COGNITIVE EFFECTS OF CONSTRUCTIVIST AND OBJECTIVIST INSTRUCTIONAL COURSEWARE ON ADULT LEARNERS WITH DIFFERENT PSYCHOLOGICAL PROFILES

NAM-OI MITRAKUL

UNIVERSITI SAINS MALAYSIA

2010

COGNITIVE EFFECTS OF CONSTRUCTIVIST AND OBJECTIVIST INSTRUCTIONAL COURSEWARE ON ADULT LEARNERS WITH DIFFERENT PSYCHOLOGICAL PROFILES

by

NAM-OI MITRAKUL

Thesis submitted in fulfilment of the requirements
for the degree of
Doctor of Philosophy

January 2010

ACKNOWLEDGEMENTS

This research will not be complete without the advice and assistance provided by many persons to whom I would like to express my immense gratitude. The first person is Professor Dr. Ng Wai Kong, who has helped to ignite a good start, without whom this research might not have been smoothly completed. Upon his retirement, Associate Professor Dr. Toh Seong Chong took over as the main supervisor for this research.

I would like to express my deepest appreciation and sincere gratitude to Associate Professor Dr. Toh Seong Chong, for his support and encouragement throughout this work. Without his invaluable guidance, incisive advice, patience, enthusiasm and general contribution of his valuable time in supervising the design of multimedia courseware, I would not able to proceed and bring this work to fruition.

I would like to express my profound gratitude to the Dean of the School of Educational Studies, Professor Dr. Abdul Rashid Mohamed and also to all the lecturers and officials at Universiti Sains Malaysia who had helped provide knowledge and facilities for this research work, especially those in the Centre for Instructional Technology and Multimedia and the School of Educational Studies, Universiti Sains Malaysia.

Special thanks to Computer Centre and Language Centre of Office of Academic Resources and Information Technology, Suratthani Rajabhat University, who have provided facilities for my study. I would also like to thank Mr. Muhammad Somree Manmad, my student, who has provided technical support and assistance during the experimental study. I am also grateful to my colleagues, Mr. Chris Hawes,

for providing the English language narration of the courseware and Mrs. Kojakorn Pengsri for helping me to analyze the data.

My sincere thanks are also extended to Mr. Jonathan Roberts for proof-reading the final draft of the thesis. I am also grateful to my Malaysian friend, Mr. Ahmad Jihadi Abu Samah, for translating the abstract from the English version to the Bahasa Melayu version. His helpfulness as well as the kindness he showed me throughout the time of our studies at CITM, USM, will always be treasured in my heart. One of the friends whom I will never forget is Dr. Ibrahim Mohammad Ali Jobeili, my fellow graduate student from Jordan who has provided valuable input during the initial stage of this study.

I would like to gratefully acknowledge the Rajabhat Surratthani University, the institute in which I am working, for providing the financial support as well as allowing me to take study leave to embark on this study.

Above all, I am grateful to my dear parents, brothers and my loving husband, Mr. Kanit Mitrakul, for their unfailing love, understanding, sacrifice, financial, and moral support. They are the wind behind my wings that has enabled me to soar to greater heights.

TABLES OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ABBREVIATIONS

CICM : Constructivist Instructional Courseware Mode

OICM : Objectivist Instructional Courseware Mode

LS1 : diverger

LS2 : assimilator

LS3 : converger

LS4 : accommodator

FI : field-independent

FD : field-dependent

I : internal locus of control

E : external locus of control

KESAN KOGNITIF KOSWER PENGAJARAN KONSTRUKTIVIS DAN OBJEKTIVIS TERHADAP PELAJAR DEWASA PELBAGAI PROFIL PSIKOOGI

ABSTRAK

Kajian ini dijalankan untuk mengkaji kesan koswer multimedia pengajaran bagi pelajar dewasa di Universiti Rajabhat, Thailand. Dua koswer multimedia yang mengandungi isi kandungan yang sama tetapi mod pengajaran berlainan dibangunkan, iaitu, Koswer Mod Pengajaran Konstruktivis (CICM) dan Koswer Mod Pengajaran Objektivis (OICM). Koswer CICM diberi kepada 122 pelajar dewasa manakala koswer OICM diberi kepada 126 pelajar dewasa. Kajian eksperimen-kuasi ini menggunakan reka bentuk faktorial 2 x 4 dan ulangan 2 x 2.

Pembolehubah tidak bersandar adalah dua pendekatan multimedia berlainan iaitu CICM dan OICM, manakala pembolehubah bersandar ialah pencapaian pelajar. Pembolehubah *moderator* adalah gaya pembelajaran pelajar, (*diverger, assimilator, converger atau accommodator*), gaya kognitif (*field-independent, FI atau field-dependent, FD)* serta lokus kawalan (*lokus kawalan dalaman, I, atau lokus kawalan luaran,E).*

Kajian ini mendapati bahawa (i) pencapaian pelajar dewasa CICM lebih baik secara signifikan berbanding pelajar dewasa OICM; (ii) mod CICM dan mod OICM member kesan hampir sama kepada pelajar *diverger, assimilator, converger* dan *accommodator*; (iii) pelajar *diverger, assimilator* dan *accommodator* dalam mod CICM menunjukkan pencapaian lebih baik secara signifikan berbanding pelajar dari mod OICM; (iv) pelajar *field-independent* mendapat pencapaian lebih baik secara signifikan berbanding pelajar *field-dependent;* (v) pelajar *field-independent* dalam

mod CICM mendapat pencapaian lebih baik secara signifikan manakala mod CICM dan mod OICM adalah mempunyai keberkesanan yang sama bagi pelajar *field-dependent;* (vi) mod CICM dan mod OICM memberi kesan yang sama bagi pelajar lokus kawalan dalaman (I) serta pelajar lokus kawalan luaran; (vii) pelajar lokus kawalan dalaman dalam mod CICM mencatatkan pencapaian lebih baik secara signifikan berbanding pelajar dari mod OICM manakala mod CICM dan mod OICM menpunyai keberkesanan yang sama bagi pelajar lokus kawalan luaran; (viii) kesan interaksi antara gaya pembelajaran pelajar dan mod pengajaran adalah tidak signifikan. Begitu juga antara gaya kognitif dan lokus kawalan.

Kesimpulan kajian ini ialah koswer yang menggunakan pendekatan konstruktivis mempunyai kesan positif dalam pembelajaran “Reka Bentuk Grafik”. Kajian ini turut menyarankan bahawa para pendidik harus memilih strategi pengajaran sempurna untuk memenuhi keperluan pelajar dewasa serta mengambil kira perbezaan individu dari segi gaya pembelajaran, gaya kognitif dan lokus kawalan.

COGNITIVE EFFECTS OF CONSTRUCTIVIST AND OBJECTIVIST INSTRUCTIONAL COURSEWARE ON ADULT LEARNERS WITH DIFFERENT PSYCHOLOGICAL PROFILES

ABSTRACT

This study is conducted to examine the effects of a multimedia instructional courseware for adult learners at the Rajabhat University, Thailand. Two multimedia courseware with similar contents but different instructional modes were developed, namely, the Constructivist Instructional Courseware Mode (CICM) and the Objectivist Instructional Courseware Mode (OICM). The CICM was assigned to 122 adult learners whereas the OICM was assigned to 126 adult learners. This quasi-experimental study employed 2 x 4 and repeated 2 x 2 factorial design. The independent variables were multimedia approaches, i.e. the CICM and the OICM, whereas the dependent variable was the learners' achievement. The moderator variables were learners' learning styles (diverger or assimilator or converger or accommodator), cognitive styles (field-independent, FI or field- dependent, FD) and locus of control (internal locus of control, I, or external locus of control, E).

This study found that (i) the CICM adult learners performed significantly better than the OICM adult learners; (ii) the CICM mode and the OICM provided almost equivalent benefits to all diverger learners, assimilator learners, converger learners and accommodator learners; (iii) diverger learners, assimilator learners, and accommodator learners of the CICM mode performed significantly better than the OICM mode; (iv) the field-independent learners performed significantly better than the field-dependent learners; (v) the field-independent learners of the CICM mode performed significantly better than the OICM mode whereas CICM and OICM were equally effective for the field-dependent learners; (vi) the CICM mode and the OICM

provided equivalent benefits for both the internal locus of control (I) learners as well as the external locus of control (E) learners; (vii) the internal locus of control learners of the CICM mode performed significantly better than the OICM mode whereas CICM and OICM were equally effective for the external locus of control learners ;(viii) the interaction effect between the learners' learning styles and the two instructional modes is not significant. It is also the same as cognitive styles and locus of control.

The conclusion of this study was supportive of positive value of employing a constructivist instruction courseware on the learning of "Graphics Design". This study suggested that the practicing teachers should select the best instructional strategies to meet the needs for adult learners and to accommodate individual differences in terms of learning styles, cognitive styles, and locus of control.

KESAN KOGNITIF KOSWER PENGAJARAN KONSTRUKTIVIS DAN OBJEKTIVIS TERHADAP PELAJAR DEWASA PELBAGAI PROFIL PSIKOOGI

ABSTRAK

Kajian ini dijalankan untuk mengkaji kesan koswer multimedia pengajaran bagi pelajar kewasa di Universiti Rajabhat, Thailand. Dua koswer multimedia yang mengandungi isi kandungan yang sama tetapi mod pengajaran berlainan dibangunkan, iaitu, Koswer Mod Pengajaran Konstruktivis (CICM) dan Koswer Mod Pengajaran Objektivis (OICM). Koswer CICM diberi kepada 122 pelajar dewasa manakala koswer OICM diberi kepada 126 pelajar dewasa. Kajian eksperimen kuasi ini menggunakan reka bentuk factorial ulangan 2 x 4, 2 x 2 dan 2 x 3.

Pembolehubah tidak bersandar adalah dua pendekatan multimedia berlainan iaitu CICM dan OICM, manakala pembolehubah bersandar pencapaian pelajar. Pembolehubah *moderator* adalah gaya pembelajaran pelajar, (*diverger, assililator, converger atau accommodator*), gaya kognitif (*field-independent, FI atau field-dependent, FD)* serta lokus kawalan (*independent, I, atau powerful others, P atau chance, C).*

Kajian ini mendapati bahawa (i) pencapaian pelajar dewasa CICM lebih baik secara signifikan berbanding pelajar dewasa OICM; (ii) mod CICM dan mod OICM member kesan hampir sama kepada pelajar *diverger, assimilator, converger* dan *accommodator*; (iii) pelajar *diverger, assmiilator* dan *accommodator* dalam mod CICM mencapai lebih baik secara signifikan berbanding pelajar dari mod OICM; (iv) pelajar *field-independent* mendapai lebih baik secara signifikan berbanding pelajar *field-dependent;* (v) pelajar *field-independent* dalam mod CICM mencapai lebih baik secara signifikan manakala mod CICM dan mod OICM adalah mempunyai

keberkesanan yang sama bagi pelajar *field-dependent;* (vi) mod CICM dan mod OICM memberi kesan yang sama bagi pelajar lokus kawalan dalaman (I) serta pelajar lokus kawalan luaran (P dan C); (vii) pelajar lokus kawalan dalaman dalam mod CICM mencapai lebih baik secara signifikan berbanding pelajar dari mod OICM manakala mod CICM dan mod OICM menpunyai keberkesanan yang sama bagi pelajar lokus kawalan luaran; (viii) kesan interaksi antara gaya pembelajaran dan mod pengajaran adalah tidak signifikan. Begitu juga antara gaya kognitif dan lokus kawalan.

Kesimpulan kajian ini ialah koswer yang menggunakan pendekatan konstrukktivis mempunyai kesan positif dalam pembelajaran “Reka Bentuk Grafik”. Kajian ini menyarankan pendidik harus memilih strategi pengajaran terbaik untuk memenuhi keperluan pelajar dewasa serta mengambil kira perbezaan individu dari segi gaya pembelajaran, gaya kognitif dan lokus kawalan.

COGNITIVE EFFECTS OF CONSTRUCTIVIST AND OBJECTIVIST INSTRUCTIONAL COURSEWARE ON ADULT LEARNERS WITH DIFFERENT PSYCHOLOGICAL PROFILES

ABSTRACT

This study is conducted to examine the effects of a multimedia instructional courseware for adult learners at the Rajabhat University, Thailand. Two multimedia courseware with similar contents but different instructional modes were developed, namely, the Constructivist Instructional Courseware Mode (CICM) and the Objectivist Instructional Courseware Mode (OICM). The CICM was assigned to 122 adult learners whereas the OICM was assigned to 126 adult learners. This quasi-experimental study employed repeated 2 x 4, 2 x 2, and 2 x 3 factorial design. The independent variables were multimedia approaches, i.e. the CICM and the OICM, whereas the dependent variable was the learners' achievement. The moderator variables were learners' learning styles (diverger or assimilator or converger or accommodator), cognitive styles (field-independent, FI or field- dependent, FD) and locus of control (independent, I or powerful others, P or chance, C).

This study found that (i) the CICM adult learners performed significantly better than the OICM adult learners; (ii) the CICM mode and the OICM provided almost equivalent benefits to all diverger learners, assimilator learners, converger learners and accommodator learners; (iii) diverger learners, assimilator learners, and accommodator learners of the CICM mode performed significantly better than the OICM mode; (iv) the field-independent learners performed significantly better than the field-dependent learners; (v) the field-independent learners of the CICM mode performed significantly better than the OICM mode whereas CICM and OICM were equally effective for the field-dependent learners; (vi) the CICM mode and the OICM

provided equivalent benefits for both the internal locus of control learners (I) learners as well as the external locus of control (P and C) learners; (vii) the internal locus of control learners of the CICM mode performed significantly better than the OICM mode whereas CICM and OICM were equally effective for the external locus of control learners ;(viii) the interaction effect between the learners' learning styles and the two instructional modes is not significant. It is also the same as cognitive styles and locus of control.

The conclusion of this study was supportive of positive value of employing a constructivist instruction courseware on the learning of "Graphics Design". This study suggested that the practicing teachers should select the best instructional strategies to meet the needs for adult learners and to accommodate individual differences in terms of learning styles, cognitive styles, and locus of control.

CHAPTER 1

INTRODUCTION

1.0 Background to the Problem Statement

The Thai educational system is currently based on the concept of lifelong learning. It consists of three types of education, namely, the formal, non-formal, and informal. In this section, the Formal Education of the Thai Educational System is discussed. The National Education Act of B.E. 2542 (1999) divides the formal education into two levels, namely the Basic Education and Higher Education (Office of the National Education Commission, 2002).

- *Basic Education*

Basic Education comprises of the pre-primary education (two years), the Primary Education (six years), the Lower Secondary Education (three years), and the Upper Secondary Education (three years).

- *Higher Education*

The Higher Education is under the supervision of the Ministry of Education (MOE) and Ministry of University Affairs (MUA), which comprises the following:

- Diploma level / Lower Degree

The Higher education for diploma level or lower degree is mainly offered by colleges and institution under the MOE. It offers vocational and teacher education for two years only of study.

- Degree level

The MOE and MUA provide the majority of teaching and learning at the degree level. The study program requires two years of study for students who have

completed diploma courses, and four to six years if the student enters university from the upper secondary education or equivalent level.

The intellectual assets of a country are defined as the people's intellectual capabilities, their creativity and learning abilities. Thus, basic education should be provided to people regardless of status to enhance their capabilities. In order to cultivate the intellectual capabilities of its people, a nation must establish an open educational system enabling its citizens to display their maximum creativity and fully realize their potentials (The Nation. 1999, December, 3).

In Thailand, some schools often do not encourage students to show their creativity in learning. The teacher is the center of the learning process using the traditional teaching style of standing at the front and giving a lecture. The "chalk and talk" style relies solely on lectures and rote memorization with limited topics provided in the curricula with no alternatives. This situation discourages the development of creativity and individuality among students at all levels particularly in the elementary and secondary schools.

In contrast, the creation of a more diverse and flexible educational system with an emphasis on cultivating creativity can truly develop the innate potential of a learner. This "learner-oriented" or "student-centred" approach provides the learner an opportunity to choose the subjects that are relevant and useful to them, which in turn motivates the student to develop a keen interest in the subjects that they has chosen

Recognizing the urgent need for educational reforms, the Thai Government through the Prime Ministers' Office under the National Education Commission (ONEC) formulated policies to bring about the necessary changes within the Thai

Educational system. An initial need of assessment research for the country was carried out nationwide and also drew on successful experiences from other countries. A comprehensive set of guidelines was subsequently formulated encompassing various educational provisions to be applied in the Thai Educational System (The Nation. 1999, December 8).

The National Education Act of B.E. 2542 (1999) is Thailand's main piece of legislation for education, providing the framework for the educational reforms. The major aspects of the reforms included the following:

1. On the learning reforms, giving the highest importance to learners. ONEC conducted an extensive research on the development of learner-oriented education, which enabled students to develop their individual potential at their own pace. The results were disseminated for application on a nationwide scale.
2. On the administrative reforms, it included adjustments and upgrading of the teaching profession by providing a system for teachers, faculty, and educational personnel, to increase efficiency in the utilization of resources and investment for educational purposes. The Educational Reform Office was established to make proposals, with inclusion of necessary legislations to ensure implementation of the activities.
3. A range of legislation and regulations were prepared or amended by the National Education Act on the learning reforms as the main concern. Section 22 states that *"education shall be based on the principle that all learners are capable of learning and self-development, and are regarded as most important. The teaching-learning process aims to develop learners to the best of their potential at their own pace"* (The National Education Act of B.E. 2542:12). Section 66 of

the Act states that "*the learners shall have sufficient knowledge and skills in using educational technology in acquiring knowledge for themselves on a continual lifelong basis"* (The National Education Act of B.E. 2542: 33).

In organizing the learning process, the educational institutions and agencies concerned should provide knowledge and activities according to the learners' interests and aptitudes taking cognizance of the learners' individual differences. Adequate training must also be provided to enhance the thinking process across situations to be able to solve problems in different contexts. For learners to excel in their studies, they must be exposed to authentic situations with practical work which are equally important, to inculcate productive habits like reading for continuous learning.

For the teachers, it is essential to integrate into the subject matter other values such as integrity of character and other desirable virtues. Thus the creation a learning environment incorporating effective use of instructional media together with instructional strategies that are student-centered will enable learners to learn in a holistic approach and making learning meaningful and relevant. In this respect, close cooperation from the parents, guardians, and all other stakeholders should be sought to help the students develop their creative potential.

In summary, the development of human capital in Thailand requires progressive and pragmatic educational reforms. In this respect, both teachers and students should have a clear understanding of their respective roles. Teachers in Thailand must be made aware that the effective uses of information and communication technologies are critical in order to motivate students to learn effectively and thus realize their full potential.

1.1 Problem Statement

1.1.1 Taxonomy of Learning and Multimedia

The concept of Higher Order Thinking Skills (HOTS) become a major educational agenda item with the 1956 publication of Bloom's taxonomy of educational objectives. The simplest thinking skills are the learning and recall of facts and recall, while higher order skills include critical thinking, analysis and problem solving. Including higher order thinking skills in learning outcomes is a frequently missing standard based education reform.

The Taxonomy of Educational Objectives, often called Bloom's Taxonomy, is a classification of the different objectives and skills that educators set for students (learning objectives). The Taxonomy was proposed by Benjamin Bloom. Bloom's taxonomy divides educational objectives into three "domains" Affective, Psychology and Cognitive. The higher levels are dependent on having attained prerequisite knowledge and skills at lower levels (Orlich, et al., 2004). A goal of Bloom's Taxonomy is to motivate educators to focus on all three domains, creating a more holistic form of education.

Most references to the Bloom's Taxonomy only notice the Cognitive domain. There are six levels in the taxonomy moving through the lowest order processes to the highest:

- Knowledge: Exhibit memory of previously-learned materials by recalling facts, terms, basic concepts and answers.
- Comprehension: Demonstrative understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.

- Application: Using new knowledge - Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in different ways.
- Analysis: Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.
- Synthesis: Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
- Evaluation: Present and defend opinions by making judgments about information, validity of ideas or quality of work based on a set of criteria.

Higher-order thinking is a concept of education reform based on learning taxonomy such as Bloom's taxonomy. The idea is that some types of learning require more cognitive processing those others, but also have more generalized benefits. In Bloom's taxonomy, for example, skills involving analysis, evaluation and synthesis (creation of new knowledge) are taught to be of higher order, requiring a different learning and teaching methodology, than the learning of facts and concepts. Higher order thinking involves the learning of complex judgmental skills such as critical thinking and problem solving. Higher order thinking is harder to learn or teach but also more valuable because such skills are more likely to be useable in novel situations.

In traditional or pedagogical education, material to be learned is often transmitted to students by teachers. That is, learning is passive. In active learning, students are much more actively engaged in their own learning while educators take a more guiding role. This approach is taught to promote processing of skills/knowledge to a much deeper level than passive learning.

Active learning is a process whereby students engage in higher order thinking tasks such as analysis, synthesis, and evaluation. Cooperative learning, problem based learning, and the use of case methods and simulations are some approaches that promote active learning.

Research suggests that personal development is also enhanced when training is challenging (Cross, 1981; Heerman, 1986). If programs capitalize on learner's experiences, then the learners will want to use the information to enhance their lives. Both Cross and Heerman found that computers can promote active learning by giving adults more ownership over their learning processes. Learners can use technology to solve problems that are therefore applicable to their needs.

Well-designed courseware can enhance teaching by bringing abstract concept to life by providing authentic, challenging & multi-sensory learning and motivate and engage learner in the learning process. Learner can learn at their own pace and control the learning path at their own convenience.

Learning is not a transfer of knowledge; rather it is an active construction. This paradigm shift gives learners a completely new role that was not earlier described in the transmission model of teaching. Technology and professional development of the teacher are best introduced in the context of broader educational reforms which embrace a shift away from teacher-centred, lecture oriented learning towards learner-centred, interactive and constructive learning environment. Multimedia and ICT can be a catalyst for such educational reform.

Multimedia courseware can promote effective instruction that is more engaging, learner-centred, interdisciplinary and more closely related to real life events and processes and adaptive to individual learning styles and needs. It also

encourages higher order thinking skills and help to construct knowledge socially. Thus, teacher professional development in the use of interactive technology should embody and model the forms of pedagogy that teachers can use themselves in their classrooms.

1.1.2 Multimedia Courseware

Technological changes have resulted in the rapid proliferation of computers in schools and the computer has now become ubiquitous learning tool in most schools. Sadly, however, most of the schools use the computers merely as tools for simple tasks such as word processing, or spread sheet calculations. In other words, the power of the computer such as interactivity, immediate feedback for learning has hardly been harnessed or utilized.

The use of computers in the classroom to assist instruction is termed Computer-Assisted Instruction (CAI). CAI is more than the application of technology to instruction (Davivongse, 1998). In order to design an effective CAI lesson, there is a need to incorporate the judicious use of technology based on sound learning theories and taking cognizance of the psychological characteristics of the learners.

A major challenge for the effective use of technology in the classroom is the lack of teachers with adequate skills in developing effective CAI courseware. The role of classroom teachers in the present age shifts from a mere provider of information to that of a facilitator, in facilitating students to learn on their own accord. This change in role of teachers requires the teachers to undergo extensive training so that they are competent in developing effective interactive CAI courseware.

Multimedia courseware has the promise of becoming a staple of instructional technology, but it must be built around sound design theories in order to be effective. The design of multimedia courseware should be based on instructional design theory, cognitive learning theories, and learner's locus or control. If these elements are not included in a deliberate manner, the multimedia courseware will not be an effective instructional tool.

At Suratthani Rajabhat University, classes are taught regularly from Mondays to Fridays, with Saturdays and Sundays for part-time students. The same subject is taught several times to multiple groups of students' characterizing the repetitive teaching activity which creates drudgery and boredom. In this situation effectiveness of learning and teaching are often questionable. Thus, the lecturers need to write learning courseware that replaces the repetitive teaching activities. In this premise the lecturers can use multimedia courseware to prepare teaching and learning resources as a medium for instruction (Maier et al., 1997).

1.1.3 Adult Learners

Suratthani Rajabhat University caters mostly to part-time students in the provinces of Suratthani, Ranong, Chumphon, Krabi, and Samui Island. It is under the supervision of MOE. Most of the students are part-time students, attending the university on Saturday and Sunday and working from Monday to Friday. Their aim is to improve their career, finish a degree, and increase the chances of them getting better positions. The part-time students at Suratthani Rajabhat University are adult learners with large age-gaps (some very young, and some very old). These heterogeneous groups of students face many learning limitations.

The adult learners are generally classified according to demographic variables, such as, life situation, motivations and other personal factors such as age, marital status, or maturity level (Cross, 1981; Knowles, 1984; Merriam & Caffarella, 1991). As a group, these adult learners have unique learning characteristics that differentiate them from other learners (Cross, 1981; Knowles, 1984). Adult learners are autonomous and self-directed (Knowles, 1980); more reflective and tolerant of contradiction and ambiguity (Caffarella & Barnett, 1994); and with greater critical thinking skills (Garrison, 1992). Adults are also characterized by limitations such as problems on schedules, insufficient time and money, pressing family problems, job responsibilities, as well as transportation problems (Neeley, et al., 1998). However, in Thailand adults are still encouraged to participate in nation-building through further education.

Needs analysis was divided into 2 parts namely from a questionnaire even to the learners and lecturers teaching this educational technology subject in order to identified the most difficult topic among the 10 topics of technology.(Appendix A). According to needs analysis, it was found that they needed instructional multimedia for graphics design topic.

1.1.4 Perspectives from Different Psychological Profiles

1.1.4.1 Learning Styles

The research on learning styles is drawn from the studies on the psychological, social and physiological dimensions of the educational process (O'Connor, 2007). The aim of learning styles research is to find clusters of learners who use similar patterns for perceiving and interpreting situations. Based on this premise, one is able to adjust to any educational environment to make learners more efficient and successful (O'Connor, 2007).

An auditory learner learns well in a lecture setting, a private learner gains more knowledge from quiet reading. When learning experiences are limited to some modes, students who rely on other styles are bound to be less successful. Limited classrooms are likely to inhibit one or more cluster of students whose preferred styles are not given the opportunity to be used. Learning style research has given educators new directions to make changes in the classrooms.

The concept of learning styles has gained growing attention from educators because it provides enough characterization to plan pedagogical strategies. These strategies appear more responsive to student needs providing better learning opportunities, giving new directions to alternative teaching more especially, the middle-level models for progressive educators engaged in student-centred, experiential philosophical positions.

Listed below are some general statements for teachers on learning style models:

- Students will learn better using their learning style preferences.
- Students will be better learners when they can expand their learning style preferences.
- When teaching accommodates various learning preferences, more students will be successful.
- Teacher can construct activities that include specific and multiple learning preferences.

Different learners learn best in different ways with one single approach for instruction that fits all learners. Several learning style approaches can be used today. Some examples appear below.

Kolb based his conceptual framework on learning styles from an experiential learning model (De Bello, 1990), which views learning as a four-stage cyclical process in which learners encounter new information, reflect on the information, form hypotheses and theories, and test these theories. There are four stages, respectively: Concrete Experience – which is the ability to involve oneself fully and openly in new experiences; Reflective Observation – which is the ability to observe and reflect on new experiences from many perspectives; Abstract Conceptualization – which is the ability to create concepts that integrate observations into logically sound hypotheses and theories; and lastly the Active Experimentation – which is the ability to test hypotheses and use theories to solve problems and make decisions. The experiential approach to learning, most effectively advance by Kolb, has become firmly rooted in adult learning practice. This four-stage model provides a theoretical basis and a practical model for experiential learning (Knowles et al., 1998).

1.1.4.2 Cognitive Style

Cognitive style refers to the individual's preferences to process information which is usually described as a personal dimension, influencing attitudes, values, and social interactions. A number of Cognitive Styles preferences among learners have been identified and studied over many years. Field independence versus the field dependence continuum probably the most well-known style.

Field Independence learners have a tendency to approach learning in an analytical fashion compared to the global ways of a field dependence learner. At a perceptual level, field independent personalities are able to distinguish figures as discrete from a complex background compared to field dependent individuals. In addition, a field dependent individual has a greater social orientation relative to a

field independent personality. Studies have identified a number of connections between this cognitive style and learning (Messick, 1978). For a field independent individual, learning is more effective under conditions of intrinsic motivation, which is influenced less by social reinforcement.

In summary, both the cognitive and learning style models could be used to predict the kind of instructional strategies or methods most effective for a given individual and learning task. To date, the research on this problem has not identified many robust relationships. Together with the learning styles framework developed by Kolb, this provides a useful advantage when learning is enhanced with the teachers' awareness of individual differences in learning.

1.1.4.3 Locus of Control

Another psychological measurement considered important in learning is the Locus of Control variable. Research in Adult Basic Education (ABE) involving the measurement of the internal-external locus of control constructs can also be very useful in determining whether adult learners also display differences in achievement when measured against their locus of control as reported in most studies involving younger learners (Piriyasurawong, 1999). Locus of control is a personality variable derived from Rotter's Social Learning Theory (Rotter, 1966). This refers to the degree which an individual perceives events in his/her life as being a consequence of his/her own actions (Lefcourt, 1981) and, on the other hand who believes that reinforcements are controlled by external forces, such as fate, chance, luck, and powerful others.

Locus of control in relation to learning and instruction is an affective learning style, based specifically on expectancy or incentive style (Keefe, 1987). Locus of

control does not mediate learning directly, but it affects learning outcome through the learner's expectations of success and the motivation to perform (Jonassen & Grabowski, 1993).

The main theme of the New National Education Act (1999) focuses on the learner-centered or self-study method, maintaining that learning styles can function well in the use of effective instructional media. Thus, this study will seek to fine out whether environmental inputs (e.g., multimedia courseware) can support learning and make any significant differences on the learners' achievements. Hence, the use of the Kolb's Learning Styles Inventory will be employed to explore the aspects of learning best supported by the multimedia courseware.

The teaching and learning in Thailand has been conducted in an objectivist environment. When the education reformation took place in the year 1999, the constructivist environment was introduced into the Thai education system. According to Thailand Educational reform, it is not too difficult to achieve for Thai students to meet their needs and for the country to improve life for it citizens.

Adult learners have several limitations and learning problems that are associated with their age. Taking cognizance of the difficulties and challenges faced by adult learners in Suratthani Rajabhat University in Thailand, this study attempts to address the problems through the judicious use of Information and communication Technology (ICT) as an innovative tool for teaching and learning. In particular, an innovative courseware is designed and developed and its efficacy tested amongst these adult learners. Therefore the study entitle "Cognitive Effects of Constructivist and Objectivist Instructional Courseware on Adult Learners with Different Psychological Profiles" was conducted to design and develop alternative multimedia

instructional courseware for adult learners to support adult learners' achievement in the Suratthani Rajabahat University.

The researcher designed multimedia courseware instruction in two modes. The first mode was the objectivist instruction based on behaviorism and it was a linear instruction like teacher-centred methodology. The second mode was the constructivist instruction that is expected to enhance the achievement of the learners. The researcher also examined whether the learner's learning styles (concrete experience, reflective observation, abstract conceptualization and active experimentation), cognitive styles (field-dependent and field-independent) and locus of control (internal and external) affect their achievement in graphics design towards multimedia instruction.

This study will provide useful to enable other educators to develop an innovative teaching strategy using multimedia courseware (CD-ROM) for adult part-time learners in institutions of higher learning, especially the 41 other Rajabhat Universities, Thailand.

1.2 Theoretical Models of the Study

This study is anchored on the Mayer's Cognitive Theory of Multimedia Learning (2002), Knowles' Andragogical Model (1998) and other learning theories namely Behaviorism, Cognitivism and Constructivism. The Theory of Learning is the underlying basis in designing the instructional multimedia courseware. This study intends to combine across the Behaviorist, Cognitivist, and Constructivist approaches in its application to individual differences. The method of instructional deliveries determines the student's Learning Styles, Cognitive Style, and Locus of Control in

learning Graphics Design. A brief explanation of the model and theories is presented in this chapter and further elaborated in Chapter 2.

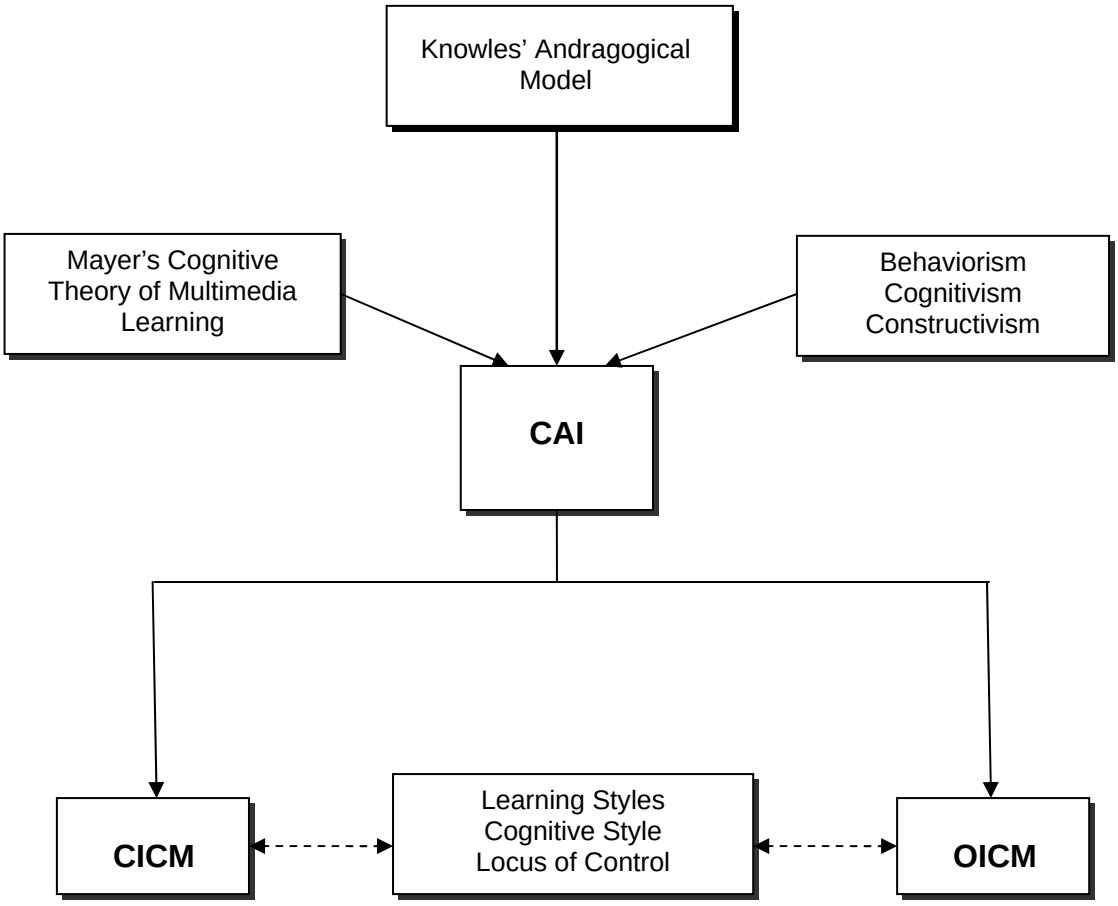

Figure 1.1 Theoretical Framework

1.2.1 Mayer's Cognitive Theory of Multimedia Learning

The cognitive theory of multimedia learning is intended to represent the human information processing system. Mayer's assumptions of multimedia work was integrated with Paivio's Dual-Coding Theory (Clark & Paivio, 1991; Paivio,1986), Baddeley's Model of Working Memory (1986, 1992, 2000), and Sweller's Cognitive Load Theory (Chandler & Sweller, 1991; Sweller, 1999). The cognitive model of multimedia learning shows how multimedia learning occurs when

the learners engage in five kinds of processing: selecting words, selecting images, organizing words, organizing images and integrating. (Mayer, 2002).

1.2.2 Knowles's Andragogical Model

The Andragogical Model is based on several assumptions that are different from those of the Pedagogical Model (Knowles et al., 1998). The Andragogical Model focuses on the education of adults based on several precepts: adults need to know why they need to learn something; adults maintain the concept of responsibility for their own decisions, their own lives; adults enter the educational activity at a higher level and more varied experiences than do children; adults have a readiness to learn in order to cope up effectively with real-life situations; adults are life-centered in their orientation to learning; and, adults are more responsive to internal motivators than external motivators (Knowles, et al., 1998).

1.2.3 Theoretical Perspectives on Learning

The basis for designing instructional multimedia is a theory of learning. There are considerable differences of opinion about what conditions and actions facilitate most learning (Alessi & Trollip, 2001). A solid foundation in learning theory is an essential element in the preparation of an Instructional Systems Design (ISD) for professionals because it permeates all dimensions of ISD (Shiffman, 1995). Depending on the learners and situation, different learning theories can be applied. The instructional designer must understand the strengths and weaknesses of each learning theory to optimize its appropriateness as a basis for an instructional design strategy. Theories are useful because they provide other possibilities and ways of seeing the world. Whether one realizes it or not, the best decisions for design are based on knowledge on learning theories (Mergel, 1998).

The basic theoretical perspectives on learning are Behaviorism, Cognitivism and Constructivism. These theories are discussed in more detail in Chapter 2 in the review of related literature.

1.2.3.1 Behaviorism

The Theory of Behaviorism centers on the study of overt behaviors that can be observed and measured (Good & Brophy, 1990). The psychologists who were influential in the development of Behaviorist Theory were Pavlov, Thorndike, Skinner, Watson, and Guthrie.

1.2.3.2 Cognitivism

Cognitive theorists recognized that much learning involves associations established through contiguity and repetition. They also acknowledged the importance of reinforcement, although they stressed its role in providing feedback on the correctness of responses as a motivator. However, even while accepting such behavioristic concepts, cognitive theorists view learning as a process that involves the acquisition or reorganization of the cognitive or intellectual structures through which humans process and store information (Good & Brophy, 1990). The major players in the development of cognitivism are Mayer, Gagne, Wertheimer Lewin and Kohler.

1.2.3.3 Constructivism

A major theme of constructivist theory is that learning is an active process. Learners construct new ideas based upon prior knowledge and experiences (Bruner, 1966). Learning occurs by synthesizing new information into exact knowledge and adjusting prior understanding and beliefs to assimilate new experiences. The major players in the development of constructivism were Piaget, Bruner and Vygotsky.

Ertmer and Newby (1993) believed that the strategies promoted by different learning theories overlap i.e. implementing the same strategy for a different reason and learning theory strategies are concentrated along different points of a continuum depending of the focus of the learning theory and the level of cognitive processing required.

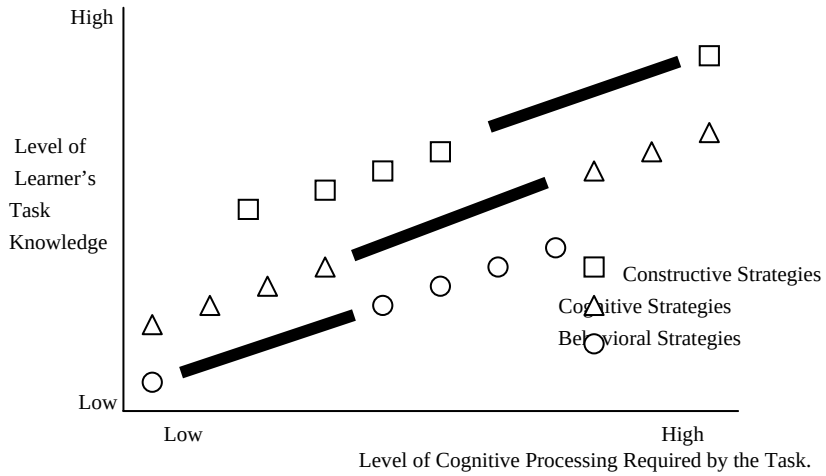

Figure 1.2 Comparison of the associate instructional strategies of the behavioral, cognitive, and Constructivist viewpoints based on the learner's level of task knowledge and the level of Cognitive processing required by the task.

From Ertmer and Newby: *Behaviorism, Cognitivism, Constructivism: Comparing Critical Features from an Instructional Design Perspective.*

Ertmer and Newby suggested that theoretical strategies can complement the learner's level of task knowledge allowing the designer to use the best available practical applications on the different learning theories. With this approach, the designer is able to draw from a large number of strategies in response to a variety of learning situations.

There are many opinions about how people learn. In reality, those who cling to a single approach (behavioral, cognitive or constructivist) are relatively few, with the majority of learning psychologists, educators and instructional designers

preferring to merge various principles from the behavioral, cognitive, and constructivist paradigms into one integrated approach (Alessi & Trollip, 2001).

1.3 Purpose of the Study

The purpose of this study was to design and develop alternative multimedia instructional courseware for adult learners with different psychological profiles to support adult learners' achievement in the Suratthani Rajabhat University. The objectives of the study are divided into two parts.

General Objectives:

To design and develop multimedia instructional courseware for adult learners at the Suratthani Rajabhat University.

Specific Objectives:

1) To compare adult learners' achievement in a "Graphics Design" module as part of an Educational Technology subject by comparing the Constructivist Instructional Courseware Mode (CICM) and the Objectivist Instructional Courseware Mode (OICM).
2) To study differences in the achievement of adult learners with different psychological profiles using the Constructivist Instructional Courseware Mode (CICM) and the Objectivist Instructional Courseware Mode (OICM).
3) To study the interaction effects of adult learners' psychological attributes with the treatment provided.

1.4 Research Questions and Hypotheses

Research questions (Q) and their accompanying hypothesis (H) are constructed based on the problems identified and their objectives of the study. Recent studies (Becker & Maunsaiyat, 2004; Kong, 2006) had demonstrated that the

constructivist instructional courseware model had been superior to objectivist instructional courseware model. The theoretical postulates by Ertmer & Newby (1993) also support the use of a constructivist mode of instruction, especially when the contents of the instruction involved higher order learning efforts. Is this true for Rajabhat University's students in Thailand? That is why this study was carried out. Hence the hypotheses in this study are stated as Research Hypotheses (Gay, 1996) in that it is expected one treatment (Constructivist Instructional Courseware Mode - CICM)) is superior to the other (Objectivist Instructional Courseware Mode - OICM). The Research Hypothesis is also known as an "alternate/directional hypothesis" that can be tested as a statistical hypothesis (Borg & Gall, 1989).

All hypotheses were formulated using alternate or directional hypotheses based on previous experiences of literature review and tested at significant level of $p<0.05$.

There are 15 hypotheses in this study. The first hypothesis relates to the effectiveness of courseware, measured by gain score of learners using the Constructivist Instructional Courseware Mode (CICM) and the Objectivist Instructional Courseware Mode (CICM). The remaining 14 hypotheses relate to the cognitive effects of the multimedia instruction on adult learners with different psychological profiles.

Q1. Do learners presented with the Constructivist Instructional Courseware Mode (CICM) obtain a significantly higher gain score (as measured by posttest minus pretest score) than learners presented with the Objectivist Instructional Courseware Mode (OICM)?

$H_1$1: Learners presented with the Constructivist Instructional Courseware Mode (CICM) will obtain a significantly higher gain score than learners presented with the Objectivist Instructional Courseware Mode (OICM).

Q2. Are there differences in gain score of learners with different Learning Styles using the CICM and OICM?

$H_1$2: There are significant differences in gain score of learners between each type of learning styles using the CICM and the OICM.

$H_1$2.1: In the CICM, there are significant differences in gain score of the learners between diverger learners, assimilator learners, converger learners, and accommodater learners.

$H_1$2.2: The diverger learners, assimilator learners, converger learners, and accommodator learners will show significant difference in gain score compared to each others in both modes.

Q3. Are there differences in gain score of learners with different Cognitive Styles using the CICM and the OICM?

$H_1$3: The field independent learners will have a significantly higher gain score than the field dependent learners in both modes.

$H_1$3.1: The field-independent learners presented with the CICM learners will have a significantly higher gain score than the field-dependent learners.

$H_1$3.2: The field-independent learners presented with the CICM learners will have a significantly higher gain score than the field-independent learners presented with the OICM.

$H_1$3.3: The field-dependent learners presented with the CICM learners will have a significantly higher gain score than the field-dependent learners presented with the OICM.

Q4. Are there differences in the gain score of learners with a different Locus of Control using the CICM and the OICM?

$H_1$4: The internal locus of control learners will have a significantly higher gain score than the external locus of control learners in both modes.

$H_1$4.1: The internal locus of control learners presented with the CICM will have a significantly higher gain score than the external locus of control learners.

$H_1$4.2: The internal locus of control learners presented with the CICM will have a significantly higher gain score than the internal locus of control learners presented with the OICM.

$H_1$4.3: The external locus of control learners presented with the CICM will have a significantly higher gain score than the external locus of control learners presented with the OICM.

Q5. What is the interaction effect of the learners' learning styles to the treatment provided, either CICM or OICM?

$H_1$5: There will be an interaction effect on the gain score between the two modes and the learning styles of the learners.

Q6. What is the interaction effect of the learners' cognitive styles to the treatment provided, either CICM or OICM?

$H_1$6: There will be an interaction effect on the gain score between the two modes and the cognitive styles of the learners.

Q7. What is the interaction effect of the learners' locus of control to the treatment provided, either CICM or OICM?

$H_1$7: There will be an interaction effect on the gain score between the two modes and the locus of control of the learners.

1.5 Significance of the Study

This study will provide a useful framework to enable other educators to develop teaching-learning courseware for adult learners in institutions of higher learning. Additionally, it will provide an innovative teaching strategy using multimedia courseware (CD-ROM) for adult part-time learners and young full-time students in Thailand especially the 41 other Rajabhat Universities.

1.6 Limitations of the Study

1. The study is limited to the development of multimedia courseware, specifically for adult learners of Suratthani Rajabhat University, Southern Thailand.
2. The topic of multimedia is limited only to the "Graphics Design" module in Educational Technology subject, which is a compulsory subject for student teachers. This effect cannot be generalized for other topics.
3. This effectiveness of this study is limited to how well or effective the courseware is being designed by the researcher.

1.7 Definitions of Terms

Multimedia refers to the instructional media using computer and software programs for communication to integrate text, graphics, animation, and sound under the control of learners, through keyboard, mouse or pointer. This system is known as an Interactive Multimedia (Mayer, 2002).