling of isolation, lack of self-confidence, reduced motivation and difficulty in accomplishing complex tasks (McLoughlin and Marshall, 2000; Reiser, 2002; Ludwig-Hardman and Dunlap, 2003). These issues have also attracted other researchers to investigate the effects of students' losing guidance from teachers and content expert. These students may lose their focus on their studies or lose hopes and interests in developing their potential skills and knowledge (Holmes *et al.*, 2010). Such effects have ignited researchers and academicians to find possible guidelines or structures that can assist learners in their learning process. As a result, scholars have come to realize that learners require guidance from instructors or more skillful peers in order to meet instructional objectives in learning (Reiser, 2002; Kazlauskas and Applebee, 2007) and this guidance is necessary when it comes to online learning.

Authoring System is one of the computer-based subjects that expose students to creative activities, ranging from simple typing content to designing and developing of complex multimedia courseware by using an authoring tool to produce computer-based instructional applications (Otto and Pusack, 2009). Sidhu and Ramesh (2006) stated that the use of multimedia authoring tools requires one to have knowledge and skills to operate such tools. For example, some challenges that concern learners include their lack of knowledge (Payne *et al.,* 2007) and technical skills (Blocher, 2003). On the other hand, the demonstration and hands-on activities in learning this subject are critical (Wang, 2006). Thus, support or scaffolding from knowledgeable others is crucial (Barg *et al.,* 2000; Jones and Issroff, 2005).

In education, scaffolding refers to the process in which teachers or skillful peers assist a learner, solve problems and help the learners to complete a complex task that is beyond his or her knowledge (Reiser, 2002; Azevedo and Hadwin, 2005; Thomas, Davis and Kazlaukas, 2007). There are four types of scaffolding that support learning: procedural, conceptual, strategic and metacognitive scaffolding (Hannafin, Land and Oliver, 1999; Hill and Hannafin, 2001). Procedural scaffolding assists on how to use resources, so it focuses on using specific functions, procedures or navigations. Conceptual scaffolding assists students in managing the concepts in learning. It helps students in making connections between concepts or in simplifying complex concepts (Way and Rowe, 2008). This type of scaffolding also supplies a conceptual model or different representations of a concept. Strategic scaffolding assists by directly or indirectly suggesting approaches to solve problems and strategies or pathways to complete a task (Devolder, Braak and Tondeur, 2012). Metacognitive scaffolding assists learners in reflecting or expelling what they have learned (self-assess), or in giving feedback/opinions on how they are learning (Teo and Chai, 2009). This method of scaffolding may be in the form of a simple prompt to think about the goal or the problem, or it may be in the form of a more sophisticated guidance for organizing or assessing knowledge.

In this situation, the guidance given by the experts among the students or the lecturers themselves actually reflects the Zone of Proximal Development (ZPD) that was also introduced by Vygotsky (1978). In particular, Vygotsky considered that students are ready to learn when they are assisted through dialogues with an expert or a knowledgeable person. He stated that students' achievements are based not only on their current level of skills, but also on their potential developments. Thus, the Zone of Proximal Development (ZPD) is the distance between what students can do with and without help. The term *proximal* (nearby) points out that the assistance provided is just beyond the learners' current knowledge in order for them to complement their abilities (Cole and Cole, 2001). The assistance can be in a form of scaffolding by the instructors and by peers.

Among the four types of scaffolding, metacognitive scaffolding seems to be the appropriate way to assist students in learning computer-based subjects.

Computer-based subject requires students to be involved with technical skills such as operating software tools and understanding its functions for the purpose of drawing, creating animations or developing multimedia applications. For students who are first being introduced to this subject, operating such tools can be quite troublesome. Thus, the guidance from the instructors through the use of metacognitive scaffolding may ease their difficulties, as this type of guidance supports students in understanding the best possible strategy to accomplish difficult tasks and thus, developing their thinking. According to Azevedo and Hadwin (2005), scaffolding students' during learning can motivate them to learn challenging tasks, particularly in a computer-based learning environment. Furthermore, Reingold, Rimor and Kalay (2008) have stated that metacognitive scaffolding supports the learning process by framing the problem, guiding students, and giving ways for them to solve problems under possible strategies. This type of scaffolding suggests that students plan ahead, evaluate progress and determine their needs. Moreover, metacognitive scaffolding may also remind the students to reflect on the goal in order to manipulate the problem at hand. By using metacognitive scaffolding in a learning process, novice students can be assisted in learning in a better environment, particularly through good guidance from experts. There is a growing body of scholarly works on integrating metacognitive scaffolding through software-based activities (Luckin and Hammerton, 2002; Quintana, Zhang and Krajcik, 2005; Graesser, McNamara and VanLehn, 2005), metacognitive scaffolding in computer-supported learning environment (Cuevas, Fiore and Oser, 2002; Pifarré and Cobos, 2009; Molenaar *et al.,* 2012) and the impact of metacognitive scaffolding on learning (Roll *et al.,* 2012).

Scaffolding students in learning through an online learning medium is quite a challenging task. Because most educators face problems with scaffolding students through an online learning medium (Sims, Dobbs and Hand, 2002), a scaffolding framework through such a medium is required. The framework can provide a foundation in identifying a mechanism that will lead to the description of successful metacognitive scaffolding approaches in learning computer-based subjects. Reingold, Rimor and Kalay (2008) have categorized metacognitive scaffolding mechanisms provided by an instructor into the following mechanisms; i) presenting the rationale of the given task; ii) ask students regarding the relationship between reading items,

course objectives and tasks, iii) Supporting student's reflective writing, iv) let students focus on the learning process, v) Encouraging the relationships among participants, vi) Permit student's thoughts especially in discriminating between the conclusion, fact, opinion or hypothesis, and finally vii) supervising or guiding student's text comprehension. All of these mechanisms are the focal points of a learning process that encourage interactions among participants. Resulting from their present study, Reingold, Rimor and Kalay discovered that metacognitive scaffolding encourages students to reflect on the task given and contributes to the students' experience as a community of learners with a common task. Based on the mechanisms, the framework was developed from the mechanisms of metacognitive scaffolding used by Reingold, Rimor, and Kalay (2008), who have also implemented the mechanisms of metacognitive scaffolding in their study among university students. However, Reingold, Rimor, and Kalay (2008) did not formulate any framework of metacognitive scaffolding that can maximize students' interaction through Facebook. With this gap, this study works into formulating the framework of metacognitive scaffolding in learning through Facebook.

Concurrent with the changes of university students' interest towards learning through the online learning medium is the existence of social networking tools that have attracted the students' attention. Facebook is known as the most popular social networking tool among university students, with the users' age ranging between 17 and 61 years old (Junco, 2012a). The services are free of charge and the users are free to connect with each other within their network. Most of the social networking sites provide multiple services to their users such as instant messaging, blogging, photo-sharing emailing and chatting services, etc. All of these services allow students to interact easily with each other. According to Santos *et al.* (2009), these sites have the potential to support teaching and learning sessions as they complement the traditional and online classroom activities.

Oradini and Saunders (2008) have shown that students can benefit social network in various ways, such as by integrating it with class activities or by sharing information about the activities they are engaged in. Santos *et al.* (2009) found that social networking sites such as Facebook may also promote informal dialogues and

knowledge sharing among students. According to Lucas and Moreira (2009), social networking tools also have the potential to support innovative pedagogical practices and different students' learning types. For instance, the Facebook site has becomes a platform for students and teachers to be connected. This connection allows them to communicate and share their thoughts, emotions, facts and opinions without feeling hesitant and shy towards others since the communications take place virtually. Besides, the students can instantly obtain new information on their academic contents from other students or teachers.

Nevertheless, discussions that occur without any guidance from any expertise (such as instructors) are considered useless or a waste of time. In Berent and Bugbee's (1993) study, they concluded that students who do not receive any external feedback or responses about their learning progress will have low learning achievements. This problem commonly occurs among novice students who do not have basic knowledge on technical applications. This is because the complexity of technical knowledge seems to daunt many people from developing their technical skills (Pavlina, 2006). As a result, students are unable to solve any technical problem even when they are attempting to make an application to work. For this reason, guidance is expected, especially when it comes to learning a computer-based subject, such as Authoring System, which requires knowledge and technical skills.

At the same time, issues in online learning process should be explored, particularly in learning through online interactions in Facebook, regardless whether the learning takes place or otherwise. One of the ways to measure a learning process in an online learning environment is by analyzing online interactions; experienced educators and researchers such as Henri (1992), Gunawardena, Lowe and Anderson, (1997), Kanuka and Anderson (1998), MacKinnon (2000), and Campos (2004) have proposed methods and models to assess learning processes through online interactions. Other scholars such as Fahy, Crawford and Ally (2001) and Jeong (2003) have explored and understood the patterns of online interactions. However, their views differ from the one addressed in the study by Topcu and Ubuz (2008), who investigated the effects of online interactions in a forum (MacKinnon, 2000) on students' learning process. The same technique proposed by Topcu and Ubuz (2008)

was applied in this research which merely focuses on students' types of online interactions facilitated through instructors' metacognitive scaffolding on Facebook.

The metacognitive scaffolding triggered by the instructors or lecturers through interactions in Facebook was based on the mechanism of metacognitive as proposed by Reingold, Rimor and Kalay (2008). Each student's interaction/post on Facebook was analyzed via a coding technique, specifically on the types of online interactions as the ones developed by MacKinnon (2000). This coding technique was chosen because of its mere focus on interactivity. Moreover, Shukri and Tasir (2012) had also used this coding technique to investigate the students' different types of online interactions in learning Authoring Language in an online forum.

Learning environment that requires scaffolding should be authentic and reflective of the project's task. This is suitable for an instructional method called project-based learning approach. The project-based learning approach allows students to work on a project over a particular period of time in which emphasis is given for doing some action-oriented tasks instead of learning on something (Muniandy *et al.,* 2009), for example, facts or theories. In other words, a project-based learning is a 'hands-on' approach for the students that will lead to their thinking skills upon completing the project. Eskrootchi and Oskrochi (2010) have investigated the effectiveness of a project-based approach in a technology-rich environment. Their findings concluded that at best, students understand a concept of a particular lesson when they participate in manipulating a particular experiment. Prior researchers tend to agree that students learn at their best with a project-based approach as they will discover things by themselves and make full use of the technological tools (Lebow and Wager, 1994; Muniandy *et al.,* 2009). With the existence of applications in learning and students' interest towards new gadgets such as the iPad and other mobile tablets, the project-based learning can be represented in a form of mobile applications (or apps). A preliminary investigation that has been conducted in this study has proven that students show positive attitudes towards learning with mobile apps. In particular, the results indicated that students prefer to learn by using apps rather than by the traditional method.

As a conclusion, it is beneficial to have a metacognitive scaffolding framework to assist students in learning the Authoring System subject through Facebook. Moreover, the notion of scaffolding students in this study was through interactions in Facebook in which project-based learning tasks were delivered through Apple and Android–based tablets and designed learning activities. Through the discussions on Facebook, instructors' dominant metacognitive scaffolding that have resulted in the dominant types of students' online interaction can be expected to form an appropriate framework.

1.3 Problem Statement

Learning a computer-based subject, such as Authoring System requires both theoretical and technical skills. This subject exposes students to the basic tools and functions to create animations and applications by using the Adobe Flash software. At the end of the semester, students are expected to develop various kinds of instructional multimedia applications. Therefore, technical skills and knowledge on theoretical basis are highly necessary for this subject. Otherwise, students who do not have prior knowledge in this subject may find it difficult to build instructional multimedia applications by using the above mentioned software. To overcome these difficulties, it is best to have discussions with peers and instructors in order to solve the learning problems because students may find it complicated if they have to work on their own. In fact, they need support from others so that in the future, they are able to sharpen their skills and build any multimedia application by using the software.

Given the need for interaction and scaffolding in developing the required skills in learning Authoring System, how do we ensure and assess that instructors' scaffolding can establish students' deeper understanding of the learning process in relation to their types of interaction in online discussions?

With the idea of discussions and interactions between students and instructors, and how they can assist learners in their learning process, the researcher

focused on the medium that is capable of becoming the platform for the discussions. Social networking tools such as Facebook is recognized as an ideal platform for students to interact and discuss with their friends and instructors regarding their progresses and problems in learning. Like other social networking tools that allow socialization among users, Facebook allows users to contribute, share information and gain knowledge because of its open environment. However, educators should realize that the discussions that take place on Facebook without guidance from instructors or skillful peers are ineffective because students may prone to discuss unrelated topics. These students need support from their instructors or skillful peers since they may find it helpful if they can discuss with more knowledgeable persons.

In education, this support is known as instructional scaffolding, or commonly known as scaffolding. Scaffolding is best implemented with the existence of authentic tasks that are proven to enhance students' performance and engagement in learning. Scaffolding can also be divided into several parts, one of them is metacognitive scaffolding. Metacognitive scaffolding provides strategy and assists students throughout their learning process. It enables them to plan what they will learn, monitor their learning and reflect upon what they have learned about a particular task. Proposed by Reingold, Rimor and Kalay (2008), the metacognitive support was injected by the instructor through the discussions with learners in a Facebook group page that is set up by the instructor him/herself. As mentioned, mobile apps were used as learning tools in which authentic tasks can be implemented. The apps contain project-based video tutorials on several topics covered in the learning of Adobe Flash. Students were given authentic tasks/activities at the end of every topic and they needed to refer to the apps to complete the tasks.

Hence, with the emergence of such authentic tasks through on-demand technology devices (such as the iPad), and with the students being assisted with metacognitive scaffolding through a social networking tool such as Facebook, the researcher then produced a proper framework that could assist learners in learning Authoring System subjects. To develop this framework, the researcher initially identified the students' metacognitive abilities in learning by investigating the

students' metacognitive skills and knowledge. Next, a Facebook group page was set up in which the students' learning process was initiated by project-based tasks delivered through mobile apps. The students' types of online interactions were measured from each post/discussion that took place in the Facebook group page. At the same time, the students were assisted with metacognitive support prompted by the instructor. At the end of the study, the researcher developed a framework of metacognitive scaffolding based on Reingold, Rimor and Kalay's (2008) seven mechanisms of metacognitive scaffolding that aim to support students in learning. In this study, these mechanisms were used to assist students in learning computer-based subjects through a discussion on Facebook, particularly by considering the students' types of online interactions as suggested by MacKinnon (2000).

1.4 Research Objectives

The objectives of this study are as follows:

i. To identify students' metacognitive abilities in learning.
ii. To identify the dominant mechanisms of metacognitive scaffolding by the instructor to assist students in learning Authoring System subject through Facebook.
iii. To identify the dominant types of online interactions among students in learning Authoring System subject when metacognitive scaffolding is infused through Facebook.
iv. To investigate the relationship among instructors' metacognitive scaffolding and students' types of online interaction with students' performance.
v. To study how does the metacognitive scaffolding helps students' in learning Authoring System subject.
vi. To develop a framework of metacognitive scaffolding in learning Authoring System subject through Facebook considering different types of students' online interaction.

1.5 Research Questions

The research questions are:

i. What are the students' metacognitive abilities in learning?

ii. What are the dominant mechanisms of metacognitive scaffolding by the instructor to assist students in learning Authoring System subject through Facebook?

iii. What are the dominant types of online interactions among students in learning Authoring System subject when metacognitive scaffolding is infused through Facebook?

iv. What is the relationship among instructors' metacognitive scaffolding and students' types of online interaction and students' performance?

v. How does the metacognitive scaffolding help students' in learning Authoring System subject?

vi. What is the framework of metacognitive scaffolding in learning Authoring System subject through Facebook considering different types of students' online interaction?

1.6 Theoretical Framework

Theoretical framework outlines the basis of theories or the basic concept that the researcher has used throughout his or her study. In this study, the researcher employed several concepts that acted as the baseline that contributed to the development of the framework of metacognitive scaffolding in learning through Facebook. Figure 1.1 shows the theoretical framework of this research.

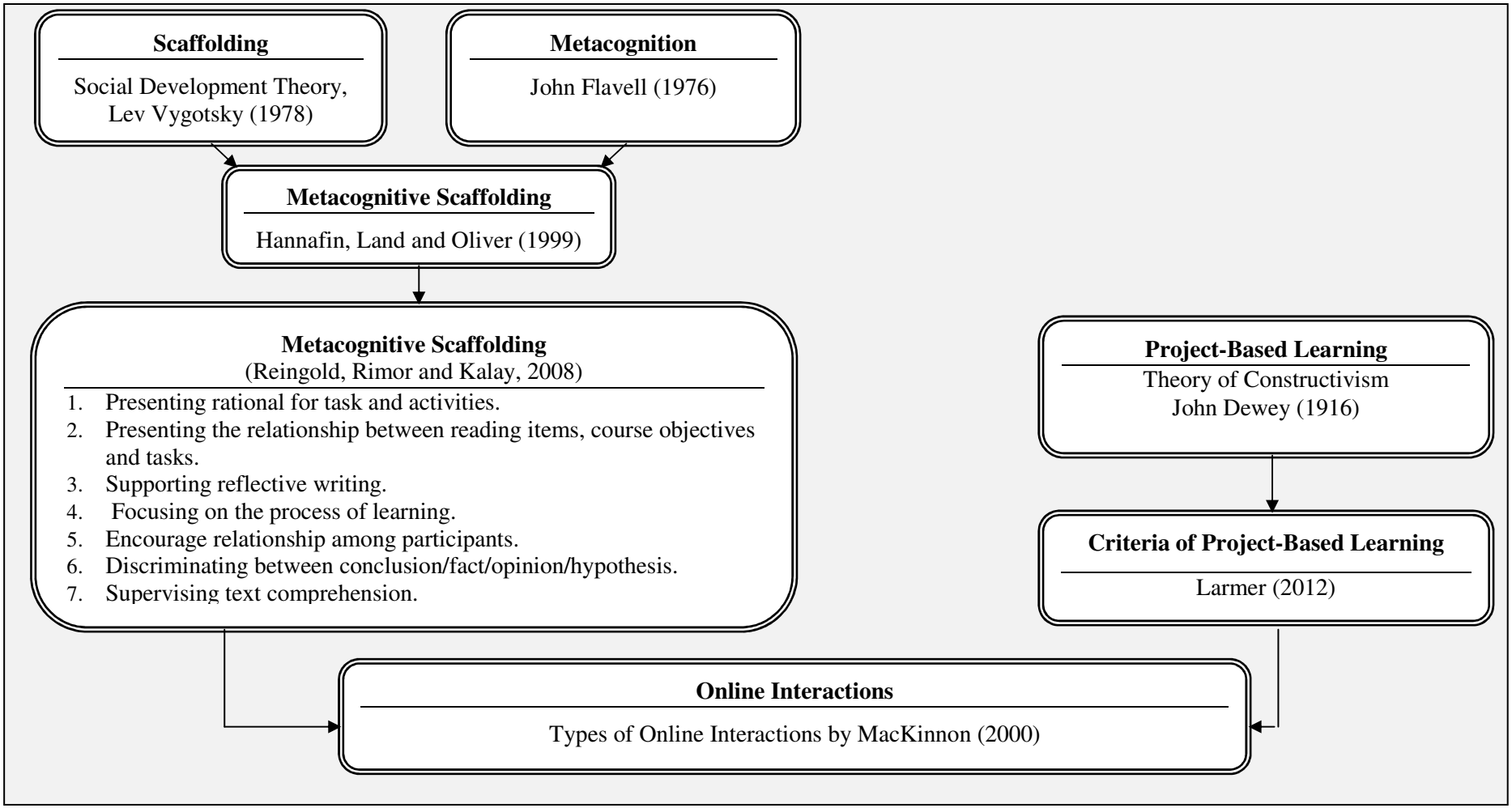

Figure 1.1 Theoretical Framework

1.6.1 Social Development Theory

The term scaffolding in education is best reflected in the works that had been carried out by Lev Vygotsky in 1978 and his renowned Social Development Theory. Social Development Theory suggests that social interaction plays an important role in cognitive development. In particular, Lev Vygotsky emphasized that community plays an important role in the process of cognition, development in which learning occurs through social interaction with skillful others. Two main principles were highlighted by Vygotsky in this theory: More Knowledgeable Others (MKO) and Zone of Proximal Development (ZPD).

Vygotsky referred MKO as teachers, parents or peers who have a higher ability level than learners; in other words, MKO are the persons whom the learners seek guidance in understanding a particular task, process or concept. The Zone of Proximal Development (ZPD) is related to the concept of MKO; it is defined as the area between what is known and what is not known from a child during learning. The ZPD is the area in which a child receives guidance or instruction from MKO, and the result is the child's ability to develop skills on his own, and the allowing of the child to develop his understanding. With the existence of MKO, individuals are able to coordinate their cognition throughout the process of learning. Understanding this process of cognition is known as metacognition.

1.6.2 Metacognition

In 1976, John Flavell published a paper in which he describes metacognition as a concept of defining "one's knowledge concerning one's own cognitive processes" (p. 232), or simply thinking about one's own thinking. It consists of both knowledge of cognition and the ability to control and regulate the cognitive processes (Flavell, 1979). Other pioneer researchers who studied metacognition include Reeve and Brown (1984), who considered metacognition as a term that has generally been referred as "individuals' ability to understand and manipulate their

own cognitive processes" (p. 3). Failing to acquire metacognitive abilities will result in poor academic performance, especially in problem-solving tasks (Romainville, 1994; Hartman, 2002; Sungur, 2007; Cornoldi, 2009). An individual's metacognition can be guided through the use of specific strategies known as metacognitive scaffolding.

1.6.3 Metacognitive Scaffolding

Fouché and Lamport (2011) once stated that metacognition is not easily taught, nor can it easily be transferred. However, many researchers proved that students' metacognition can actually be trained (King, 1998). According to Luckin and Hammerton (2002), metacognitive scaffolding obviously can support and teach students' metacognition in learning. Luckin and Hemmerton particularly studied how the technique could be a strategy to support the learners' ability to challenge their own skill level and look for appropriate assistance.

The term metacognitive scaffolding was first introduced by Hannafin, Land and Oliver (1999). They referred metacognitive scaffolding as one of the types of scaffolding in an online learning environment that assists learners in establishing what is known and how to think during a learning process. For sure, metacognitive scaffolding has its root from the concept of metacognition defined by John Flavell in 1976, and the term of scaffolding was founded by the famous psychologist, Lev Vygotsky in 1978.

In this study, each student had to participate in ongoing discussions in a social networking tool, which is the Facebook group page created by the instructor. The discussion itself was initiated by the instructor based on the mechanisms of metacognitive scaffolds promoted by Reingold, Rimor and Kalay (2008). The mechanisms include:

i. Presenting rational for task and activities.

ii. Presenting the relationship between reading items, course objectives and tasks.
iii. Supporting reflective writing.
iv. Focusing on the process of learning.
v. Encouraging relationship among participants.
vi. Discriminating between conclusion/fact/opinion/hypothesis.
vii. Supervising text comprehension.

1.6.4 Theory of Constructivism

This study also included the work of the Theory of Constructivism by John Dewey in 1916. In particular, Dewey (1916) pointed out that education depends on the action: the experience given to learners are important as it draws meaning to them. His ideas became influential to other researchers as the latters believed that the expanded ideas that evolved around the Theory of Constructivism explain how learners construct their own understanding. This study involved a learning strategy called project-based learning. A project-based learning requires students to be involved in authentic activities in which they can experience learning by doing.

1.6.5 Types of Online Interaction

Woo and Reeves (2007) claimed that an interaction is the vital element in any learning process. As we all know, the nature of interaction itself can be at a distance, or in a form of face-to-face interaction. The same goes to interaction that takes place in a learning environment. Interactions in learning have shifted from being in a face-to-face classroom setting to being in a technology-enabled medium. Educational technologies have long considered interactions in an online learning medium or what we know as online interactions or online discussions (Vrasidas and McIsaac, 1999; Spatariu, Hartley and Bendixen, 2004; Lee, 2006; Lai, Yang and Liang, 2006; Mavrou, Lewis and Douglas, 2010; Song and McNary, 2011).

Researchers have also considered the different types of online interactions among students in learning, and they have particularly conducted various methods to analyze them (Davidson-Shivers, 2009; Lee, 2006; MacKinnon, 2000; Song and McNary, 2011). In this study, however, the researcher gathered the students' different types of online interactions based on the coding techniques of messages used by MacKinnon (2000). In particular, MacKinnon categorized types of interactions into specific categories including i) acknowledgement of opinion, ii) question, iii) compare, iv) contrast, v) evaluation, vi) idea to example, vii) example to idea, viii) clarification or elaboration, ix) cause or effect and lastly, x) off-topic or off-topic discussion. He then developed a coding technique called "cognotes" to evaluate students' participation in an electronic discussion group. Other researchers, Topcu and Ubuz (2008), also used this coding technique to assess students' interactions in an online forum. Based on the interactions that took place on Facebook, students' engagements were considered important as from here, instructors could perceive the different types of online interactions among the students.

1.7 Research Framework

A research framework (Figure 1.2) explains how the researcher conducted this research in order to produce a framework of metacognitive scaffolding in learning through Facebook. Prior to assessing the students' metacognitive scaffolding in learning, the researcher distributed General Metacognition Questionnaire (GMQ) as the one developed by Topcu (2005). The GMQ comprises questions that aim to assess students' metacognitive abilities in three aspects of metacognition: metacognitive knowledge, metacognitive judgment and monitoring, and metacognitive self-regulation and control.

According to Pifarré and Cobos (2009), metacognitive knowledge is knowledge that concerns one's metacognitive skills, such as how students can control their own learning processes. These metacognitive skills are highly related to

tasks and contexts' characteristics. For example, students who can regulate their own thinking on a given task are those who possess metacognitive knowledge. This means that these students plan and organize their thinking well while completing a particular task. They know what they should or should not do in order to complete a task. Students with metacognitive knowledge will assure the understanding of their learning objective. They are the kind of students who will order their brain to perform well in order to meet the objective in learning.

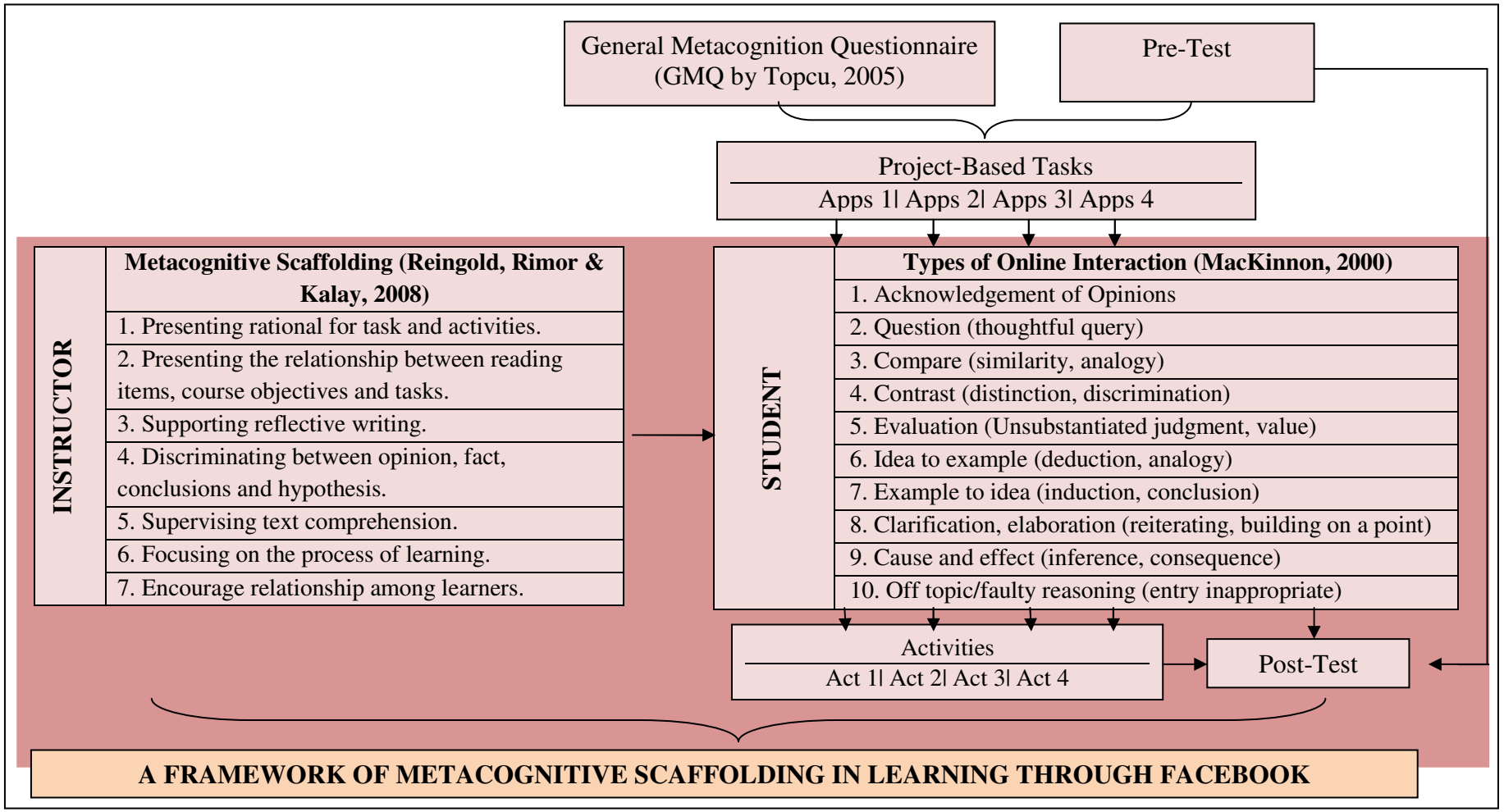

Figure 1.2 Research Framework

Unlike metacognitive knowledge, metacognitive judgment and monitoring refer to the way students confidently judge their success in learning by reporting that the information they obtained will be remembered later (Hertzog and Dunlosky, 2011). To demonstrate, these are the kinds of students who can extract the core important information while they are studying, and they remember what they referred previously. They can easily monitor their own learning materials and categorize them as 'easy' or 'difficult', and if they are stuck in Plan A, they will construct and go to Plan B.

Metacognitive self-regulation and control refer to the extent where students take control of their learning process (Mullin, 2012). Metacognitive self-regulation and control helps students to focus well in their studies. These students know what they are doing; the learning objective is clear for them to move on and strategically organize what and how they should do to meet those objectives in learning. Metacognition is known as an important aspect for successful learning and for this reason, it is crucial to assist or scaffold a learner's metacognition process. Thus, metacognitive scaffolding is the best strategy to use.

In this study, the instructors prompted questions or statements that refer to the above mechanisms of metacognitive scaffolding in order to assess the students' learning process. These mechanisms of metacognitive scaffolding were used by Reingold, Rimor and Kalay (2008) to study the relationship between an instructor's scaffolding and students' metacognition in online forums. The results of their study indicated that students' metacognitive processes in learning were all correlated with the content - support type of instructor's metacognitive scaffolding. This means that it is imperative to have instructors' support in assessing a student's learning process, especially to promote his or her metacognitive thinking.

In this study, the students were scaffolded throughout their learning process, while learning a computer-based subject (Authoring System). Metacognitive scaffolding seemed to be the best method to assess the students' learning process; according to Bannert, Hildebrand and Mengelkamp (2009), a successful learning

mainly depends on metacognitive activities that are performed and constantly monitored during learning.

A learning environment that requires scaffolding should be authentic and reflect task based on project. In this study, the researcher developed iPad apps that contain a tutorial on learning Adobe Flash. The students were required to refer to the apps in order to complete the tasks/activities prepared by the instructors. Besides that, this project-based tasks had encouraged the students to use resources other than textbooks in order to communicate their findings; work collaboratively; and think critically, creatively and independently (Kwok and Tan, 2004). In this study, the researcher followed some criteria of project-based learning as forwarded by Larmer (2012). The criteria are as follows:

i. The project meets real world situations beyond the classroom setting, or the products that the students created can be used by real people. For example, students develop a project of multimedia application by using software, and the app can be used by others. They produce a product that they develop and design by themselves.
ii. The project focuses on a problem, issue or topic that is relevant to the learning content. For example, instructors provide a project or task that requires students to complete particular tasks. The main aspect is that it must be related to the learning content in class.
iii. The project sets up a scenario or simulation that is realistic.
iv. The project involves tools, tasks or processes in real settings. For example, students explore the issue of how to design a web-based system that can apply users' interactivity by using an appropriate program language.

The above criteria of project-based learning has been embedded throughout the study in which the mobile apps will act as an educational tool for the students. The apps consist of interactive information and a video tutorial of learning Adobe Flash. The students must refer to the apps in order to complete the tasks provided by the instructor at the end of every topic. From here, the students may utilize hands-on approaches to complete the tasks on their personal computers by referring to the

apps. The interactive information and video tutorial in the apps provide the students with in-depth understanding of the learning content. On the other hand, the mobile feature of iPad has made it possible for the learners to access it anywhere and at any time, even outside the classroom setting. The assessment tasks were similar to the instructions provided in the apps, thus the students were fully responsible and had full control of their own learning. As a result, the learning process was gained through the learning project provided, that is the tasks. Obviously, in this study, the teacher acted as the facilitator of the learning who guided the students with metacognitive scaffolding prompts from the interactions that occurred in Facebook.

With metacognitive scaffolding infused by the instructor, the students' responses were assessed according to the types of online interactions as proposed by MacKinnon (2000). As mentioned, MacKinnon has set up a coding technique of messages to assess students' interactivity in an online discussion. In this study, the students' types of online interactions represent the student's learning process. A pre-test and post-test were also conducted by the researcher to access the students' performance throughout this study.

1.8 Rationale of the Study

The findings of this study are useful as it defined students' metacognitive abilities in learning, measured through a General Metacognition Questionnaire (GMQ) as the one developed by Topcu (2005). The rationale for this was to obtain an understanding of the students' level of metacognitive abilities, whether they possess such metacognitive skills, metacognitive judgments and metacognitive self-regulation in their learning processes. Metacognitive supports provided by the instructors explained by the mechanisms of metacognitive scaffolding through Facebook which has assisted the students in learning.

Furthermore, the mechanisms of metacognitive scaffolding in learning Authoring System subjects was prior to instructor's metacognitive scaffold as the one

developed by Reingold, Rimor and Kalay (2008). This revealed the importance of instructors' support in learning computer-based subjects. Besides that, all the metacognitive scaffolding provided by the instructor was believed could have triggered different types of online interactions among students through their discussions on the social networking tool, which is in the Facebook. Thus, this study provides a better understanding on how metacognitive scaffolding can assist learners in learning Authoring System subjects through Facebook. The existence of mobile apps, on the other hand, has acted as a learning tool that assisted the students to complete the project-based tasks provided by the instructors while at the same time, the mobile tablets have allowed them to assess and participate in the discussions on Facebook anywhere and at any time.

Students who have metacognitive abilities in learning are believed to be better problem-solvers and critical thinkers than those who do not possess such skills (Dawson, 2008, Magno, 2010). They are more motivated persons and are able to cope with difficulties (Dawson, 2008). Thus, this will encourage them to perform better in class (Coutinho 2007). Rahman *et al.* (2011) have studied 'metacognitive reflection' activity in the classroom and have contributed towards variations of students' metacognitive skills. Their findings, however, have indicated that the instructors or teachers did not quite participate in the activity. It was suggested that instructors or teachers can also participate and scaffold students throughout the learning process. It is for this reason that the instructors and students in this study participated in the online discussions on the Facebook page so that they are guided by the metacognitive support throughout their learning.

Recently, the interest in metacognition has increased among researchers who study students' reflections in an online learning environment (Reingold, Rimor and Kalay, 2005; Murphy, 2008; Molenaar *et al.,* 2012). This study will serve as a conceptual model or framework that is hoped to assist researchers in analyzing transcripts of online discussions on Facebook, particularly for evidence of engagement in metacognition by instructors who assess learners' participations and those who set up metacognitive experiences for learners.

Facebook is often conceived as a space for exchanging thoughts and opinions among learners. It may constitute a valuable tool for examining student's metacognition reflections. The comments, responds and feedback generated by the students seem appropriate for deriving metacognitive indices based on easily obtainable learner' written reflections. The outcome of this study will be of great help in identifying the types of online interactions among students in learning through social networking tools especially when metacognitive scaffolding is infused to them. Hence, it can be valuable information for researchers to transcribe the students' learning process.

The rationale of using mobile apps in this study follows a trend of today's technology (Bellman *et al.,* 2011). This study implemented the use of mobile computing or tablets, such as iPad as an educational tool in an educational setting. The preliminary investigation revealed that the majority of the student's agreed to use iPad as an educational tool and to assist them in learning (Jumaat *et al.,* 2012).

1.9 Importance of the Study

This study imposes importance to certain entities including students, instructors or lecturers, and the Ministry of Education in Malaysia (MOE).

1.9.1 Students

The findings from this study will inform students on how to perform better in learning computer-based subjects such as Authoring System through interactions and participation in online discussion in Facebook. Students will prompt different types of online interactions that represent their learning process through the discussion sessions with instructors and peers in Facebook group page.

1.9.2 Instructors or Lecturers

The framework can serve as a guideline for the instructors or lecturers to assist students based on the mechanisms of metacognitive scaffolding. At this point, the instructors can identify the different types of online interactions among students that represents their learning process occur through Facebook's discussion. It is good to monitor the students' learning process so that they will not lose hope and lose their motivation to learn. Besides that, instructors or lecturers can evaluate the students' understanding of learning an Authoring System subject throughout the discussion process.

1.9.3 Ministry of Education (MOE)

The Ministry of Education (MOE) is able to identify the mechanisms of metacognitive scaffolding that help students to perform better in class. A proper framework provides an initiative for MOE to implement metacognitive scaffolding in the learning of computer-based subjects through social networking tools such as the Facebook. On the other hand, Facebook will be recognized as a potential platform for students to discuss their class lessons and other classroom activities.

1.10 Scope of the Study

This study features some scopes in which the readers will receive a clear cut about the capacity involved in this study. They include:

i. Sample Size

The respondents were limited to the postgraduate students who have enrolled in the Educational Technology Program in one university faculty in the southern region of Peninsular Malaysia.

ii. Subject Matter

The study only focused on the learning of one of the computer-based subjects offered by the Faculty that is Authoring System, and it has particularly narrowed down to the learning of the Adobe Flash software.

iii. Demographic Variables

In this study, the researcher restricted the indicators in demographic variables by only reporting the respondents' gender, age and educational background.

iv. General Metacognition Questionnaire (GMQ)

Although General Metacognition Questionnaire (GMQ) was designed and developed to assess students' metacognitive abilities in learning, the indicators may seem insufficient to cover all areas that measure metacognition criteria among students. In particular, they only measure students' metacognitive knowledge, metacognitive judgments and monitoring, and metacognitive self-regulation and planning.

v. Performance Level

The assessment of performance among students in learning the subject was conducted only through a pre-test and post-test, and the students' learning process can only be accessed through their participation and interactivity in the Facebook discussions.

1.11 Operational Definitions

There are several key terms that have been repeatedly used in this study. Below are the key terms and their definitions:

i. Scaffolding

In education, scaffolding means providing students with sufficient support to promotes learning when concepts or skills are first being introduced to them. Scaffolding in the teaching context is everything that a teacher does to assist the pupils in achieving higher-level thinking than what the learners would if they were working alone. Through scaffolding, teachers or instructors should first create a process and provide support, which finally enable the learners to solve problems, carry out the given tasks, or achieve goals that are beyond their efforts.

Scaffolding is a term associated with Vygotsky's (1978) in the notion of the Zone of Proximal Development (ZPD). In essence, the ZPD is the difference between what a child can accomplish alone and what he or she can accomplish with the assistance from teachers or knowledgeable others. In this study, scaffolding refers to instructors' support to assist students in learning a computer-based subject.

ii. Metacognition

Metacognition is often defined as "thinking about thinking". The concept of metacognition is usually associated with John Flavell (1976). He described that "*metacognition refers to one's knowledge concerning one's own cognitive processes or anything related to them, e.g., the learning-relevant properties of information or data. For example, I am engaging in metacognition if I notice that I am having more*

trouble learning A than B; if it strikes me that I should double check C before accepting it as fact".

The definition emphasizes a role of metacognition of a learner's cognitive process that finally can be reflected on his/her knowledge and understanding. In this study, the students' metacognition in learning was developed through the guidance they received from the instructors' scaffolding.

iii. Metacognitive Scaffolding

According to Way and Rowe (2008), metacognitive scaffolding is a strategy that assists learners to reflect on what they have learned (self-assess), or to reflect on how they are learning (awareness of processes). It may be in the form of a simple prompt to think about the goal or problem, or it may be a more sophisticated guidance for organizing or assessing knowledge. In order to create metacognition, teachers or instructors need to expand their position by taking on a guiding, questioning role which involves informing students about learning, for example, "what they are doing?" and "how they are going to do it?"

Successful metacognitive scaffolding is produced when teachers or instructors are prompting, modeling questions, demonstrating strategies, discussing about learning, helping students to reflect on what they have accomplished, and organizing students' self-evaluation. In this study, the instructors initiated the discussion with metacognitive support indices developed by Reingold, Rimor and Kalay (2008) in order to evaluate the mechanisms of metacognitive scaffolding in learning a computer-based subject.

iv. Metacognitive Abilities

Generally, metacognition is defined as thinking about thinking (Coutinho, 2007). Metacognition also refers to one's ability to control their cognitive (thinking) processes. These include one's ability in metacognitive knowledge, metacognitive judgments and self-regulation. Students with high metacognitive abilities are the ones who have control over their own knowledge in their learning processes and learning activities. For example, students who are able to identify their own way to succeed in learning, providing strategies and reflect upon their thinking process are the ones who have high metacognitive abilities. In this study, students' metacognitive abilities were evaluated following the distribution of the General Metacognition Questionnaire (GMQ) that covers students' metacognitive knowledge, metacognitive judgment and monitoring, and self-regulation and control.

v. Social Networking Tool

Walsh (2011) defined social networking tool as an application that has "social aspect" in it. It requires the users to be part of it in order to use these tools to communicate and interact with others. Facebook is one of social networking tools that attract researchers to study on its usage in teaching and learning.

Ozkan and McKenzie (2008) reported that the existence of social networking tools and their popularity have made them compelling applications especially in higher education. They added that the social networking tools may be used in educational setting by offering a network in which communications and interactions affect the way people know and learn things. In this study, the researcher used Facebook as a platform for the communications and interactions between the instructors and peers.

vi. Authoring System Subject

Authoring System is one of a computer-based subject that exposes students to the creation and development of multimedia applications. This subject teaches the students the functions and tools in the Adobe Flash software that enables the students to develop multimedia applications at the end of their study.

vii. Project-Based Learning

Project-based learning is an instructional approach by which students are required to accomplish authentic task in authentic learning activities (Kwok and Tan, 2004). It is a combination of understanding a concept and application of skills. Students work on their own, organize strategies, and investigate possible solutions and decide potential ways to complete the task (Kwok and Tan, 2004). From this experience, the students are able to generate their own thinking skills and make them realize several ways of solving a problem.

The project-based learning in this study was incorporated into the design and development of mobile apps that acted as the educational tool that reflected tasks based on the project. This study follows the criteria of the project-based learning approach as proposed by Larmer (2012). This is further explained in Chapter Two of this thesis.

viii. Mobile Applications

Mobile application or apps consist of iPad apps and Android-based apps. Mobile apps are software applications that are developed for iPad and other mobile tablets. They are generally known as apps. Apps vary in categories including games, e-books, education, news, music, entertainment, etc. These apps are available for

download by users through purchase or download for free via the App Store or Google Play. The software applications run on iOS and Android-based devices. iOS is Apple's mobile operating system. Again, these four mobile apps of learning Adobe Flash were developed by the researcher; the apps acted as the educational tools that were used throughout this study. In this study, however, the apps were installed for free by the researcher instead of being purchased by the students purchasing via the Apps Store or Google Play.

ix. Online Interactions

Moore (1989) pioneered in defining interaction within the context of distance education. He classified interactions in distance education into three types: learner-content, learner-instructor and learner-learner. Wagner (1994) defined interactions as common shared events that occur between at least two entities and two actions. Hillman, Willis, and Gunawardena (1994) indicated that the interactions must exist via a medium in a technology-rich environment. They added the fourth type of interaction: learner-interface interaction. Sutton (2001) then added the fifth type of online interaction named as "vicarious interactions" in which students actively engage in interactions apart from observing the interactions between other students or those with their instructors.

In this study, the researcher looked upon the types of online interactions that occurred during the discussion sessions based on MacKinnon's (2000) coding techniques on types of online interactions. Moreover, MacKinnon (2000) has focused only on students' participation and interactivity in an online discussion session.

1.12 Summary

There is a growing body of research on students' scaffolding in order to assist them in performing well it their studies. However, metacognitive scaffolding seems to be the appropriate way to assist students in learning computer-based subject like Authoring System since the technique offers a comprehensive strategy of guiding students to think technically during the learning process. Interactions among peers and instructors allow the researcher to look upon the types of interactions among students as such an interaction will represent the students' learning processes. Studies on these two factors were explored to produce the appropriate metacognitive scaffolding framework and to support the research. Chapter Two will discuss the theories and the findings of previous studies that relate to this research.

REFERENCES

Abd Rahman, N. A., & Tasir, Z. (2010). *Metacognitive Scaffolding Through Facebook In Authoring System Subject*. Unpublished master thesis. UTM, Skudai.

Adams, W.K., Reid, S., LeMaster, R., McKagan, S.B., Perkins, K.K., Dubson, M. and Wieman, C.E. (2008). A Study of Educational Simulations Part I - Engagement and Learning. *Journal of Interactive Learning Research, 19*(3), 397-419. Chesapeake, VA: AACE.

Anderson, M. D. (2001). Individual characteristics and web-based courses. In C. R. Wolfe (Ed.). *Learning and teaching on the World Wide Web*. (pp. 47- 68). San Diego: Academic Press.

Anderson, N. J. (2002). The role of metacognition in second/foreign language teaching and learning. *ERIC Digest. Washington DC: ERIC Clearinghouse on Languages and Linguistics.* Retrieved from www.cal.org/ericcll/digest/0110anderson.html

Anderson, T. and Garrison, D. R. (1998). Learning in a networked world: New roles and responsibilities. In C. Gibson (Ed.), *Distance learners in higher education* (pp. 7-112). Madison, WI: Atwood Publishing.

Anderson, P. (2007).*What is Web 2.0?Ideas,technologies and implications for education. JISC reports.* Retrieved from http://www.jisc.ac.uk/media/documents/techwatch/tsw0701b.pdf

Ariffin, S. R. and Mohamad, S. (1996). Pemikiran guru cemerlang: kesan terhadap prestasi pengajaran. Kertas kerja seminar isu-isu pendidikan Negara. Fakulti pendidikan, Universiti Kebangsaan Malaysia, Bangi, 26-27 November.

Artino, A. (2009). Think, feel, act: Motivational and emotional influences on military students' online academic success. *Journal of Computing in Higher Education, 21*(2), 146-166.

Azevedo, R. and Hadwin, A. F. (2005). Scaffolding Self-Regulated Learning and Metacognition – Implications for the Design of Computer-based Scaffolds. *Instructional Science, 33*(5), 367-379.

Azevedo, R., Cromley, J. G.,Winters, F. I., Moos, D. C. and Greene, J. A. (2005). Adaptive human scaffolding facilitates adolescents' self-regulated learning with hypermedia. *Instructional Science, 33,* 381-412.

Azevedo, R., Moos, D. C., Greene, J. A., Winters, F. I. and Cromley, J. G. (2008). Why is externally-facilitated regulated learning more effective than self-regulated learning with hypermedia? *Educational Technology Research and Development, 56*(1), 45–72.

Balaji, M. S., and Chakrabarti, D. (2010). Student Interactions in Online Discussion Forum: Empirical Research from 'Media Richness Theory' Perspective. *Journal of Interactive Online Learning, 9* (1), 1–22.

Bandura, A. (1971). *Social learning theory*. New York : General Learning Press.

Bannert, M., Hildebrand M., and Mengelkamp, C. (2009). Effects of a metacognitive support device in learning environments. *Computers in Human Behavior, 25,* 829–835.

Barbour, M., and Collins, M. (2003). Online writing as a form of electronic communication in a second year biology Course: Media and technology for human resource development: *Journal of Educational Technology*, *14* (1-2), 33-42.

Barg, M., Fekete, A.,Greening, T., Hollands, O., Kay, J., and Kingston, J. H. (2000). Problem-Based Learning for Foundation Computer Science Courses. *Computer Science Education. 10* (2), 109-128.

Baxter, P., and Jack, S (2008). Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. *Qualitative Report*, *13*, 544-559.

Beldarrain, Y. (2008). Integrating Interaction in Distance Learning: A Comparative Analysis of Five Design Frameworks. In C. Bonk *et al.* (Eds.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2008* (pp. 1471-1477). Chesapeake, VA: AACE.

Bellman, S., Potter, R. F., Treleaven-Hassard, S., Robinson, J. A., and Varan, D. (2011). The Effectiveness of Branded Mobile Phone Apps. *Journal of Interactive Marketing, 25,* 191-200.

Berent, F. M., and Bugbee, A. C, Jr. (1993). Study practices and attitudes related to academic success in a distance learning program. *Distance Education, 14*, 97-113.

Blattner, G., and Fiori, M. (2009). Facebook in the language classroom: Promises and possibilities. *Instructional Technology and Distance Learning (ITDL), 6*(1), 17–28.

Blocher, M. (2003).Designing, developing and implementing an online multimedia authoring course: lessons learned. In C. Crawford et al. (Eds.), *Proceedings of Society for Information Technology* and *Teacher Education International Conference (SITE) 2003* (pp. 1656-1658). Chesapeake, VA: AACE.

Bosch, T. E. (2009). Using online social networking for teaching and learning: Facebook use at the University of Cape Town. *Communicatio, 35*(2), 185-200.

Boyatzis, R. (1998). *Transforming qualitative information: Thematic analysis and code development*. Thousand Oaks, CA: Sage.

Boyd, D. M. and Ellison, N. B. (2007). Social Networking Sites: Definition, History and Scholarship. *Journal of Computer-Mediated Communication 13*(1), 210-230.

Brandtzæg, P.B and Heim, J. (2009). Why people use social networking sites. A Paper presented at Third International Conference, OCSC 2009, San Diego, CA, USA, In A.A. Ozok and P. Zaphiris (Eds.): *Online Communities, LNCS* (pp. 143–152). Springer-Verlag Berlin Heidelberg.

Brindley, J., Blaschke, L., & Walti, C. (2009). Creating effective collaborative learning groups in an online environment. *The International Review Of Research In Open And Distance Learning, 10*(3). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/675/1271

Brown, A. L. (1987). *Metacognition, Executive control, Self-regulation, and Other more mysterious mechanisms*. Hillsdale, NJ: Lawrence Erlbaum.

Brunstein, A., Betts, S., and Anderson, J. R. (2009). Practice enables successful learning under minimal guidance. *Journal of Educational Psychology*, *101*(4), 790-802.

Bullen, M. (1998). Participation and critical thinking in online university distance education, *Journal of Distance Education, 13(2),* 1 – 32.

Bunt, A., Conati, C., Huggett, M. and Muldner, K. (2001). On improving the effectiveness of open learning environments through tailored support for exploration. Paper presented at the Proceedings of AIED 2001, 10th International Conference on Artificial Intelligence in Education (pp. 365-376). San Antonio, TX.

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

Campos, M. (2004). A constructivist method for the analysis of networked cognitive communication and the assessment of collaborative learning and knowledge-building. *Journal of Asynchronous Learning Environments, 8*(2), 1–29.

Carr, A., Luckin, R., Avramides, K., and Yuill, N. (2011). Scaffolding metacognitive processes in the Ecolab: Help-seeking and achievement goal orientation. In G. Biswas (Eds.), *Artificial Intelligence in Education*, *Lecture Notes in Computer Science, 6738,* (pp.432-434). Springer Berlin Heidelberg.

ChanLin, L. (2008). Technology integration applied to project-based learning in science. *Innovations in Education and Teaching International, 45*(1), 55-65.

Chen, C. J., and Toh, S. C. (2005). A feasible constructivist instructional development model for virtual reality (VR) – based learning environments: Its efficacy in the novice car driver instruction of Malaysia. *Educational Technology Research & Development, 53* (1), 111-123.

Cheng, C. K., Paré, D. E., Collimore, L., and Joordens, S. (2011). Assessing the effectiveness of a voluntary online discussion forum on improving students' course performance. *Computers & Education, 56*, 253–261.

Chi, M.T.H, Siler, S., Jeong, H., Yamauchi, T. and Hausmann, R. (2001). Learning from human tutoring. *Cognitive Science 25,* 471-534.

Cho, M. H., and Jonassen, D. H. (2009). The development of the human interaction dimension of self-regulated learning questionnaire in asynchronous online learning environments. *Educational Psychology: An International Journal of Experimental Educational Psychology, 29* (1), 117 – 138.

Choi, I., Land, S. M., and Turgeon, A, J. (2005). Scaffolding peer-questioning strategies to facilitate metacognition during online small group discussion. *Instructional Science*, *33,* 483-511.

Clark, R. E., Kirschner, P.A., and Sweller, J. (2012). Putting students on the path to learning: The case for fully guided instruction. *American Educator*, pp. 6-11.

Clark, W., Logan, K., Luckin, R., Mee, A. and Olover, M. (2009). Beyond Web 2.0: mapping the technology landscapes of young learners. *Journal of Computer-Assisted Learning, 25,* 56-69.

Cohen, J (1988). *Statistical power analysis for the behavioral sciences.*2nd Edition. Hillsdale, NJ: Lawrence Earlbaum Associates.

Cole, M. and Cole, S. (2001). The Development of Children. 4th Ed. New York: Scientific American Books. NY: Routledge/Falmer.

Collis, B. (1998). New didactics for university instruction: why and how? *Computers & Education, 31*(4), 373 – 393.

Cook, T.D. and Campbell, D.T. (1979). *Quasi-Experimentation: Design and Analysis for Field Settings*. Rand McNally, Chicago, Illinois.

Cooper, M. M., and Sandi-Urena, Santiago. (2009). Design & Validation of an Instrument to access Metacognitive Skilfulness in Chemistry Problem Solving. *Journal of Chemical Education, 86(2),* 240-245.

Cornoldi, C. (2009). Metacognition, intelligence and academic performance. In H. S. Waters, & W. Schneider (Eds.), *Metacognition, strategy use, and instruction* (pp. 257–276). New York: The Guilford Press.

Cosenza, V. (2012, June 1). *World map of social networks*. Retrieved from http://vincos.it/world-map-of-social-networks/

Coutinho, S. (2007). The relationship between goals, metacognition, and academic success. *Educate, 7*(1), 39–47.

Craven, R.G., Marsh, H. W., Debus, R. L., and Jayasinghe, U. (2001). Diffusion effects: Control group contamination threats to validity of teacher-administered intervention. *Journal of Educational Psychology, 93* (3), 639-645.

Creswell, J. W. (2005). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (2nd Ed.). Upper Saddle River, NJ: Pearson.

Cuevas, H.M., Fiore, S. M. and Oser, R. L. (2002). Scaffolding cognitive and metacognitive processes in low verbal ability learners: use of diagrams in computer-based training environments. *Instructional Science, 30,* 433-464.

Davidson-Shivers, G. V. (2009). Frequency and types of instructor interactions in online instruction. *Journal of Interactive Online Learning, 8* (1), 23-40.

Davis, M. (2006, October 23-25). Using procedural scaffolding to support online learning experiences. Paper presented at IEEE International Professional Communication Conference. doi: 10.1109/IPCC.2006.320376

Dawson, T. L. (2008) .*Metacognition and Learning in Adulthood.* Prepared in response to tasking from ODNI/CHCO/IC Leadership Development Office Developmental Testing Service, LLC. Retrieved from https://www.devtestservice.org/PDF/Metacognition.pdf

DeSchryver, M., Mishra, P., Koehleer, M. and Francis, A. (2009). Moodle vs. Facebook: Does using Facebook for Discussions in an Online Course Enhance Perceived Social Presence and Student Interaction?. In I. Gibson et al. (Eds.), Proceedings of Society for Information Technology & Teacher Education International Conference 2009 (pp. 329-336). Chesapeake, VA: AACE.

De Vos A. S., Strydom, H., Fouche, C. B., and Delport, C. S. L. (2002). *Research at grass roots: For the social sciences and human service professions*.2nd ed. Pretoria: Van Schaik Publishers.

Dekker, H., Schönrock-Adema, J., Snoek, J. W., van, d. M., and Cohen-Schotanus, J. (2013). Which characteristics of written feedback are perceived as stimulating students' reflective competence: An exploratory study. *BMC Medical Education*, *13*, 94.

Dennen, V. P., & Burner, K. J. (2008). The cognitive apprenticeship model in educational practice. In J. M. Spector, M. D. Merrill, J. Van Merrienboer, & M. P. Driscoll (Eds.), *Handbook of educational communications and technology* (pp. 425-439). Mahwah, NJ: Erlbaum.

Devolder, A., Braak, J. V., and Tondeur, J. (2012). Supporting self-regulated learning in computer-based learning environments: systematic review of effects of scaffolding in the domain of science education. *Journal of Computer Assisted Learning, 1,* 1-17.

Dewey, J. (1916). *Democracy and Education. An introduction to the philosophy of education* (1966 ed.), New York: Free Press.

Dexter, S. L., Anderson, R. E., and Becker, H. J. (1999). Teachers' views of computers as catalysts for changes in their teaching practice. *Journal of Research on Computing in Education, 31* (3), 221-239.

Dick, W and Carey, L. M (1996). *The systematic design of instruction*. Addison-Wesley Pub, New York.

DiVall, M., and Kirwin, J. L. (2012). Using Facebook to facilitate course-related discussion between students and faculty members. *American Journal of Pharmaceutical Education, 76* (2), 1 -5.

Dogruer, N., Menevis, I., and Eyyam, R. (2011). What is the motivation for using Facebook? *Procedia-Social and Behavioral Sciences, 15*, 2642-2646.

Edelson, D. C., Gordin, D. N., and Pea, R. D. (1999). Addressing the challenges of inquiry-based learning through technology and curriculum design. *Journal of the Learning Sciences, 8*(3/4), 391-450.

Efklides, A. (2006). Metacognition and affect: What can metacognitive experiences tell us about the learning process? *Educational Research Review, 1,* 3-14.

Ellison, N. B., Steinfield, C., and Lampe, C. (2007). The benefits of Facebook "friends": Social capital and college students' use of online social network sites. *Journal of Computer-Mediated Communication, 12*(4), 1143-1168.

Eskrootchi, R., and Oskrochi, G. R. (2010). A study of the efficacy of project-based learning integrated with computer-based simulation – Stella. *Educational Technology & Society, 13*(1), 236-245.

Faessler, L., Hinterberger, H., Dahinden, M. and Wyss, M. (2006). Evaluating student motivation in constructivistic, problem-based introductory computer science courses. In T. Reeves and S. Yamashita (Eds.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare & Higher Education 2006.* (pp. 1178-1185). Chesapeake, VA: AACE.

Fahy, P. J. (2002). Epistolary and expository interaction patterns in a computer conference transcript. *Instructional Science, 34* (5), 367-397.

Farahani, G. O. (2003). *Existence and importance of online interaction*. Unpublished doctoral dissertation. Virginia Polythechnic Institute and State University, USA.

Farreira, D. J., and Lacerda Dos Santos, G. (2009). Scaffolding online discourse in collaborative ill-structured problem-solving for innovation. *Informatics in Education, 8* (2), 173 – 190.

Fahy, P., Crawford, G., and Ally, M. (2001). Patterns of interaction in a computer conference transcript. *International Review of Research in Open and Distance Learning, 2*(1), 1–24.

Faul, F., Erdfelder, E., Lang, Albert-Georg and Buchner, A. (2007).G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39* (2), 175-191.

Field, A. (2009). *Discovering Statistics using SPSS* (3rd Ed.). London: Sage.

Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), *The nature of intelligence*, (pp. 231-235). Hillsdale, NJ: Erlbaum.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive developmental inquiry. *American Psychologist, 34,* 906-911.

Fouché, J. and Lamport, M. A. (2011). Do metacognitive strategies improve student achievement in secondary science classrooms?, *Christian Perspectives in Education*, *4*(2), 1-25.

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

Garrison, D. R., Anderson, T., and Archer, W. (2001). Critical thinking, cognitive presence, and computer conferencing in distance education. *The American Journal of Distance Education*, *15*, 7-23.

Gay, L. R., Mills, G. E., and Airasian, P. W. (2009). *Educational Research: Competencies for Analysis and Applications,* Merrill: Pearson.

Ge, X., and Land, S. M. (2003). Scaffolding students' problem-solving processes in an ill-structured task using question prompts and peer interactions. *Educational Technology Research and Development, 51* (1), 21-38.

George, D., and Mallery, P. (2003). SPSS for windows step by step: A sample guide and reference. reference. Boston: Allyn & Bacon.

Golder, S. A., Wilkinson, D., and Huberman, B. A. (2007). Rhythms of social interaction: Messaging within a massive online network. In C.Steinfield, B. Pentland, M. Ackerman, and N. Contractor (Eds.), *Proceedings of Third International Conference on Communities and Technologies.* (pp. 41–66). London: Springer.

Graesser, A. C., McNamara, D. S., and VanLehn, K. (2005). Scaffolding deep comprehension strategies through point & query, autotutor and istart. *Educational Psychologist, 40*(4), 225-234.

Graesser, A., Wiemer-Hastings, K., Wiemer-Hastings, P., Kruez, R. (2000). The Tutoring Research Group AutoTutor: A simulation of a human tutor. *Journal of Cognitive Systems Research. 1*, 35–51.

Gray, K., Annabel, L., and Kennedy, G. (2010). Medical students' use of Facebook to support learning: Insights from four case studies. *Medical Teacher, 32,* 971-976.

Grosseck, G., Bran, R., and Tiru, L. (2011). Dear teacher, what should I write on my wall? A case study on academic uses of Facebook. *Procedia of Social and Behavioral Sciences, 15,* 1425-1430.

Gunawardena, C, N., Hermans, M.B., Sanchez,D., Richmond,C., Bohley, M., and Tuttle, R. (2009). A theoretical framework for building online communities of practice with social net-working tools. *Educational Media International*, *46*(1), 3–16.

Gunawardena, L., Lowe, C., and Anderson, T. (1997). Interaction analysis of a global online debate and the development of a constructivist interaction analysis model for computer conferencing. *Journal of Educational Computing Research, 17*(4), 397- 431.

Gunter, M. A., Estes, T. H., and Schwab, J. (2002). *Instruction: A models approach* (4th ed). Boston: Allyn & Bacon.

Hacker, D. J., Dunlosky, J., and Graesser, A.C. (1998). *Metacognition in educational theory and practice*. Hillsdale. NJ: Lawrence Erlbaum Associates, Inc.

Hannafin, M. J. (1999). *Learning in open-ended environments: Tools and technologies for the next millennium*. Paper presented at the annual meeting of the Association for Educational Communications and Technology, Houstan, TX. Retrieved from http://itech1.coe.uga.edu/itforum/paper34/paper34.html

Hannafin, M., Land, S. and Oliver, K. (1999). Open learning environments: Foundations, methods and models. In C.M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory, 2,* (pp. 115-140). Mahwah, NJ: Lawrence Erlbaum Associates.

Hara, N., and Kling, R. (1999). Students' frustrations with a web-based distance education course. *First Monday, 4*(12). Retrieved from http://www.firstmonday.dk/issues/issue4_12/index.html

Hara, N., Bonk, C. J., and Angeli, C. (2000). Content analysis of online discussion in an applied educational psychology course. *Instructional Science*, *28,* 115-152.

Harasim,L., Hiltz. S.R., Teles, S. and Turoff, M. (1997*). Learning networks: A field guide to tecahing and learning online*. Cambridge, Massachusetts: MIT Press.

Hardjito, D. (2010). The use of scaffolding approach to enhance students' engagement in learning structural analysis. *International Education Studies, 3*(1), 130-135.

Harrington, T. W., Jr. (1991). *Preaching as teaching in light of albert bandura's social cognitive learning theory.* The Southern Baptist Theological Seminary. Retrieved from *ProQuest Dissertations and Theses.*

Hartman, H. (2002). Scaffolding & Cooperative Learning. *Human Learning and Instruction* (pp. 23-69). New York: City College of City University of New York.

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

Herbert, B. E. *(2003, November).* The role of scaffolding student metacognition in developing mental models of complex, Earth and environmental systems. *In DFG-NSF International Workshops on Research and Development in Mathematics and Science Education,* (pp. 19-21). Washington, DC.

Herrington, J., and Kervin, L. (2007). Authentic learning supported by technology: Ten suggestions and cases of integration in classrooms. *Educational Media International, 44*(3), 219–236.

Hertzog, C., and Dunlosky, J. (2011). Metacognition in later adulthood: Spared monitoring can benefit older adults' self-regulation. *Current Directions in Psychological Science, 20,* 167-173.

Hew, K. F. (2011). Students' and teachers' use of Facebook. *Computers in Human Behavior, 27,* 662-676.

Hietala, P., Koivunen, K., and Ropo, E. (2004). Analysis of student decision-making in online collaboration. *Journal of Information Technology Impact*, *4*(2), 99 – 120.

Hill, J. R., and Hannafin, M. J. (2001). Teaching and learning in digital environments : the resurgence of resource-based learning, *Educational Technology Research and Development*, *49*(3), 37-52.

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

Hipp, J., Guntzer, U. and Nakhaeizadeh, G. (2000). Algorithms for association rule mining - a general survey and comparison. *SIGKDD Explorations Newsletter, 2* (1), 58-64. doi:acm.org/10.1145/360402.360421.

Hirumi, A. (2002). The Design and Sequencing of e-Learning Interaction: A Grounded Approach. *International Journal on e-Learning.* 19-27.

Hmelo-Silver, C. E., Duncan, R. G., and Chinn, C. A. (2007). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Kirschner, Sweller, and Clark (2006). *Educational Psychologist*, *42* (2), 99–107.

Ho, S. (2002). Encouraging online participation?. *Proceedings of the 11th Annual Teaching and Learning Forum 2002,* Perth, Australia. http://www.ecu.edu.au/conferences/tlf/2002/pub/docs/Ho.pdf

Holmes, B. D., Birds, K., Seay, A. D., Smith, D. B., and Wilson, K. N. (2010). Cohort learning for graduate students at the dissertation stage. *Journal of College Teaching and Learning, 7*(1), 5-11.

Hu, P.-Y. (2007). Book review: Interactions in online education (Charles Juwah). *Educational Technology & Society*, *10* (2), 228-229.

Huang, H., Wu, C., and Chen, N. (2012). The effectiveness of using procedural scaffolding in a paper-plus-smartphone collaborative learning context. *Computers & Education, 59*(2), 250-259.

Huitt, W. (2011). Bloom *et al.*'s taxonomy of the cognitive domain. *Educational Psychology Interactive*. Valdosta, GA: Valdosta State University. Retrieved from http://www.edpsycinteractive.org/topics/cognition/bloom.html

Im, Y. and Lee, O. (2003). Pedagogical implications of online discussion for pre-service teacher training. *Journal of Research of Technology in Education, 36* (2), 155-170.

Irwin, C., Ball, L., Desbrow, B., and Leveritt, M. (2012). Students' perceptions of using Facebook as an interactive learning resource at university. *Australasian Journal of Educational Technology, 28*(7), 1221-1232.

Isman, A. (2011). Instructional design in education: new model. *The Turkish Online Journal of Educational Technology* , *10* (1), 136-142.

James, I., and Okpala, C. O. (2010). The use of metacognitive scaffolding to improve college students' academic success. *Journal of College Teaching & Learning, 7*(11), 47-50.

Jbeili, I. (2012). The effect of cooperative learning with metacognitive scaffolding on mathematics conceptual understanding and procedural fluency. *International Journal for Research in Education, 32*, 45-71.

Jeong, A. C. (2003). The sequential analysis of group interaction and critical thinking in online threaded discussions. *The American Journal of Distance Education, 17*(1), 25–43.

Jones, A., and Issroff, K. (2005). Learning technologies: Affective and social issues in computer-supported collaborative learning. *Computers & Education*, *44,* 395–408.

Joyce, K. M., and Brown, A. (2009). Enhancing social presence in online learning: mediation strategies applied to social networking tools. *Online Journal of Distance Learning Administration, 12*(4).

Jumaat, N. F, Tasir, Z., Harun J., and Lee, Y. Y. (2012). Learning Computer-based Subject through Apps among Adult Learners: A Small Scale Study. *Energy Education Science and Technology Part B: Social and Educational Studies*, *5*(3): 1537-1550.

Jumaat, N. F., Tasir, Z (2014, April 11-13). *Instructional scaffolding in online learning environment: A Meta-analysis*. Paper presented at the IEEE International Conference on Teaching and Learning in Computing and Engineering (LaTiCE). doi: 10.1109/LaTiCE.2014.22

Junco, R. (2012a). The relationship between frequency of Facebook use, participation in Facebook activities, and student engagement. *Computers & Education, 58,* 162-171.

Junco, R. (2012b). Too much face and not enough books: The relationship between multiple indices of Facebook use and academic performance. *Computers in Human Behavior, 28,* 187-198.

Kabilan, M.K., Ahmad, N. and Abidin, M.J.Z. (2010). Facebook: An online environment for learning of English in institutions of higher education? *Internet and Higher Education, 13*, 179-187

Kalyuga, S., Ayres, P., Chandler, P., and Sweller, J. (2003). The Expertise Reversal Effect. *Educational Psychologist, 38*(1), 23–31.

Kanuka, H., and Anderson, T. (1998). On-line social interchange, discord, and knowledge construction. *Journal of Distance Education, 13* (1), 57-74.

Kaplan, A.M. and Haenlein, M. (2010) Users of the world, unite! The challenges and opportunities of social media. *Business Horizons*, *53*(1), 59–68.

Kazlauskas, A. and Applebee, A. (2007). ICT supported scaffolding of generic skills acquisition by first year students: A collaborative approach. Poster presented at Proceedings Ascilite. Singapore. Retrieved from http://www.ascilite.org.au/conferences/singapore07/procs/kazlauskas-poster.pdf

Kim, M. C., and Hannafin, M. J. (2011). Scaffolding problem solving in technology-enhanced learning environments (TELEs): bridging research and theory with practice. *Computers & Education, 56* (2), 403–417.

King, A. (1998). Transactive peer tutoring: distributing cognition and metacognition, *Educational Psychology Review*, *10* (1), 57-74.

King, A. (1999). Discourse patterns for mediating peer learning. In: O'Donnell, A., King, A. (Eds), *Cognitive Perspectives on Peer Learning*. London, Lawrence Erlbaum, pp. 87–152.

Kirschner, P. A., and Karpinski, A. C. (2010). Facebook and academic performance. *Computers in Human Behavior, 26,* 1237-1245.

Kirschner, P. A., Sweller, J., and Clark, R.E. (2006). Why minimal guidance during instruction does not work: an analysis of the failure of constructivist, discovery, problem-based, experiential an inquiry-based teaching. *Educational Psychologist, 41*(2), 75-86.

Klahr, D., and Nigam, M. (2004). The equivalence of learning paths in early science instruction: Effects of direct instruction and discovery learning. *Psychological Science, 15*, 661–667.

Krajcik, J., Blumenfeld, P. C., Marx, R. W., Bass, K. M., Fredricks, J., and Soloway, E. (1998). Inquiry in project-based science classrooms: initial attempts by middle school students. *The Journal of the Learning Sciences, 7,* 313-350.

Krejcie, R. V., and Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30,* 607-610.

Kujath, C. L. (2010). Facebook and Myspace: complement or substitute for face-to-face interaction?. *Cyberpsychology, Behavior, and Social Networking, 14*(1-2), 75-78.

Kvale, S. (2007). *Doing interviews.* Thousand Oaks, CA: Sage.

Kwok, P. L. Y., & Tan, C. Y. G. (2004, May). Scaffolding supports in project-based learning through Knowledge Community (KC): Collaborative learning strategies and pedagogical facilitation. Paper presented at the 8th Global Chinese Conference on Computers in Education, The Chinese University of Hong Kong, China. Retrieved from http://repository.ied.edu.hk/dspace/handle/2260.2/4715

Lai, C. H., Yang, J. C., and Liang, J. S. (2006). Situated Learning in Class Using Pocket PCs via a Mobile Learning System. *In Proceedings of 2006 International Workshop on International Workshop on Human-Computer Interaction and Learning Technologies (In conjunction with International Computer Symposium--ICS 2006)*. Taipei, Taiwan.

Landis, J. R., and Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33,* 159 – 174.

Larmer, J. (2012, June 5). *PBL: What Does It Take for a Project to Be "Authentic"?* Retrieved from http://www.edutopia.org/blog/authentic-project-based-learning-john-larmer

LaRue, E. M. (2012). Using Facebook as course management software: a case study. *Teaching and Learning in Nursing, 7,* 17-22.

Laurillard, D. (2002, January 1). *Rethinking Teaching for the Knowledge Society*. *EDUCAUSE Review*. Retrieved from http://www.educause.edu/ero/article/rethinking-teaching-knowledge-society

Lebow, D., and Wagner, W. (1994). Authentic activity as a model for appropriate learning activity: Implications for emerging instructional technologies. *Canadian Journal of Educational Communication, 23*(3), 231-244.

Lee, J.-M. (2006), Different types of human interaction in online discussion: An examination of using online discussion forum. *Proceedings of the American Society for* Information Science *and* Technology*, 43*(1), 1–11. doi: 10.1002/meet.14504301232

Leech, N. L., Barrett, K. C., and Morgan, G. A. (2011). *SPSS for intermediate statistics: Use and interpretation* (4th ed.). New York, NY: Routledge/Taylor & Francis

Lempe, C., Ellison, N., and Steinfield, C. (2006). A face(book) in the crowd: Social searching vs. social browsing. *Proceedings of the 20th Anniversary*

Conference on Computer Supported Cooperative Work. Banff, Alberta, Canada.

Linder, S. P, Abbott, D., and Fromberger, M. (2006). An instructional scaffolding approach to teaching software design. *Journal of Computing in Small Colleges, 21*(6), 238-250

Linton, J. (2013, July 9). *Increasing interaction in online learning environments*. Retrieved from http://www.fractuslearning.com/2013/07/09/online-learning-environments/

Liu, C., and Tsai, C. (2008). An analysis of peer interaction patterns as discoursed by on-line small group problem-solving activity, *Computers & Education, 50,* 627 – 639.

Livingston, J. A. (1997). *Metacognition: an overview*. Retrieved from http://www.gse.buffalo.edu/fas/shuell/cep564/Metacog.htm

Lucas, M. and Moreira, A. (2009). Bridging formal and informal learning: a case study on student's perception on the use of social networking tool. *Proceedings of the 4th European Conference on Technology Enhanced Learning (EC-TEL 2009).* 29 September – 2 October. Berlin Springer-Verlag. 325-337.

Luckin, R., and Hammerton, L. (2002). Getting to know me: helping learners understand their ownlearning needs through metacognitive scaffolding. In Cerri, S. A., Gouarderes, G., Paraguaco, F. (Eds.) 6th International Conference on Intelligent Tutoring Systems (pp. 759-771). Springer, Heidelberg.

Ludwig-Hartman, S. and Dunlap, J. C. (2003). Learner support services for online students: Scaffolding for success. *The International Review of Research in Open and Distance Learning 4*(1). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/131/211

Luetkehans, L. and Prammanee, N. (2002). Understanding Participation in Online Courses: A Triangulated Study of Perceptions of Interaction. In P. Barker & S. Rebelsky (Eds.), *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications* (pp. 1596-1597). 24 – 29 June. Lugano: Switzerland.

MacKinnon, G. R. (2000). The dilemma of evaluating electronic discussion groups. *Journal of Research on Computing in Education, 33*(2), 125 – 132.

Mango, C. (2010). The role of metacognitive skills in developing critical thinking. *Metacognition Learning, 5,* 137-156.

Manlove, S., Lazonder, A.W., and de Jong, T. (2006). Regulative support for collaborative scientific inquiry learning, *Journal of Computer Assisted Learning, 22*(2), 87–98.

Markett, C., Arnedillo Sanchez, I., Weber, S., and Tangney, B. (2006). Using short message service to encourage interactivity in the classroom. *Computers & Education, 46,* 280 – 293.

Martin, F. (2011). Instructional design and the importance of instructional alignment. *Community College Journal of Research and Practice, 35* (12), 955-972.

Mateycik, F., Jonassen D. H., and Rebello N. S. (2009, April 17-21). Facilitating case based reasoning in physics problem solving. Paper presented at National Association for Research in Science Teaching Annual Meeting 2009. Retrieved from https://web.phys.ksu.edu/papers/2009/mateycik-narst-symp.pdf

Mavrou, K., Lewis, A., and Douglas, G. (2010). Researching computer-based collaborative learning in inclusive classrooms in Cyprus: The role of the computer in pupils' interaction. *British Journal of Educational Technology, 41*(3), 486-501.

Mayer, J. D. (2004). Should there be a three-strikes rule against pure discover learning. *American Psychologist, 59* (1), 14-19.

Mazman, S. G., and Usluel, Y. K. (2010). Modelling educational usage of Facebook. *Computers & Education, 55,* 444-453.

Mazzolini, M., and Maddison, S. (2007). When to jump in: The role of the instructor in online discussion forums. *Computers & Education, 49*, 193–213.

Mc Mahon, M., and Oliver, R. (2003). Teaching metacognitive regulation of reading comprehension in an on-line environment. In D. Lassner & C. McNaught (Eds.), *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2003* (pp. 2464-2471). Chesapeake, VA: AACE.

McKenzie, W. and Murphy, D. (2000). I hope this goes somewhere: Evaluation of an online discussion group. *Australian Journal of Educational Technology, 16*(3), 239-257.

McLachlan, C., Craig, A. and Coldwell, J. (2010). Student perceptions of ICT: a gendered analysis. *Proceeding of 12th Australasian Computing Education Conference* (pp. 127 – 136). Brisbane, Australia.

McLeod, S. (2010). *Simply Psychology*. Retrieved from http://www.simplypsychology.org/Zone-of-Proximal-Development.html

McLoughlin, C. and Marshall, L. (2000, February 2-4). Scaffolding: A model for learner support in an online teaching environment. In A. Herrmann and M.M. Kulski (Eds.), Flexible Futures in Tertiary Teaching. Paper presented at the 9th Annual Teaching Learning Forum, Perth: Curtin University of Technology.

McLoughlin, C. (2004, February 9-10). Achieving excellence in teaching through scaffolding learner competence in Seeking Educational Excellence. Paper presented at the 13th Annual Teaching Learning Forum. Perth: Murdoch University.

Meyer, K. (2002). Quality in distance education: Focus on online learning. *ASHE-ERIC Higher Education Report, 29(4),* 1 – 7, San Francisco: Jossey-Bass.

Miao, Y., Weinbrenner, S., Engler, J., Giemza, A., and Hoppe, H. U. (2011). A flexible approach to metacognitive scaffolding in computer mediated inquiry learning. In T. Hirashima et al. (Eds.) Paper presented at the 19th International Conference on Computers in Education. Chiang Mai, Thailand: Asia-Pacific Society for Computers in Education.

Minocha, S., Schroeder, A., and Schneider, C. (2010). Role of the educator in social software initiatives in further and higher education: A conceptualization and research agenda. *British Journal of Educational Technology, 42*(6)*,* 889–903.

Mohd Razali, N., and Wah, Y. B. (2011). Power comparisons of Shapiro–Wilk, Kolmogorov–Smirnov, Lilliefors and Anderson–Darling tests. *Journal of Statistical Modeling and Analytics, 2*(1), 21–33.

Molenaar, I., Roda, C., van Boxtel, C., and Sleegers, P. (2012). Dynamic scaffolding of socially regulated learning in a computer-based learning environment. *Computers & Education, 59*, 515–523.

Molenaar, I., van Boxtel, C. A. M., and Sleegers, P. J. C. (2011). Metacognitive scaffolding in an innovative learning arrangement, *Instructional Science, 39,* 785 – 803.

Moore, K.. and McElroy, J. C. (2012). The influence of personality on Facebook usage, wall postings, and regret. *Computers in Human Behavior, 28,* 267-274.

Moore, M. G. (1989). Three types of interaction. *The American Journal of Distance Education, 3*(2), 1-6.

Moore, M. G., and Kearsley, G. (1996). Distance education: A systems view. Boston, MA: Wadsworth Publishing.

Morrison, G. R., Ross, S. M., and Kemp, J. E. (2004). Designing effective instruction(4th ed.). Hoboken, NJ: John Wiley & Sons, Inc.

Mortera-Gutierrez, F. and Murphy, K. (2000). *Instructor interactions in distance education environments: A case study*. Concurrent session presented at the annual distance education conference sponsored by the Texas A&M Center for Distance Education, Austin, TX.

Moursund, D. (2009). *Project-based learning using information technology*. International Society for Technology in Education: Eugene, OR.

Muirhead, B., and Juwah, C. (2004). Interactivity in computer-mediated college and university education: A recent review of the literature. *Educational Technology & Society*, *7* (1), 12-20.

Mullin, M. (2012, February 5). Metacognition helps build self-regulation and executive functioning skills. Retrieved from http://bitsofwisdomforall.com/2012/02/05/metacognition-helps-build-self-regulation-and-executive-functioning-skills/

Muniandy, B., Mohamad, R., Fook, F. S., and Idrus, R. M. (2009). Technology application in project-based learning. *Journal of Communication and Computer, 6* (12), 78-84.

Munoz, C., and Towner, T. (2009). Opening facebook: How to use facebook in the college classroom. In I. Gibson et al. (Eds.), *Proceedings of society for information technology & teacher education international conference 2009* (pp. 2623–2627). Chesapeake, VA: AACE.

Murphy, E. (2008). A framework for identifying and promoting metacognitive knowledge and control in online discussants. *Canadian Journal of Learning Technology*, *34*(2). Retrieved from http://www.cjlt.ca/index.php/cjlt/article/view/491/222

Murray, T and Arroyo, I (2002, June 2-7). Toward measuring and maintaining the zone of proximal development in adaptive instructional systems. *Proceedings*

of 6th International Conference ITS 2002, *Intelligent Tutoring Systems* (pp. 749–758). Biarritz, France and San Sebastian, Spain.

Nagel, L., and Kotze, T. (2010). Supersizing e-learning: What a CoI survey reveals about teaching presence in a large online class. *The Internet and Higher Education, 13*(1–2), 45–51.

Neo, M., and Neo, T. (2010). Students' perceptions in developing a multimedia project within a constructivist learning environment: A Malaysian experience. *The Turkish Journal of Educational Technology, 9*(1), 176-184.

Nett, U. E., Goetz, T., Hall, N. C., and Frenzel, A. C. (2012). Metacognitive strategies and test performance: an experience sampling analysis of students' learning behavior, *Education Research International*, *2012.* http://dx.doi.org/10.1155/2012/958319

Nilson, H. (2009). Influence on student academic behaviour through motivation, self efficacy and value-expectation: An action research project to improve learning, *Issues in informing Science and Information Technology, 6,* 545-556.

Northrup, P. T. (2001). A framework for designing interactivity into web-based instruction. *Educational Technology, 41*(2), 31-39.

Piyanan Nuankhieo (2010). A comparative study of the effects of instructional design-based scaffolding and management-based scaffolding on learning in online collaborative groups. PhD Dissertation, 2010, University of Missouri – Columbia.

O'Neil, H. S. Jr., and Brown, R. S. (1998). Differential Effects of Question Formats in Maths Assessment on Metacognition and Affect. *Applied Measurement in Education, 11*(4), 331-351.

Obrist, M., Geerts, D., Brandtzæg, P. B., and Tscheligi, M. (2008). Design for creating, uploading and sharing user generated content. *Proceeding of the 26th Annual CHI Conference Extended Abstracts on Human Factors in Computing Systems CHI 08* (pp. 2391-2394), ACM Press.

Oh, S., and Jonassent (2007). Scaffolding online argumentation during problem solving. *Journal of Computer Assisted Learning, 23*, 95-110.

Ophus, J. D., and Abbitt, J.T. (2009) Exploring the Potential and Perceptions of Social Networking Systems in University Courses. *MERLOT* Journal of Online Learning and Teaching, *5* (4), 639-648.

Oppermann, R. (2002). User-interface design. In H.H. Adelsberger, B. Collis, and J.M. Pawlowski (Eds.), *Handbook on Information Technologies for Education and Training* pp. 233-248. Berlin: Springer.

Oradini, F., and Saunders, G. (2008). The use of social networking by students and staff in higher education. *Paper presented at the iLearning Forum, Paris*.

Otto, S. E. K. and Pusack, J. P. (2009).Computer-assisted language learning authoring issues. *The Modern Language Journal, 93* (1), 784-801.

Ozkan, B., and McKenzie, B. (2008). Social networking tools for teacher education. *Proceedings of Society for Information Technology and Teacher Education International Conference 2008* (pp. 2772-2776)

Palincsar, A. S., and Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 1*(2), 117-175.

Palloff, R., and Pratt, K. (1999). *Building learning communities in cyberspace: effective strategies for the online classroom*. San Francisco: Jossey-Bass.

Papanikolaou, K., and Boubouka, M. (2010). Promoting Collaboration in a Project Based E-Learning Context. *Journal of Research on Technology in Education,43* (2), 135-155.

Papleontiou-louca, E. (2003) . The concept and instruction of metacognition. *Teacher development: An international journal of teachers' professional development*, *7*(1), 9 - 30.

Pavlina, S. (2006, August 4). *10 Reasons to Develop Your Technical Skills*. Retrieved from http://www.stevepavlina.com/blog/2006/08/10-reasons-to-develop-your-technical-skills/

Payne, D.T., Henry, P.D. Watson, J. and McDowell, B. (2007). *Teaching multimedia authoring and production as a complex skill*. Retrieved from http://www.programhouse.com/maple1.htm

Petrović, N., Petrović, D., Jeremić, V., Milenković, and Ćirović, M. (2012). Possible educational use of Facebook in higher environmental education. In

*Proceedings of International Conference on information communication technologies in education (ICICTE) 2012 (*pp. 355-362). Rhodes, Greece.

Pifarré, M., and Cobos, R. (2009). Evaluation of the development of metacognitive knowledge supported by the knowcat system. *Educational Technology Research and Development*, *57*(6), 787-799.

Pifarré, M., and Cobos, R. (2010). Promoting metacognitive skills through peer scaffolding in a CSCL environment. *International Journal of Computer Supported Collaborative Learning, 5*(2), 237-253.

Pintrich, P. R., Wolters, C. A., and Baxter, G. P. (2000). Assessing metacognition and self-regulated learning. In G. Schraw & J. C. Impara (Ed.), *Issues in the measurement of metacognition* (pp. 43-97). Lincoln: Buros Institute of Mental Measurements.

Potter, J. (1997). Discourse analysis as a way of analysing naturally occurring talk, in D. Silverman (ed). *Qualitative Research*. London: Sage.

Quintana, C., Zhang, M., and Krajcik, J. (2005). A framework for supporting metacognitive aspects of online inquiry through software-based scaffolding.*Educational Psychologist, 40*(4), 235-244.

Quinton, S. and Smallbone, T. (2010). Feeding forward: using feedback to promote student reflection and learning - a teaching model, *Innovations in Education and Teaching International*, *47*(1), 125-135.

Rahman, S., M. Yasin, R., Jusoff, K., Ariffin, S, R., Hayati, N., and Yusof, S. (2011). The promotion of metacognitive development in the classroom. *World Applied Sciences Journal, 13(1),* 95-99.

Reeve, R. A., and Brown, A. L. (1984). *Metacognition reconsidered: Implications for intervention research*. Champaign, IL: University of Illinois.

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

Reiser, B. J.(2004). Scaffolding complex learning: the mechanisms of structuring and problematizing student work. *The Journal Of The Learning Sciences, 13*(3), 273–304.

Reiser, B. J. (2002). Why scaffolding should sometimes make tasks more difficult for learners. In Stahl, G. (Eds.) *Computer Support for Collaborative*

Learning: Foundations for a CSCL Community, (pp. 255-264). Erlbaum, Hillsdale, NJ.

Rhea, M. R. (2004). Determining the magnitude of treatment effects in strength training research through the use of the effect size. *Journal of Strength and Conditioning Research, 18*(4), 918-920.

Roll, I., Holmes, N. G., Day, J., and Bonn, J. (2012). Evaluating metacognitive scaffolding in guided invention activities instructional science. *An International Journal of the Learning Sciences, 40*(4), 691-710.

Romainville, M. (1994). Awareness of Cognitive Strategies: the relationship between university students' metacognition and their performance. Studies in Higher Education, *19*(3), 359-366.

Roper, A. R. (2007). How students develop online learning skills. *Educause Quarterly, 30*(1), 62–64.

Ross, C., Orr, E. S., Sisic, M., Arseneault, J. M., Simmering, M. G., and Orr, R. R. (2009). Personality and motivations associated with Facebook use. *Computers in Human Behavior, 25,* 578-586.

Rovai, A. (2002). Building sense of community at a distance. *International Review of Research in Open and Distance Learning, 3*(1), 1-16.

Rovai, A. P., and Wighting, M. J. (2005). Feelings of alienation and community among higher education students in a virtual classroom. *The Internet and Higher Education, 8*(2), 97-110.

Russell, I., Coleman, S., Markov, Z. (2012). A contextualized project-based approach for improving student engagement and learning in ai courses. *Proceedings of CSERC 2012 Conference* (pp. 9-15). New York, NY: ACM Press.

Santos, I. M., Hammond, M., Durli, Z., and Chou, S.-Y. (2009). Is There a Role for Social Networking Sites in Education? In A. Tatnall & A. Jones (Eds.), *IFIP Advances in Information and Communication Technology Education and Technology for a Better World* (pp. 321-330). Boston: Springer.

Santoso, A. (2008). The Art of Scaffolding an EFL Writing Class in a Hybrid Environment: A Practical Experience. *Proceedings at the Fifth International Conference on eLearning for Knowledge-Based Society.* Bangkok: Thailand,

Savage, R. N., Chen, C., and Vanasupa, L. (2007). Integrating project-based learning throughout the undergraduate engineering curriculum. *Journal of STEM Education, 8*(3), 15-27.

Schaller, D., Allison-Bunnell, S., Borun, M. and Chambers, M. (2002). How do you like to learn? Comparing user preferences and visit length of educational web sites. Paper presented at the *Museums and the Web Conference*, Boston, Massachusetts. Retrieved from http://www.eduweb.com/likelearn.html

Schraw, G., and Moshman, D. (1995). Metacognitive theories. Educational Psychology Review, *7*, 351–371.

Schwandt, T. A. (1997). Qualitative inquiry: a dictionary of terms. Thousand Oaks, CA: Sage.

Selwyn, N. (2009). Faceworking: exploring students' education-related use of Facebook. *Learning Media and Technology, 34*(2), 157-174.

Shambare, R., and Mvula, A. (2011). South African students' perceptions of Facebook: Some implications for instructors. *African Journal of Business Management, 5*(26), 10557-10564.

Shapiro, S. S and Wilk, M. B. (1965). An analysis of variance test for normality. *Biometrika, 52* (3/4), 591 – 611.

Shen, C., and Liu, H. (2011). Metacognitive skills development: A web-based approach in higher-education. *The Turkish Online Journal of Educational Technology, 10* (2), 140-150.

Sheridan, K., and Kelly, M. A. (2010). The indicators of instructor presence that are important to students in online courses. *MERLOT Journal of Online Learning and Teaching, 6* (4). Retrieved from http://jolt.merlot.org/vol6no4/sheridan_1210.htm

Shiu, H., Fong, J and Lam, J. (2010). Facebook – Education with social networking websites for teaching and learning. In P. Tsang et al. (Eds.), *Lecture Notes in Computer Science* (pp. 59-70). Springer.

Shukri, S., and Tasir, Z. (2012). *Pengaplikasian Metacognitive Scaffolding Menerusi Perbincangan Atas Talian Serta Jenis Interaksi Pelajar.* Unpublished master thesis, Universiti Teknologi Malaysia, Skudai.

Sidhu, S. M and Ramesh, S. (2006). Multimedia learning packages: Design issues and implementation problems. *Malaysian Online Journal of Instructional Technology (MOJIT) 3* (1), 43-56.

Sims, R. (2003). Promises of interactivity: Aligning learner perceptions and expectations with strategies for flexible and online learning. *Distance Education, 24*(1), 87- 103.

Sims, R., Dobbs, G., and Hand, T. (2002). Enhancing quality in online learning: Scaffolding design and planning through proactive evaluation. *Distance Education, 23*(2), 135-148.

Smith, P.L. and Ragan, T.J. (2000). *Instructional Design.* John Wiley & Sons, Inc, New York.

Solomon,G.(2003).Project-based learning: A primer. *Technology & Learning, 23*(6), 20–26.

Song, L., and McNary, S. W. (2011). Understanding students' online interaction: analysis of discussion board postings. *Journal of Interactive Online Learning, 10*(1), 1-14.

Sosik, V. S., and Bazarova, N. N. (2014). Relational maintenance on social network sites: How Facebook communication predicts relational escalation. *Computers in Human Behavior, 35,* 124-131.

Spatariu, A., Hartley, K., and Bendixen, L. D. (2004). Defining and measuring quality in online discussions. *The Journal of Interactive Online Learning*, *2*(4), 1-15.

Special, W. P., and Li-Barber, K. T. (2012). Self-disclosure and student' satisfaction with Facebook. *Computers in Human Behavior, 28* (2), 624-630.

Stern, D., and Huber, G. (1997). *Active learning for students and teachers: Reports from eight countries*. New York: Peter Lang.

Strijbos, J. W., Martens, R. L., Prins, F. J., and Jochems, W. M. G. (2006). Content analysis: What are they talking about?*, Computers & Education, 46,* 29-48.

Stroud, D. (2008). Social networking: an age-neutral commodity-social networking become a mature web application, *Journal of Direct, Data and Digital Marketing Practice, 9*(3) 278-292.

Stupans, I., and Owen, S. (2009). Planning and scaffolding for learning in experiential placements in Australian pharmacy schools. *Asia-Pacific Journal of Cooperative Education, 10(1),* 29-37.

Stutzman, F., Capra, R., and Thompson, J. (2011). Factors mediating disclosure in social network sites, *Computers in Human Behavior, 27,* 590-598.

Sungur, S (2007). Contribution of motivational beliefs and metacognition to students' performance under consequential and non-consequential test conditions, *Educational Research and Evaluation*, *13*(2), 127-142.

Sutton, L. A. (2001). The principle of vicarious interaction in computer-mediated communications. *International Journal of Educational Telecommunications, 7*(3), 223–242.

Swan, K. (2001). Virtual interaction: Design factors affecting student satisfaction and perceived learning in asynchronous online courses. *Distance Education, 22*, 306-331.

Taras, M. (2005). Assessment – summative and formative – Some theoretical reflections. *British Journal of Educational Studies, 53* (4), 466 – 478.

Tasir, Z., Abour, M. E. A., Halim, N. D. A., and Harun, J. (2012). Relationship between teachers' ICT competency, confidence level, and satisfaction toward ICT training programmes: a case study among postgraduate students. *The Turkish Online Journal of Educational Technology, 11* (1), 138 – 144.

Teo, Y.H., and Chai, C.S. (2009). Scaffolding online collaborative critiquing for educational video production. *Knowledge Management & E-Learning: An International Journal, 1*(1), 51-66.

Thomas, G. P., and McRobbie, C. J.(2001). Using a metaphor for learning to improve students' metacognition in the chemistry classroom. *Journal of Research in Science Teaching, 36(2),* 222-259.

Thomas, G., Anderson, D., and Nashon, S. (2008). Development of an instrument. designed to investigate elements of science students' metacognition, self-efficacy and learning processes. *International Journal of Science Education, 30*(13), 1701–1724.

Thomas, T., Davis, T., and Kazlauskas, A. (2007). Embedding critical thinking in IS curricula. *Journal of Information Technology Education,6,* 327 – 346.

Topcu, A. (2005). *The effect of the web based asynchronous teaching method course on the pre-service teachers' achievement, metacognition, and attitudes towards computer, www and web based course.* Unpublished doctoral dissertation, Middle East Technical University, Turkey.

Topcu, A., and Ubuz, B. (2008). The effects of metacognitive knowledge on the pre-service teachers' participation in the asynchronous online forum. *Educational Technology & Society, 11* (3), 1-12.

Treffinger, D. J., Selby, E. C., and Isaksen, S. G. (2008). Understanding individual problem-solving style: A key to learning and applying Creative Problem Solving. *Learning and Individual Differences, 18,* 390-401.

Trentin, G. (2000). The quality-interactivity relationship in distance education. *Educational Technology, 40*(1), 17-27.

Tseng, K., Chang, C., Lou, S., and Chen, W. (2013). Attitudes towards science, technology, engineering and mathematics (STEM) in a project-based learning (PjBL) environment. *International Journal of Technology and Design Education, 23*(1), 87-102.

Tsuei, M. (2012). Using synchronous peer tutoring system to promote elementary students' learning in mathematics, *Computers & Education, 58* (4), 1171 – 1182.

Van de Pol, J., Volman, M., and Beishuizen, J. (2010). Scaffolding in teacher-student interaction: A decade of research. *Educational Psychology Review, 22*(3), 271-296.

Veenman, M. V. J., Elshout, J. J., and Busato, V. V. (1994). Metacognitive mediation in learning with computer-based simulations. *Computers in Human Behavior, 10*, 93–106.

Veenman, M. V. J., Van Hout-Wolters, B. H. A. M., and Afflerbach, P. (2006). Metacognition and learning: Conceptual and methodological considerations. Metacognition and Learning, *1* (1), 3–14.

Verenikina, I. (2003). *Understanding scaffolding and the ZPD in educational research.* Retrieved from http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1695&context=edupapers

Verezub, E. and Wang, H. (2008). The role of metacognitive reading strategies instructions and various types of links in comprehending hypertexts. *In:* Hello! Where are you in the landscape of educational technology? *Proceedings Ascilite Melbourne* 2008 (pp. 1071 – 1078), 30 November – 3 December. Melbourne:

Visagie, S and De Villiers, C. (2010). The consideration of Facebook as an academic tool by ICT lecturers across five countries. *Proceedings of SACLA 2010.* South Africa.

Vivian, R. (2011). University students' informal learning practices using Facebook: help or hindrance? In Kwan et al. (Eds.), *Communications in Computer and Information Science* (pp. 254-267). Springer, Heidelberg.

Vrasidas, C., and McIsaac, M. S. (1999). Factors influencing interaction in an online course. *American Journal of Distance Education, 13*(3), 22–36.

Vygotsky, L. S. (1978). *Mind in society.* Cambridge, MA: Harvard University Press.

Wagner, E. D. (1994). In support of a functional definition of interaction. *The American Journal of Distance Education, 8*(2), 6–26.

Walsh, K. (2011, June 5). *7 reasons to leverage social networking tools in the classroom*. Retrieved from http://www.emergingedtech.com/2011/06/7-reasons-to-leverage-social-networking-tools-in-the-classroom/

Wang, Q., Woo, H., Quek, C., Yang, Y., and Liu, M. (2012). Using the Facebook group as a learning management system: An exploratory study. *British Journal of Educational Technology, 43* (3), 428–438.

Wang, S. K. (2006). Learning hands-on skills in an online environment: the effectiveness of streaming demonstration animation. *Journal of Interactive Online Learning*, *5* (1), 1 – 14.

Way, J and Rowe, L (2008). The role of scaffolding in the design of multimedia learning object. *Paper presented at 11th international congress on mathematical education, Mexico*. Retrieved from http://tsg.icme11.org/document/get/263

Wellman, H. (1985). The origins of metacognition. In D.Forrest-Pressley, G. MacKinnon, & T. G. Waller (Eds.), *Metacognition, cognition, and human performance: Theoretical perspectives* (pp. 1- 31). Orlando, FL: Academic.

Wenden, A., 2001. Metacognitive knowledge in SLA: the neglected variable. In: Breen, M.P. (Ed.), *Student Contributions to Language Learning: New Directions in Research* (pp. 44–64). Pearson Education, Harlow, Essex.

Wilkinson, I. A. G., and Fung, I. Y. Y. (2012). Small-group composition and peer effects, *International Journal of Educational Research 37,* 425–447.

Willis, J. (1995). A recursive, reflective instructional design model based on constructivist-interpretivist theory. *Educational Technology, 35*(6), 5-23.

Willis, J., and Wright, K. E. (2000). A general set of procedures for constructivist instructional design: The new R2D2 model. *Educational Technology, 40*(2), 5-19.

Wilson, G. and Stacey, E. (2003). Online interactions impacts on learning: teaching the teachers to teach online. In G.Crisp, D. Thiele, I. Scholten, S. Barker and J. Baron (Eds), *Interact, Integrate, Impact: Proceedings of the 20th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education.* Adelaide, 7-10 December 2003.

Woo, Y., and Reeves, T. C. (2007). Meaningful interaction in web-based learning: A social constructivist interpretations. *Internet and Higher Education, 10,* 15-25.

Wood, D., Bruner, J. and Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology & Psychiatry & Allied Disciplines 17*(2), 89–102.

Wozniak, H., and Silveira, S. (2004). Online discussions: promoting effective student to student interaction. *Proceedings of ASCILITE Conference 2004* (pp. 956-960). Perth, Western Australia.

Xie, K., and Bradshaw, A. C. (2008). Using question prompts to support ill-structured problem solving in online peer collaborations. *International Journal of Technology in Teaching and Learning, 4*(2), 148-165.

Yang, Y., and Cornelious, L. F. (2005). Preparing instructors for quality online instruction. *Online Journal of Distance Learning Administration, 8* (1). Retrieved from http://www.westga.edu/~distance/ojdla/spring81/yang81.htm.

Yin, R. K. (2004). *Case study research: design and methods* (4th ed.). Thousand Oaks, CA: Sage Publishing.

Yun-ho. A, (2010). Scaffolding Wiki-Based, III-Structured Problem Solving in an Online Environment. *Journal of Online Learning & Teaching. 6*(4), 723-734.

Zhang, M., and Quintana, C. (2012). Scaffolding strategies for supporting middle school students' online inquiry processes. *Computers & Education, 58,* 181-196.

Zimmerman, B. J., and Schunk, D. H. (2001). Reflections on theories of self-regulated learning and academic achievement. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theoretical perspectives* (pp. 289-307). Erlbaum: Mahwah, NJ.

VALIDATION OF PRE AND POST TEST ASSESSMENT

I hereby certify that the items in Pre and Post Test assessment that were implemented in this study conducted by Nurul Farhana Jumaat from Faculty of Education, Universiti Teknologi Malaysia was reviewed and appropriate with the respect to the objective in this study.

Signature	:	
Full Name	:	Norasykin Mohd Zaid
Teaching Experience	:	6 years
Post	:	Senior Lecturer
Qualification	:	PhD
Name and Address of Institution	:	DR NORASYKIN MOHD ZAID LECTURER School of Educational Science, Mathematics & Multimedia Creative Faculty of Education Universiti Teknologi Malaysia 81310 UTM Skudai, Johor, MALAYSIA

APPENDIX E

VALIDATION OF LEARNING ACTIVITIES

I hereby certify that the items in learning activities that were implemented in this study conducted by Nurul Farhana Jumaat from Faculty of Education, Universiti Teknologi Malaysia was reviewed and appropriate with the respect to the objective in this study.

Signature : _____

Full Name : Shaharuddin b. Md Salleh

Teaching Experience : 13

Post : Senior Lecturer

Qualification : Ph D.

Name and Address of Institution :

DR SHAHARUDDIN B. MD SALLEH
Senior Lecturer / Academic Supervisor
Dept. Of Educational Science,
Mathematic and Multimedia Creative,
Faculty of Education
81310 UTM Johor Bahru, Johor Darul Takzim

VALIDATION OF LEARNING ACTIVITIES

I hereby certify that the items in learning activities that were implemented in this study conducted by Nurul Farhana Jumaat from Faculty of Education, Universiti Teknologi Malaysia was reviewed and appropriate with the respect to the objective in this study.

Signature : 

Full Name : Norasykin Mohd Zaid

Teaching Experience : 6 years

Post : Senior Lecturer

Qualification : PhD

Name and Address of Institution :

DR NORASYKIN MOHD ZAID
LECTURER
School of Educational Science, Mathematics & Multimedia Creative
Faculty of Education
Universiti Teknologi Malaysia
81310 UTM Skudai,
Johor, MALAYSIA

APPENDIX F

List of Publications

Jumaat, N. F., Tasir, Z., Harun, J. & Yong, L. Y. (2012). Learning computer-based subject through apps among adult learners: A small scale study*, Energy Education Science and Technology Part B: Social and Educational Studies*, *5*(3): 1537-1550.

Jumaat, N. F., Tasir, Z (2014). *Instructional scaffolding in online learning environment: A Meta analysis*. Paper presented at the IEEE International Conference on Teaching and Learning in Computing and Engineering (LaTiCE). doi: 10.1109/LaTiCE.2014.22

Jumaat, N. F., Tasir, Z (2013). Students' types of online interaction through Facebook discussion. *Procedia – Social and Behavioral Sciences*, *97* (6), 353 – 360.

Jumaat, N. F., Tasir, Z (2013). Integrating project based learning environment into the design and development of mobile apps for learning 2-D animation. *Procedia – Social and Behavioral Sciences*, *103* (26), 526-533.

Harun, J., Tasir, Z., Shukor, N. A., Megat Zakaria, M. A. Z. & Jumaat, N. F (2012). Students' Expectations towards Online Collaborative Learning Environment, *Procedia – Social and Behavioral Sciences*, 2012 .

Jumaat, N. F., Tasir, Z. (2012). A Framework of instructors' metacognitive scaffolding in learning through Facebook discussion. *Paper presented at International Malaysia Educational Technology Convention (IMETC),* 29th – 31st Oct 2012, Concorde Inn, KLIA.

Jumaat, N. F., Tasir, Z. (2011). Using apps in learning computer-based subject with metacognitive scaffolding through social networking tool, *Paper presented at Education Postgraduate Research Seminar (Edupres),* 14th – 15th December 2011, Faculty of Education, Universiti Teknologi Malaysia (UTM).