DESIGN, DEVELOPMENT AND EVALUATION OF A WEB COURSEWARE WITH A PEDAGOGICAL AGENT

by

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(Bismilla Hirrahmaan Nirrahiim)

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
CAI	Computer Aided Instruction
CAL	Computer Assisted Learning
CALL	Computer Assisted Language Learning
CALLA	Cognitive Academic Language Learning Approach
CBT	Computer Based Training
CD-ROM	Compact Disc Read Only Memory
CFT	Cognitive Flexibility Theory
CLE	Constructivist Learning Environment
CMC	Computer Mediated Communication
E-mail	Electronic Mail
ESL/EFL	English as a Second Language or English as a Foreign Language
FTF	Face-to-face
HCI	Human-computer Interaction
HTTP	Hypertext Transfer Protocol
ICALL	Intelligent Computer Assisted Language Learning
LCMS	Learning Content Management System
LMS	Learning Management System
PA	Pedagogical Agent
PDA	Personal Digital Assistant
PHP	Hypertext Processor
PPA	Personalized Pedagogical Agent
NPPA	Non-personalized Pedagogical Agent
SILL	Strategy Inventory in Language Learning
SLA	Second Language Acquisition
ZPD	Zone of Proximal Development

REKABENTUK, PEMBANGUNAN, DAN PENILAIAN ATAS KOSWER WEB DENGAN AGEN PEMBELAJARAN

Abstrak

Kajian ini bertujuan mengkaji kesan-kesan agen pengajaran (PA) berbeza tahap personaliti dalam pembelajaran bahan-bahan bertema melalui koswer web. Kesan-kesan ini dikaji berdasarkan inventori untuk strategi-strategi mempelajari bahasa (SILL). Dua mod persembahan menggunakan multimedia interaktif web bertemakan bandar suci *Al-Quds* telah direkabentuk dan dibangunkan. Mod pertama menggunakan agen pengajaran berpersonaliti (PPA) dan mod kedua menggunakan agen pengajaran tanpa personaliti (NPPA). Elemen-elemen personaliti ini ialah kiu-kiu sosial, perbualan dialog, dan maklumbalas tidak langsung. Koswer ini dibangunkan berdasarkan model rekabentuk dan pembangunan multimedia Alessi dan Trollip (2001). Rasional penggunaan agen pengajaran dalam persekitaran pembelajaran web adalah disandarkan kepada teori pembelajaran sosial Vygotsky (1978), teori komunikasi (Reeves & Nass, 1996), teori kognitif pembelajaran multimedia (Mayer, 2001), dan teori kognitif fleksibiliti (Spiro et al., 1992).

Rekabentuk eksperimen kuasi dengan faktorial 2 x 3 telah digunakan dalam kajian ini. Pembolehubah bebas ialah dua mod persembahan (PPA dan NPPA). Pembolehubah bersandar ialah skor pencapaian pembelajaran dan skor penarafan program. Pembolehubah moderator pula ialah skor SILL. Seramai 96 orang pelajar yang mempelajari bahasa Arab pada tahap tinggi di Universiti Islam Antarabangsa Malaysia telah menyertai kajian ini. Pelajar-pelajar telah dibahagikan kepada tiga kumpulan menggunakan mod PPA dan empat kumpulan menggunakan mode NPPA. Statistik deskriptif dan statistik inferensi telah dijalankan untuk menganalisa data-data yang dikumpulkan. Prosedur ANOVA sehala dan dua hala telah digunakan untuk mengkaji

kesan-kesan utama dan interaksi di antara pembolehubah bebas dan pembolehubah-pembolehubah bersandar.

Keputusan kajian menunjukkan min skor pelajar-pelajar yang menggunakan mod PPA adalah lebih tinggi secara signifikan bebanding pelajar-pelajar yang menggunakan mod NPPA hanya dalam komponen soalan terbuka untuk pencapaian pembelajaran. Min skor untuk kertas penarafan program tidak mempamerkan perbezaan yang signifikan di antara kumpulan PPA dan kumpulan NPPA. Analisa seterusnya berdasarkan kumpulan-kumpulan SILL (tinggi, sederhana, dan rendah) memperlihatkan kelebihan kepada pelajar-pelajar yang diklasifikasikan sebagai tinggi mengikut SILL berbanding pelajar-pelajar yang memperolehi skor SILL lebih rendah. Pelajar-pelajar SILL tinggi memperolehi skor min pencapaian pembelajaran yang lebih tinggi secara signifikan berbanding pelajar-pelajar SILL sederhana dan rendah.

Kajian ini mendapati mod PPA adalah lebih efektif dalam meningkatkan komitmen pembelajaran dan minat terhadap kefahaman menyeluruh maklumat berkaitan budaya dan tamaddun Islam yang diintergasikan ke dalam koswer web. Analisa kumpulan-kumpulan SILL menunjukkan tahap preferen-preferen perisian adalah lebih berkesan terhadap kumpulan SILL tinggi berbanding kumpulan SILL sederhana dan rendah.

DESIGN, DEVELOPMENT AND EVALUATION
OF A WEB COURSEWARE WITH A PEDAGOGICAL AGENT

Abstract

This study examined the effects of a pedagogical agent (PA) with different levels of personalization in a web courseware on the learning of thematic materials. These effects were studied based on the Strategy Inventory in Language Learning (SILL). Two modes of an interactive multimedia web courseware on the theme of the holy city of *Al-Quds* were systematically designed and developed. While the first mode used a personalized version of the pedagogical agent (PPA), the second mode used a non-personalized PA (NPPA). The personalization elements include an integration of social cues, dialogue conversations, and indirect feedback. The courseware was developed based on Alessi and Trollip's (2001) Model of Design and Development of Multimedia Learning. The rationale of adopting pedagogical agents in a web learning environment is based on Vygotsky's social learning theory (1978) , communication theory (Reeves & Nass, 1996), cognitive multimedia learning theory (Mayer, 2001), and cognitive flexibility theory (Spiro et al., 1992).

A 2 x 3 quasi-experimental factorial design was used in this study. The independent variables were the two modes of presentation (PPA and NPPA). The dependent variables were the learning gains and the program rating score. The moderator variable was the SILL score. 96 students studying the Arabic language at an advanced level at the International Islamic University Malaysia participated in the study. The students were divided into three groups using the PPA mode and four groups using the NPPA mode. Descriptive and inferential statistics were used to analyze the collected data. Two-way and One-way ANOVA procedures were used to examine the main and interaction effects between the independent variable and the dependent variables.

The results showed that the mean score of the students presented with the PPA mode is significantly higher compared to students presented with the NPPA mode related only to the *open-ended question* component of the learning gains. The mean score of the program rating sheet demonstrated no significant differences between the PPA and NPPA groups. Further analysis based on each of the SILL groups (high, medium, and low) revealed advantages for the students classified as high by SILL compared to students achieving a lower SILL score. The high SILL group obtained significantly higher mean score of the program rating sheet when compared to the medium and low SILL groups.

The study found that PPA mode was more effective in increasing learning engagement and interest for the overall understanding and comprehension of the Islamic culture and civilization information integrated in the web courseware. Analysis on the SILL groups indicated that the effects of software preferences were stronger for the high SILL groups as compared to the medium and low SILL group.

CHAPTER ONE

INTRODUCTION

1.1 Background

According to Weinstein and Mayer (1986, p. 315), the use of learning strategies is, "to affect the learner's motivational or affective state, or the way in which the learner selects, acquires, organizes, or integrates new knowledge." This broad description of learning strategies include instances such as planning to acquire new knowledge, focusing and selecting information, and analyzing and monitoring information during the process of acquisition. For the assessment and evaluation phase, strategies such as evaluating the learning process, and rechecking the learning process to determine if it has succeeded or not have to be conducted. These strategies may be in an abstract or a concrete form. Thus, they may influence the acquisition of strategies ranging from a simple memorization word vocabulary task to more complex tasks, such as, language production and understanding (O'Malley & Chamot, 1990).

Several studies have shown the importance of strategies use in particular for acquiring and mastery of learning the target language (Beauquis, 2000; Hismanoglu, 2000; Lessard-Clouston, 1997; McDonough, 2001; Oxford, 1989; Wenden, 1999). The main reason to practise these strategies is to ensure the success of achieving the intended learning objectives. From the student's perspective, they are expected to be able to choose from a wide range of learning strategies and apply them in accordance to their learning styles and preferences. Eventually, the students will be equipped with the necessary skills to discover and gain new knowledge at their own pace and become more autonomous. This is the main goal and characteristic of a successful learner particularly in a constructivist learning environment.

Researchers have been interested in the use of strategies particularly in a computer based learning environment (Harris, 2003; Wang, Contino & Ramirez, 1997). Wang et al. (1997) have designed a system for implementing cognitive learning strategies in computer based interaction. This integrated system enables teachers to create instructional modules encapsulating their teaching strategies and mimicking experienced teachers in teaching complicated learning materials. The teacher's burdens would then be reduced and the students will be able to maximize the use of their time and learn at their own pace.

The case of learning and teaching through the use of the online approach should be handled with great care. This is due to the nature of the Internet itself which is attributed to interrelatedness and complexity. The issue may become more prevalent if more complex subjects are delivered via the online approach. Here, Spiro et al. (1992) offer a viable solution, according to their proposed cognitive flexibility theory, where the complexity should be realized and designated accordingly to the learning materials delivered. This is to equip the students with the necessary cognitive flexibility and learning skills for the knowledge to be acquired in its holistic form.

However, several studies have alerted that the constructivist nature of the Internet content may lead to difficulties and become learning impediments if it is left to the students without proper instructional guidance (Allen, 2003; Toh, 2004; Tuovinen, 2001). This guidance acts as a facilitator to ensure that the student will be able to efficiently choose a suitable strategy for any learning tasks or activities at any time without compromising the goals of the required learning. In this respect, the role of an emerging tool, namely the pedagogical agent (PA) offers a feasible and enticing approach to tackle this issue. The significant functionality of the PA has been validated in several studies (Mayer, Dow & Mayer, 2003; Moreno & Mayer, 2004; Mayer, Sobko & Moutone, 2003). Though this tool has been around for some time, the usability

potential of the tool has yet to be discovered and still in its infancy. The current study argues that adding more personalized elements onto the PA will accelerate the process of internalizing the learning materials due to the factors relatively referred to learning engagement and preparedness to complete the tasks or assigned activities.

1.2 Statement of Problem

Recently personalized instructions in a computer based learning environment have been of interest among educational technologists (Martinez, 2001; Mayer et al., 2004; Mayer, Sobko & Mautone, 2003; Moreno & Mayer, 2000). In fact, learners are always treating computers as their personalized social companions (Reeves & Nass, 1996).

In this respect, the need to have more personalized instructions for accelerating the process of acquiring knowledge is important. The integrity of learning materials designed in accordance to the principles of multimedia personalization is crucial to ensure that students are able to engage themselves with the learning process (Allen, 2003). Additionally, a personalized instructional design will be able to guide the students to choose a correct learning strategy in line with their learning tasks and activities. It has been found that personalization in instructions has been studied sporadically by researchers and educationists with each research focusing on a small or minor component of this aspect. As such, this study intends to go a step further in pioneering the combination of these personalization elements and examine whether the results would be supportive and in line with the previous studies conducted in this area.

The principle of personalization entails two rules to be accounted in order to internalize the learning and knowledge acquiring process (Clark & Mayer, 2003). The first rule states the use of a conversational style rather than a formal style in the printed or spoken text presented to the learner. In addition, the second rule affirms the

employment of onscreen coaches or PAs to promote learning engagements and performances. Both rules have been substantiated by several researches and studies conducted in the domain of learning through the use of multimedia (Atkinson, 2002; Craig, Gholson & Driscoll, 2002; Mayer, Dow & Mayer, 2003; Mayer, Sobko & Moutone, 2003; Moreno & Mayer, 2004). In fact, this principle originated from the perspective of individual differences where low-knowledge learners seem to benefit more from the multimedia learning instructions than high-knowledge learners, and high-spatial learners rather than low spatial learners (Mayer, 2001).

Moreno (1999) conducted a study on the effects of social cues on learning performance. According to the study, the social cues include eye movements, facial expressions, motions, and gestures. She found that the integration of these social elements significantly contributed to learning attainments through continuous learning engagement and task preparation. Several studies have also shown the significant role of social cues on increasing learning engagement and continuous learning task execution (Cassell, 2001; Huang, 1999; Okonkwo & Vassilev, 2001; Predinger & Ishizuka, 2003). Thus, the second element of personalization needed for creating personalized instructions is the inclusion of social cues in the learning materials.

The third element of personalization was derived from the studies conducted on feedback and corrective evaluation. In the field of second language acquisition, it is argued that the nature of feedback should be focused more on the content rather than on the form or to be precise, indirect feedback rather than direct feedback (Cohen, 1987; Semke, 1984; Zamel, 1985). These studies have shown that the students benefit more from the indirect feedback given.

In short, the current study argues that these three personalization elements: 1) multimedia principle of personalization 2) integration of social cues, and 3) indirect

corrective feedback, serve as an accelerating factor for learning engagement and learning management strategies and thus affect the outcome of the learning process i.e. learning attainment and performance.

1.3 Purpose of the Study

The purpose of this study is divided into two parts. The first part of the study is to develop a web module which integrates features of a web PA. Second, it seeks to investigate the differential effects of a personalized PA and a non-personalized PA on the learning gains and program rating scores in relation to learning strategies for language acquisition through online learning using an agent-based application.

1.4 Significance of the Study

The significance of this study can be divided into two; theoretical and practical perspectives. From a theoretical perspective, this study intends to uncover the relationships existing in the instructional procedures by applying the agent among learners, teachers, and the presented teaching and learning materials. At the same time, it seeks to refine the principle of personalization for learning through multimedia as formulated by Clark and Mayer (2003). The inclusion of a social PA could not be accomplished at will. In fact, some important characteristics of the agent should be highlighted to ensure its effectiveness in carrying out the tasks provided. Hopefully, this study contributes to building an exemplary model of learning and teaching from the social perspective.

From a practical perspective, it is expected that the study may encourage instructional designers to integrate social PAs into their web modules and materials. The results of the study indeed help and guide the rationale behind this integration and the advantages that may be derived from its implementation.

1.5 Theoretical Framework

The theories and models underlying this study are divided into two sections. Firstly, the theories and models that support the use of the web and the agent character from a pedagogical rationale and secondly, the practical model related to the instructional representation of this study. The theories supporting web usage and social PAs employment are social learning theory, communication theory and cognitive multimedia learning theory. The nature of teaching-learning through the web materials is explained by the application of the cognitive flexibility theory. Moreover, for the PA character representation, the study employs a cognitive apprenticeship model to designate the instructional functions of two modes of presentation; personalized pedagogical agent (PPA) and non-personalized pedagogical agent (NPPA).

Vygotsky's (1978) theory of social interaction asserts that learning should not be isolated from its social context. The interaction that takes place during the process of learning and acquiring knowledge could promote deeper understanding and better accumulate the building of knowledge and experiences (Vygotsky, 1978). The theory of the zone of proximal development (ZPD) illustrates this scenario in a clearer picture. It posits that the student would reach a certain level of knowledge attainment using his own personal endeavour. It is through interaction with others that would bring him beyond this level in internalizing the acquired knowledge. The personalized web PA used in this study intends to shed some light and clarifications in the field of social interaction.

From a communication point of view, the employment of a PA is substantiated by the media equation theory which asserts that human computer interaction exhibits tendency for imitating human to human communication. The study shows that students view and interact with computer in a similar way they make contact with their peers (Reeves & Nass, 1996). Furthermore, the communication theory accentuates that

there are two types of communication models. Firstly, the directional communication (Lane & Molyneaux, 1992; Reynolds, 1998) which occurs during the process of interaction where the message received from the sender goes through an encoding process which later translated to be meaningful for the receiver. Different factors could hinder this process such as, environment, receiver's attention, and motivation. Secondly, the bi-directional communication (Brennan, 1990; Heinich et al., 1999) which regards the receiver as an active participant who cognitively encodes and translates the messages received to establish an interactive process of communication. Social and individual processes in a bi-directional communication model are more complex than what has been portrayed by the directional communication model. The transactional model (Hahner, Sokoloff & Salisch, 2002) entailed from a bi-directional understanding of communication. It conceptualizes the application of a PA for enhancing teaching-learning processes.

Furthermore, the theory of cognitive multimedia learning (Mayer, 2001) formulates several principles and guidelines pertinent to the teaching-learning process. One of the principles formulated for this process is the principle of individual differences. This principle accentuates that multimedia design effects are stronger for low-knowledge learners than for high-knowledge learners and for high-spatial learners than for low-spatial learners. The application of the personalization principle in multimedia learning entails two rules to be explicitly implemented (Clark & Mayer, 2003). The first rule is the use of a conversational style rather than a formal style and the second is the employment of onscreen coaches or PAs to propagate learning engagements and performances.

In applying the online mode as a medium for disseminating the learning courseware, the cognitive flexibility theory argues that the World Wide Web is built from an ill-structured content full of complexities. Thus, oversimplification should be avoided to

ensure the integrity of the knowledge and skills acquired. It is also necessary to avoid knowledge compartmentalization (Spiro et al., 1992). Therefore it is essential for the student to navigate the content with assistance and help either cognitively or strategically to ensure that he or she obtains the fullest of what have been presented in a global outlook. Therefore, the use of an online learning mode with the assistance of the PA is supported substantially.

The practical model represents the instructional portion of the PA integration that utilizes and uses the cognitive apprenticeship model (Collins, Brown, & Nevman, 1989) to map the integration of the PA using an online learning mode. The model consists of five main elements; modelling, coaching, articulation, reflection, and exploration. The personalization principle of the cognitive multimedia learning theory suggests the use of an on-screen PA as an instructional approach in accompanying web based courseware (Clark & Mayer, 2003; Mayer, 2001). Details for each of these elements will be elaborated in the next chapter on literature review.

This study used two modes of PA (personalized and non-personalized PA) as the independent variable. While the personalized PA symbolized the higher level of personalization, the non-personalized PA represented the personalization at the lower level. For the dependent variables, the learning gains and the scores of the program rating sheet were manipulated to measure the performance and the level of software preferences. The learning gains were selected as an indicator of academic performance for all groups who participated in the study. The level of preferences of using PA-based software was measured using the program rating sheet. The moderator variable was the three classifications of the Strategy Inventory in Language Learning (SILL) i.e. high, medium, and low. Each of these variables will be explained in detail in Chapter 3 on research methodology and procedures. Thus, the pictorial representation of the theoretical framework of the study is illustrated in Figure 1.1.

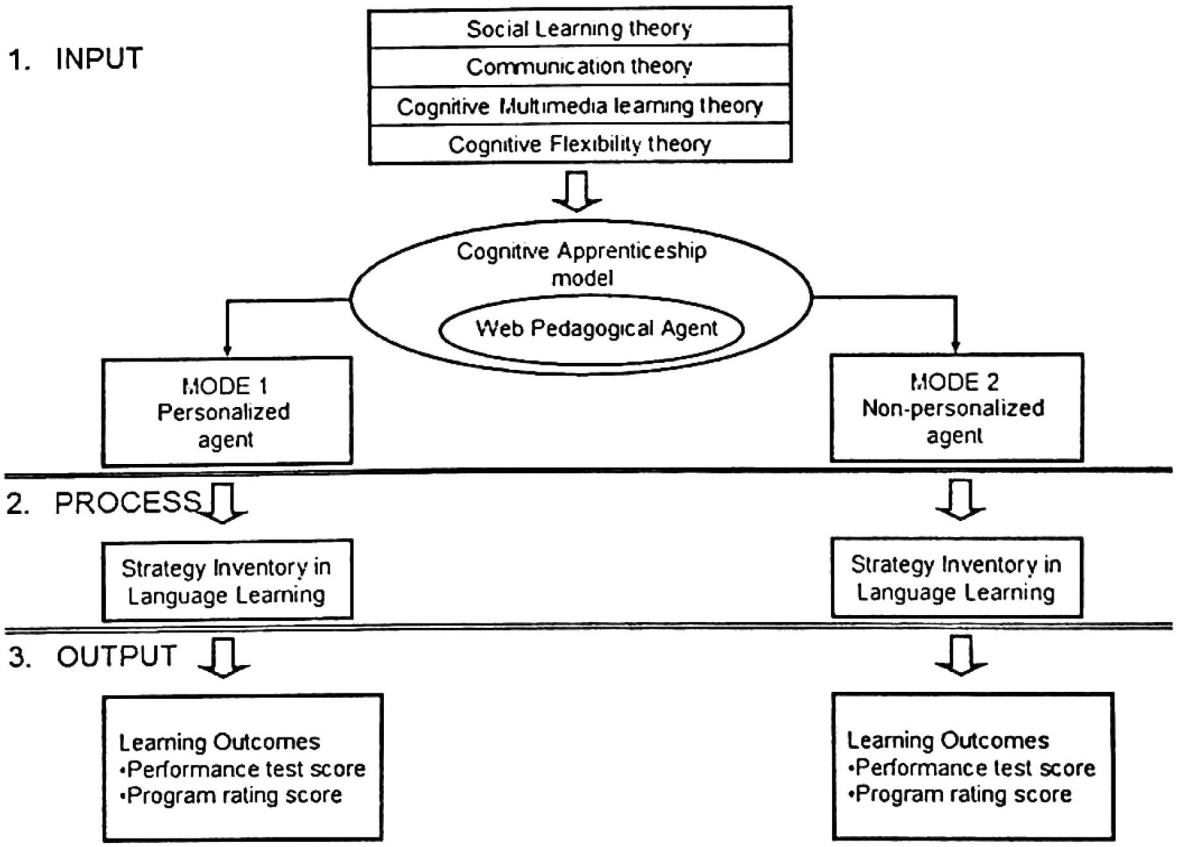

Figure 1.1 Research Framework of the Study

1.6 Research Questions

From the presented theoretical rationale the following questions were formulated;

1. Would students taught via a personalized pedagogical agent perform significantly higher than students taught via a non-personalized pedagogical agent in terms of performance and program rating score?

2. Would high frequency strategy students taught via a personalized pedagogical agent perform significantly higher than high frequency strategy students taught via a non-personalized pedagogical agent in performance and program rating score?

3. Would medium frequency strategy students taught via a personalized pedagogical agent perform significantly higher than medium frequency strategy

students taught via a non-personalized pedagogical agent in performance and program rating score?

4. Would low frequency strategy students taught via a personalized pedagogical agent perform significantly higher than low frequency strategy students taught via a non-personalized pedagogical agent in performance and program rating score?

5. Are there any interaction effects between the instructional methods and the levels of frequency strategy (high, medium, and low) on the performance and program rating score?

6. What are the components pertinent to the design and development of a web-based courseware with a pedagogical agent?

7. What are the issues deemed essential to the design and development of a web-base courseware with a pedagogical agent?

1.7 Research Hypotheses

H1 - Students taught via a personalized pedagogical agent will perform significantly better than students -taught via a non-personalized pedagogical agent.

H1.1 - Students taught via a personalized pedagogical agent will perform significantly better than students taught via a non-personalized pedagogical agent in performance.

H1.2 - Students taught via a personalized pedagogical agent will perform significantly better than students taught via a non-personalized pedagogical agent in program rating score.

H2 - High frequency strategy students taught via a personalized pedagogical agent will perform significantly better than high frequency strategy students taught via a non-personalized pedagogical agent.

H2.1 - High frequency strategy students taught via a personalized pedagogical agent will perform significantly better than high frequency strategy students taught via a non-personalized pedagogical agent in performance.

H2.2 - High frequency strategy students taught via a personalized pedagogical agent will perform significantly better than high frequency strategy students taught via a non-personalized pedagogical agent in program rating score.

H3 - Medium frequency strategy students taught via a personalized pedagogical agent will perform significantly better than medium frequency strategy students taught via a non-personalized pedagogical agent.

H3.1 - Medium frequency strategy students taught via a personalized pedagogical agent will perform significantly better than medium frequency strategy students taught via a non-personalized pedagogical agent in performance.

H3.2 - Medium frequency strategy students taught via a personalized pedagogical agent will perform significantly better than medium frequency strategy students taught via a non-personalized pedagogical agent in program rating score.

H4 - Low frequency strategy students taught via a personalized pedagogical agent will perform significantly better than low frequency strategy students taught via a non-personalized pedagogical agent.

H4.1 - Low frequency strategy students taught via a personalized pedagogical agent will perform significantly better than low frequency strategy students taught via a non-personalized pedagogical agent in performance.

H4.2 - Low frequency strategy students taught via a personalized pedagogical agent will perform significantly better than low frequency strategy students taught via a non-personalized pedagogical agent in program rating score.

H5 - There is no interaction effect between the instructional methods and the levels of frequency strategy (high, medium, and low) on performance and program rating score.

The level of significance in all statistical analyses for this study was set at ($p = 0.05$).

1.8 Limitations and Delimitations

In terms of generalization, the results of this study are limited by:

1. it is confined to the use of web pedagogical agent on a selected topic of the holy city of *Al-Quds* at the advanced level of Arabic language. Thus, the results of this study could not be generalized to other levels of the Arabic language i.e. beginning and intermediate,
2. it is confined to the students of Arabic language at the advanced level at the Centre for Languages, International Islamic University Malaysia. Thus, the results and outcomes of this study may apply to the aforementioned institution exclusively due to the characteristics and in fact the environment of the study itself,
3. it is confined to the testing of four question formats to represent learning attainment; *agree-disagree, matching, factual recall*, and *open-ended question*. The study does not include a *retention test* and only four aspects of language comprehension were included. Other language elements, such as grammar and morphology as well as sentence structure are not within the scope of this study,
4. it is confined to an environment where the online teaching and learning is provided as a supplementary reference to learners. Other online teaching and learning modes such as hybrid mode, a combination of online teaching-learning, face-to-face sessions, and CD-based multimedia presentations, and purely online mode are not within the scope of this study,
5. it is confined to the normal way on accessing online learning materials where the materials can be obtained anywhere and at any place. Thus, several aspects such as discussions and sharing of experiences are out of the researcher's control though precautions have been taken to prevent them from occurring.

1.9 Operational Terms

Pedagogical agent (PA) - an on screen character who helps and guides the learning process during an online interaction. This study uses a cartoon-like character to represent the PA.

Personalized mode (PPA) - a learning mode which includes dialogue conversation, social cues (eye movement, gestures, motion and facial expressions), and indirect feedback as represented by the PA.

Non-personalized mode (NPPA) - a learning mode which includes monologue conversation without any hints or social cues and direct feedback as represented by the pedagogical agent.

Strategies inventory for language learning (SILL) - an inventory to survey the learning strategies applied by the language learners which later classifies them to three categories: high, medium, or low.

Program rating sheet - a test adapted from Moreno's (1999) agent based software favourableness survey to measure the level of preferences of using an agent- based application.

Performance test - a test developed by the researcher to measure knowledge on the materials as well as learning gains obtained after using the web-based courseware.

Performance - the scores of the performance test

Learning gains - the scores of the post-test deducted by the scores of the pre-test.

Language strategy - strategies used in acquiring language, such as, guessing, asking questions and self-monitoring.

High frequency strategy students - students whose average scores for the SILL are equal to or above 3.5.

Medium frequency strategy students - students whose average scores for the SILL are equal to or below 3.4 but equal to or above 2.5.

Low frequency strategy students - students whose average scores for the SILL are equal to or below 2.4.

Design - the designing process of the web courseware used in this research which includes writing objectives, generating teaching-learning ideas, and collecting the related resources.

Development - the development process of the web courseware used in this research which includes preparing the programming codes, and providing supporting materials.

Web courseware - a complete learning module delivered via the web which consists of materials, such as, reading texts, audios, and video clips under the broad theme of the holy city of *Al-Quds*.

1.10 Summary

Studies have shown positive relationship between levels of personalization integrated into teaching materials and learning outcomes. Three elements (social cues, dialogue conversation, and indirect feedback) were included to represent the higher level of personalization. Thus, two modes of presentation were designed and developed; (1) personalized PA and (2) non-personalized PA. The application of a PA in the teaching-learning process has been substantiated by several studies (Vygotsky, 1978; Reeves & Nass, 1996; Clark & Mayer, 2003). Moreover, the study seeks to examine the components and issues pertinent to the design and development of a web courseware with a pedagogical agent.

CHAPTER TWO

REVIEW OF RELEVANT LITERATURE

2.1 Overview

This study examines effects of pedagogical agents with different levels of personalization on the performance and the score of the program rating sheet which measures preferences in using a software with a pedagogical agent (PA). The presentations of multimedia learning materials in the current study are web-based in nature. Thus, studies conducted and documented in the field of multimedia learning as well as teaching-learning via the web format are to be included and reviewed in this chapter. This effort seeks to shed some light in understanding the nature of web-based multimedia learning processes, particularly, the elements pertinent to this study. The research questions and hypotheses are further expanded through this literature review.

This chapter has been divided into four main parts; (1) language learning via online facilities; (2) social agents and learning; (3) evidence from multimedia learning principles; and (4) strategies for acquiring a second language. The findings are summarized and presented as a conclusion for this chapter.

2.2 Language Learning and the Web

2.2.1 The Nature of Second Language Acquisition (SLA)

Language acquisition theories fall along a continuum with empiricist views at one side and rationalist or mentalist views on the other end of this continuum (Hadley, 1993). The rationalists claim that human beings have an innate capability of language development which is genetically inherited to develop his or her linguistic system (Chomsky, 1965).

On the other hand, the empiricists argue that the learner's experience is the main influence of acquiring a language and is more important than any specific innate capacity (Larsen-Freeman, 1991). According to empiricists, there is no special innate device to support language ability. The process of language acquisition is merely one aspect of learning similar to other types of general learning and capacity. The classification of a third language acquisition theory assumes that both the innate capacity and the learner's experience have to be taken into account. This combination is termed as interactionist theory of Second Language Acquisition (SLA) (Larsen-Freeman, 1991).

Krashen's (1982) monitor theory and Chomsky's (1965) notion of universal grammar represent the typical theories among mentalists to explain the process of language acquisition. According to Chomsky, language is a species-specific genetically determined capacity which is controlled by the biological mechanism. His notion of innateness in human's language acquisition leads to the discovery of a fixed set of linguistics features in all languages which he termed as universal grammar or language. He classified these grammar elements into two categories; core and peripheral grammar. While the former is in line with the idea of universal grammar, the later is composed of elements that are excluded from it.

Similarly, Krashen (1982) also claims the existence of natural elements in language acquisition which he called the language device or the black box. He insists that for the language to be mastered skillfully the process of acquiring it should be as natural as possible. Therefore, according to Krashen (1982), motivation and anxiety-free environments are important factors for ensuring that the language acquisition can take place and learning is a success. In doing so, error correction should be minimized and the input should be designed to be as comprehensible as possible. This leads to his notion of comprehensible input which basically means providing the learner with a

learning content at a slightly higher level as compared to his or her existing level of language proficiency.

On the other hand, empiricists focus more on the learner's experience and not on any existing innate biological mechanism. This can be illustrated in Schumann's (1978) acculturation model. According to Schumann (1978), acquiring a language is a process of accommodating oneself to a new culture. In this case, the mutual relation between the learner's community and the target language community is crucial to the success of the language acquisition process. The degree of which the learner is able to accommodate to the target language determines the degree of which this language can be acquired. There are several factors affecting the process of acculturation which include attitude, social dominance, and cultural congruence. These elements have been grouped together under a big umbrella of social dominance. Psychological dominance, on the other hand, jointly affects the degree of acculturation obtained. This includes factors, such as, language shock, culture shock, and motivation.

The third group of interactionists is more comprehensive because it takes into considerations both the innate and environmental factors to explain language learning (Larsen-Freeman & Long, 1991). Givon's (1981) functional and typological theory explains language acquisition from an interactionist point of view. It is functional due to the analyses of functional syntactic structures depicted from human discourse and typological due to the considerations of the diversity for all languages, and not restricted to one single language or language family. He differentiates two modes of language communication; pragmatic and syntactic. He further claims that the move of language change resides from pragmatic to syntactic. He called this change as a process of syntacticization which consists of characteristics contrasting in both pragmatic and syntactic modes.

The theories presented by mentalists, empiricists, and ineractionists have received many critiques from SLA researchers. The explicit flaws embedded in some theories, such as Chomsky's universal grammar and Krashen's monitor theory leads to the question of validity and reliability of the approaches chosen. Moreover, Schumann's effort to predict one's language acquisition based on group level phenomenon is questionable and rarely produces an anticipated outcome. Similarly, Givon's differentiation of pragmatic and syntactic modes of communication is hard to comprehend and in actual reality may be biased towards written data as compared to natural speech data. The data in a written format are easier to quantify and less problematic as compared to the data in a spoken format (Larsen-Freeman & Long, 1991).

Nonetheless, these theories contributed to the body of knowledge particularly in understanding the process of language acquisition. It is incorrect to consider one theory to be all incompetent when compared to others due to the complexities and multi-faceted features that language acquisition has shown. Additionally, all these theories share one important characteristic of language acquisition that is for the language to be acquired at the mastery level, an environment which is conducive to learning should be made available to the learner. This opportunity would then enable the learner to immerse himself in the environment and be acquainted with the surroundings. Apparently, this brings about the usefulness of offering technology to assist in creating a comprehensible input due to the unlimited capabilities that this tool has provided.

2.2.2 Computer-Assisted Language Learning (CALL)

The application of technology for the teaching and learning processes has been attributed to various concepts related to the degree of its integration and adoption. Some of the concepts are Computer-Aided Instruction (CAI), Computer-Assisted

Learning (CAL), Computer-Based Training (CBT), and Computer-Assisted Language Learning (CALL). The notion of CALL has been specifically designated to the application of the computer technology for the purposes of teaching and learning a language.

The development of CALL has encompassed processes which includes phases for learning and cognition beginning from behaviourism to cognitivism and finally to constructivism (Warschauer, 1996). Behaviourism focuses on stimulus and response process which later formulated in a form of familiarizing one's self to a task required through ongoing repetitive orientation. Cognitivism appears to overcome aspects which have been a matter of neglect among behaviourists. These include the understanding of the knowledge and one's own process of learning (Piaget, 1970). In the field of language learning and teaching, this notion of acquiring language skills has been translated into communicative approach where the focus is on the language skills acquisition with the ability to practice them in any situation and condition (Hadley, 1993). With the major concentration that has always been the student as a centric focus, constructivism plays an active role to ensure that the student could experience the process of knowledge acquisition through his or her perception, or through interaction with peers and other friends (Duffy & Cunningham, 1996).

However, Bax (2003) provides a more critical view of CALL categorization from different perspective for attaining "more detailed analyses of institutions and classrooms than earlier analyses." He proposed three categories of CALL; restricted, open and integrated. By restricted, it means that those software or computer programs which propagate language at its system level, such as closed drills and quizzes. The second category of open CALL offers more on the system as well as skills required to master the target language which include simulations, and games software. Integrative CALL goes one step further to the application of this knowledge of language system

and skills for communication purposes. The software of this type include programs, such as computer mediated communication (CMC), electronic mail (e-mail), and word processor used during performing collaborative work and tasks.

Though computers have been used for teaching and learning language in particular, researchers of second language acquisition (SLA) are still interested in knowing how suitable activities could be managed among student and to what extent the meaningful interaction could be carried out. Chapelle (1997), for instance, outlines the need for SLA to develop CALL research agenda which includes CALL activities and the nature of language interaction achieved throughout these activities. Additionally, Harrington and Levy (2003) posit the differences between using the CMC software from the face-to-face (FTF) interaction which demonstrates the use of language from a more complicated dimension. They signified that the nature of interaction in CMC is more complicated when compared to the interaction generated in the traditional FTF. This brings about the need to analyze the CALL within the CMC perspective which is different from the previous analyses which were mainly based on "interaction account" (Long, 1996). In the midst of carrying suitable CALL activities, Gonzalez-LLoret (2003) proposes a networked environment delivered via the web. Though it is based on the principles formulated for teaching and learning language through multimedia (Chapelle, 1998), the framework proposed by Gonzalez-LLoret (2003) could be used for the basis of analyzing the interaction generated from the activities.

The development of theories and principles for multimedia learning has affected the field of language acquisition as well as other science or technical based disciplines. Plass (1998), for instance, uses cognitive based multimedia principles (Mayer, 2001) for the development of a program called "CyberBuch". Here, the cognitive approach is the basis of the analysis which consists of three main components; (1) working memory model (Baddeley, 1992); (2) Paivio's dual-coding theory (1986); and (3) cognitive load

theory (Sweller & Chandler, 1994). Each of these components will be discussed in details in the following sections.

2.2.3 CALL and the Web

The web has long been utilized to facilitate language teaching and learning process due to its capabilities, particularly its abilities to provide a one stop source of information and opportunities for language learners to communicate among themselves either synchronously through chat and online messenger or asynchronously through bulletin board and electronic mail (e-mail). A more advanced language application could also be designed through the web medium which will tackle several aspects of language characteristics, such as, reading a text, listening to an audio, analyzing grammar elements, and building sentences, as well as identifying word structures. For instance, Tsiriga and Virvou (2001) have designed a web tool called the Intelligent Computer Assisted Language Learning (ICALL) to facilitate the acquiring of English language among its non-native speakers. The tool uses a remedial system to provide feedback to students in acquiring one aspect of English grammar i.e. passive voice. Moreover, the program provides them with useful feedback and more individualized instructions.

The acceptance of the web is not solely founded by its very capabilities of providing assistance and facilities to language learners. In fact, psychological ratification scored a high level of acceptance. Elements such as, motivation, perception, and experience were but a few that convey the scenario in a clear picture. Stepp-Greany (2002), for instance, found that students have demonstrated a positive view of learning through the use of the web. They perceived favorably the role of instructor and were able to enhance their skills of acquiring cultural knowledge, listening and reading, and other independent skills, such as, ways of acquiring information, self regulatory, and time management. In supporting the evidence, Osuna and Meskill (1998) have found that

the web is a suitable tool to increase language acquisition and cultural knowledge. Moreover, the students' psychological aspects of motivation were also favorably improved. Nevertheless, Warschauer (2000) delineates that integration of the learning materials on the web must be conducted purposefully, effectively, and in a delicate manner. While the content should be student-centered in nature, a moderate control has been handed over to the student in planning and implementing his or her learning activities.

As noted, the student's experience on the web use plays an important role and is considered as a determinant for the acceptance of this tool and later enhancement of his or her language skills. Several aspects related to advantages of using this tool were reported. These included time flexibility, learning reinforcement, privacy, and its role as a resource of providing information. The study, however, also reported several aspects considered as the source of burden of using this tool for language acquisition, such as, distraction, absence of teacher and personal interaction, as well as the lack of speaking practice.

In the area of distance learning, the web has been applied as a mediator between the instructor and his or her students. Strambi and Bouvet (2003) examined the necessity of having a hybrid approach of language learning and teaching through a combination of web based learning materials and non-web materials, such as, CD-ROM, hand-outs, and brochures. In Malaysia, University of Tun Abdul Razak (UNITAR) is one of the higher learning institutions that employs a hybrid approach by combining the use of the non-web and web based learning materials. In fact, the importance of face-to-face interaction is also taken into consideration as one element to be carried out during the period of semester study at various intervals (Alhabshi, 2002).

Furthermore, several steps have been taken to identify language skills that are closely relevant to the web. For instance, Harris (2003) found that reading and listening would be the most influential language skills to be incorporated into this learning tool. Although speaking posits some difficulties for the integration, it could easily be handled through other non-web materials. However, it is expected that new advancement and innovations will soon be discovered and eventually will ease the integration of the other language skills including speaking as well as writing into the web. For example, Collentine (2000) demonstrates the use of the web for teaching grammar purposes. He uses tracking technologies to identify modes of development among the students in acquiring grammar elements. The development of grammar acquisition can be interpreted using the data obtained from the tracking procedure. This includes types of grammar error produced, frequency of the errors, and time intervals of when these errors happen. Moreover, similar approach of using the web has been adopted to study students' learning behavior in acquiring reading comprehension skills (Lomicka, 1998). Here, two types of reading texts have been composed; the first contained glossary function and the second is without such function. The data collected from this research were used to better understand students' learning styles in acquiring these skills.

Additionally, efforts have been conducted to simulate an environment in easing the acquisition of these skills. With the use of a virtual classroom, for instance, all functions can be imitated and to a certain extent similar to the traditional classroom with the exception of physical contact. This would benefit language students who are acquiring language via a distance learning mode (William, 1999). Activities such as online discussion, chat, information browsing, and audio listening can be conducted in this virtual classroom. Students would then be equipped with the necessary knowledge of computer skills in understanding the functions and the user interface design of the tool prior to its usage. Nevertheless, such environment expects high responsibility from the

students in regulating their learning styles and strategies, particularly in comprehending the given materials. Only then will this tool contribute to the effectiveness and efficiency of the learning and teaching process.

2.2.4 Teaching-learning Through the Web

Teachers play an important role in the teaching-learning process. The integration of the web is not to be understood as a replacement to the essential role of teacher. Rather, it is a complementary element to fulfill the rubric of learning experience owned by the students. Stepp-Greany (2002) reports that students are aware of the importance of the teacher's role and at the same time appreciate the richness of information that the web provides them in order to enhance their learning skills and promote their cultural knowledge. In view of the promising future of the web integration, Liaw (2002) outlines several similarities and differences between the use of computer and the use of the web for educational purposes. In order to achieve the goal, data related to students' attitudes on both mediums have been gathered. The study provides insightful view of the relationship, studied variables and information pertinent to demographic data between the two.

The emergence of constructivism as a thinking and practicing paradigm has contributed to the web usage penetration in the society, in particular, academic communities. Constructivism was based on the premises that one acquires the knowledge through his own self-experience and build on that basis his own understanding of the acquired targeted knowledge constructively through continuous guiding, coaching, and scaffolding (Duffy & Cunningham, 1996). Two main arguments of constructivism are; (1) learning is an active process of constructing rather than acquiring knowledge, (2) instruction provided is a process of constructing rather than communicating knowledge. Both position the individual as a centric body who manages the process of knowledge construction. It differs from cognitivism which

claims that an individual acquires knowledge through assimilation and accommodation in order to build his or her schemata or accumulated knowledge. Behaviorism, on the other hand, focuses on the process of stimulus and response which would eventually create habitual effect through reinforcement on the assigned tasks.

Jonassen (1999) proposes a learning situation that he termed as constructivist learning environment (CLE) to promote constructivist learning styles of acquiring knowledge. The model of CLE has been characterized as manipulative, constructive, collaborative, conversational, reflective, contextualized, complex, and intentional. Each of these components is interrelated to one another producing solid environment suitable to accommodate constructivist flexible learning styles. Given that the web has the similar characteristics matched to constructivism paradigm, the similar model could also be employed to the use of web for disseminating knowledge. For instance, Taylor and Maor (2000) conducted a study on this field focusing the extent of constructivist learning styles among students. The study highlights aspects pertinent to the process of acquiring knowledge which include relevance, interactivity, reflective, cognitive, affective, and interpretation. This leads to the discovery of quality needed for online learning environment. They conclude that the results are not a stand alone entity. In fact, these outcomes should be interpreted hand in hand with the other findings or data relevant to the study. Therefore, higher expectations on online learning do not necessarily contribute to the higher academic achievement and vice versa. It is, however, accepted that individualized instruction is a prerequisite before these outcomes could be justified. Other than the CLE model for developing web content, several other models have also been suggested to be used, such as motivational framework for web based instruction (Duchastel, 1997) and collaboration model (McLellan, 1997).