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A Study of the Relation between Junior High School Students' Learning Adaptation and Computer Assisted Instruction

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Abstract

This study employed the mixed factorial quasi-experimental design to experiment in multi-media computer assisted instruction learning on 220 junior high school students from the six counties of southern and eastern Taiwan. The students participating in the experiment were divided into two groups: one group learned the CD curricula at school and the other one learned them at home.

The main purposes of the experiment were to understand if there were any differences in learning achievement among students with different capabilitiesin learning to adapt after they had attended the multi-media curricula, and toobserve the changes in computer attitudes, which may have occurred before andafter the learning process, among students with different capabilities in learning to adapt. The results showed that student mental and physical adaptation, learning attitudes, and computer attitudes all influenced the learning process and effects. Besides, the results also showed that students with worse capabilities in learning to adapt, after their participation, had more positive responses than they did before their participation.

keywords: multi media, computer assisted instruction, CAI, computer attitude,

I. Introduction

Learning is the basis from which human beings do all kinds of activities. Psychologists and educators have been continuously trying to realize the natureand properties of learning, the process of learning, and the factors that affect learning. Educational technology is a newly-rising applied science that attempts to apply to instructional design those results and theories through which human learning behavior is analyzed and researched, in order to improve the quality of learning (Ju Shiang-jyi, 1994). Hoping to help students learn through this scientific technology, Taiwan has been actively pushing computer assisted instruction since the 1970's, during which different kinds of forms have varied from the idea of curricular development stressing programmed instruction to proficiency learning that focuses on practice. During this period, what has received most attention from the public is the concept of Personalized System of Instruction (PSI) which emphasizes that students should learn at their own pace. Up to the present day when computer assisted instruction has been developed very far, what is being given the most attention is a multi-media computer assisted instruction that combines many media objects and full utilization of the senses for individualized learning.

Teaching activities are a process of knowledge conveyance, while media are the tools that convey the teaching content. The question to which researchers of teaching technology pay more concern and attention is by what media the information should be conveyed to get the predicted and expected teaching effects. Since the 1960's the important directions of media instruction studies have been: (1) the verification that media can promote and improve teaching, (2) the advancement of media instruction through evaluation technology, and (3) the development of the instructional strategies of applied media (Heinich, Molenda & Russell, 1993). These studies contributed much to the promotion and designing of teaching media later. Since the rise of the micro computers in the 1980's, computer technology has made rapid progress, and micro computers have been extensively employed in teaching, while the founding of all kinds of teaching theories related to behavioral science has fallen far behind the upgrading of computer technology. Every kind of media application or teaching method has its own quality, and the mental capabilities that are demanded by it through the information presented by different media may vary and the effects on learning may be different. To date the job that is more important is to understand how to use these media to help learners of different learning capabilities or with learning methods to adapt themselves, for the ideal of fully applying teaching tools to the teaching of adaptation.

According to Piaget's cognitive theory of development, junior high school students, developing from the concrete operational stage that stresses arithmetical operations, special concepts, and real and concrete experiences, are at the age of the formal operational stage--hypothesis, deduction, inference,

induction, and reasoning-- that puts emphasis on possibility and imaginary experiences. The maturity of both mental and physical development often causes junior high school students to face certain questions pertaining to learning and the phenomenon of self-absence appears. Adaptation in learning is very much related to students' academic achievements and personality development. The expectation that student potentiality can be exploited to promote academic achievement and personality development is clearly worthy of discrete and cautious investigations as to the effects on learning of the different methods employed by students who show variations in adaptation, in order to realize how the methods will influence student learning. Chen Ing-haur (1989) synthesized eleven learning adaptation evaluation or learning behavior tools from outside the country and ten domestic ones into five subscales-- learning methods, learning habits, learning attitudes, learning environments, and mental and physical adaptation--to help learners realize their own learning qualities. At this period when computer assisted instruction is widely and extensively employed as a learning assistance tool of high school students, this study embarked on research in experimental teaching, with the software of computer assisted instruction developed in 1995 by the Department of Education, Taiwan Province. By purposively sampling 220 junior high school students of the six counties of southern and eastern Taiwan (Tainan, Kaohsiung, Pingtung, Penghu, Taitung, and Hualien), it sought to understand what variations in computer attitudes and effects on learning there may be after different junior high school students with different capabilities in learning to adapt have learned by means of multi-media computer assisted instruction.

The effects that computer assisted instruction has achieved have been widely confirmed. Since 1990, the Department of Education, Taiwan Province, for the purpose of enhancing the utilizing of learning methods and promoting learning quality, has actively and vigorously developed more than 500 units of computer assisted instruction software and has distributed them to every junior high school. Those units, developed over the past two years, are mostly multi-media ones, and were designed to be operated from compact disk (CD). They include English, chemistry, earth science, physics, health education, geography, and the computer, forming eight units on seven subjects. The learning experimentation of this study is based on this disk, and the two learning modes were (1) learning in the computer classroom, and (2) bringing the disk home and learning by the student himself/herself. The experimenter's goal was to broadly discovering and comprehending the factors that may influence computer attitudes and effects on learning after students of different learning qualities have learned with this disk.

II. The purposes and methods of the study

1. Purposes

Based on the motives stated above, the purposes of this study are:

(1) to explore the relationship between students' qualities in learning adaptation and the employment of computers in curricular learning.

(2) to understand whether computer attitudes and learning effects are influenced by different learning environments, for example, in the computer classroom and the home.

(3) to examine the effects on learning that learners with different capabilities might show after they have employed multi-media as learning tools, and related factors that may influence the learning effects.

2. Subjects and Procedures

220 second-year students were sampled out from the seven junior high schools of the six counties of southern and eastern Taiwan as the subjects for the experiment in computer assisted instruction. The disk, developed by the Department of Education, Taiwan Province, in 1995, includes eight units which are: English--Daily American English, Chemistry--Halogen, Earth Science--Beautiful Taiwan, Physics--Mass and Weight, Chemistry--Carbon Dioxide, Health Education--Male Puberty, Geography--Crust Movement, and the Computer--Computer Mainboard. A total of 10,000 copies of this disk were issued to a total of 680 junior high schools of Taiwan Province, with Taipei City and Kaohsiung City excluded. The data on satisfaction degree of the returned 861 copies of the questionnaire (86.1% of the total copies) showed that this disk got excellent evaluations for meeting teaching goals, being helpful to teaching, students' willingness to use it, the practicality of the contents, and user friendliness. As for the five-scale total evaluation, 10% of the returned copies of the questionnaire gave excellent assessments, and 70% gave good assessments. The information above showed that this disk, which contains eight teaching units, was accepted and affirmed by the users for it's structure and contents.

The environments for putting the computer assisted instruction curricula software into effect were in the computer classroom at school or at home. According to the design of the experiment, this study divided the students into two groups: those who learned in the computer classroom and those who learned at home. Since it was necessary for the schools and students that took part in this experiment to have more advanced equipment, such as CD players, and the operational environment of Windows V3.1 Chinese Edition and at least 4M RAM to operate the software on the CD, only a school that had more advanced equipment was ampled out from the six counties of southern and eastern Taiwan.

Also, about 25 second-year students that had equipment fitting the necessary requirements for operating the CD in their homes were randomly sampled out from each of the six schools (140 students in total) to operate the CD at their home as the control group for the experiment.

The illustrtion of independent variables and dependent variables as Table 1.

Table 1. Variables of the Study

Covariate	Independent variables	Dependent varibles
a. Learning ability	a. Personal background	a. Learning effects
. Intelligence	. sex	
- Language	. interest in courses	b. Post-learning
- Math	. parent education	computer attitudes
. Academic grades	. family head profession	. confident
		. application in eduction
	b. Pre-learning	. anxiety
	computer attitudes	. necessity
	. confident	. usefulness
	. application in eduction	
	. anxiety	
	. necessity	
	. usefulness	
	c. Learning daptations	
	. learning methods	
	. learning habits	
	. learning attitudes	
	. learning enviroment	
	. physical and intellect adptation	
	d. Learning location	
	. at school (experiment group)	
	. at home (control group)	

For eight weeks, the students of the control group learned a unit per week,and were required to hand in the appointed assignments at the assigned time each week to make sure that the students were learning the curricula according to the schedule.

As for the experimental group of students that learned in the computer classroom at school, one school was sampled out from the six counties, and two classes, 74 students in total, were randomly sampled out from the second year students of this school to spend two hours learning two units a week for four weeks, at the same pace as the control group; these 74 students were also required to do the assignments.

Every student taking part in the experiment was given a pre-test on (1) knowledge related to the eight units and (2) computer attitudes. To avoid an excessive concentration of the tests, the students were not given the test with the learning adaptation scale until the third week in order to understand student quality. After four weeks of learning, all the students that took part in the experiment were given tests on learning achievement (the test papers were the same as the pre-test ones) and computer attitudes.

3. The tools

In order to effectively obtain the needed data of the experiment, the measuring tools employed by this study were divided into a computer attitude scale, learning adaptation scale, learning achievement scale, and intelligence quotient test scale:

3.1 Computer attitude scale

The computer attitude scale edited by Wu Ming-lung (1993) was adopted by this study. This scale, including thirty-four questions, adopted Likert's four-point scale in which the subjects, according to their own opinions, chose any one from the following items: "Disagree very much", "Slightly disagree","Slightly agree", and "Agree very much". The factors that the scale can measure include confidence, application in education, anxiety, necessity of curricula, and usefulness. The alpha value of the reliability (the internal

consistency) was .8675 and the alpha value of the retest reliability (after an interval of one week) was .8273.

3.2 Learning adaptation scale

This standardized scale, edited by Li Kun-chorng (1996), mainly aimed to measure the junior high school students in the five subscales of learning methods: learning habits, learning attitudes, learning environments, and mental and physical adaptation. There was a total of sixty questions in all the five subscales, each subscale including twelve questions. The students, according to their own learning qualities, chose any one of the following items: "Very much equivalent ", "Slightly equivalent", "Slightly different", and "Very much different". The alpha value of this scale was .67, showing that the internal consistency of the scale was quite good.

3.3 Learning achievement scale

Edited according to the teaching contents of the CD, this scale, containing five questions for each of the eight units and thus a total of forty questions for all eight units, was used to measure the pre-test and post-test achievements of the students.

3.4 Intelligence quotient test scale

For an understanding of the academic aptitudes of the students, this study adopted the "Intelligence Quotient Tests for Junior High Schools: The Third Type", edited by Luh Jiun-yue, et al. (1991). This scale consisted of two parts: language and math. The mean value (M) for the norm of this scale, as far as second-year students of junior high schools were concerned, was 89.98 and the standard deviation (SD) was 22.18. This scale is now being used in junior high schools in Taiwan Province as the basic academic test for the admission of junior high school students.

4. Statistics

The statistical methods employed by this study are the following:

a. The Analyses of Variance (ANOVA) on students from different schools and different family backgrounds to understand whether the multi-media achievement effects and computer attitudes would change because of their different backgrounds.

b. The T-test on students of different sexes and different learning adaptation conditions to understand whether the change in computer attitudes would be influenced by their sex different learning adaptation conditions.

c. The analyses of Covariance (ANCOVA) on students of different learning adaptation conditions and different computer attitudes to understand whether the multi-media learning achievements of junior high school students would change accordingly as their learning adaptation conditions and computer attitudes changed.

d. The Canonical Correlation on students of different learning methods, learning habits, learning attitudes, learning environments, and mental and physical adaptation to understand what route was most related to their multi-media learning achievements and computer attitudes.

III. Results

This study aimed to explore if there were any differences in effects on learning after employing the multi-media assisted instruction curricula among junior high school students with different capabilities in learning adaptation, to investigate under which environment the students would obtain get greater assistance, and to understand the variation in computer attitudes before and after the students attended the computer assisted instruction curricula. The students were divided into the experimental group, which studied in the computer classroom at school and the control group, which brought the disks home and studied them in their homes. The results showed the following:

1. The entire comparisons of all the students

The data on all 214 students showed that there were significant differences in (1) mental and physical adaptation and (2) learning attitudes, among the five factors of student learning adaptation. The factors pertaining to mental and physical adaptation represented the influence of student mental and physical conditions on learning. They include self-conception, self-control capabilities, emotional stability, and health. A high-score group and a low-score group were picked out from the section on mental and physical adaptation, in which 12 questions, 1 to 4 points for each question, were included. The higher the score, the better the learning adaptation, according to the learning adaptation scale. The score of 30 being the critical point and intelligence being the covariance, the results of the covariance analyses showed that, after the dismissal of the influence of intelligence, the adjusted mean of the low-score group was 6.77 and
that of the high-score group was 18.14, with significant differences in the two groups ($p<.001$), meaning that, as far as effects on learning were concerned, the students with better learning adaptation got higher scores than those with worse learning adaptation.

The other significant factor was the learning attitudes--the attitudes that students hold toward learning--which included learning interests, attitudes toward their curricula, and attitudes toward the learning environments. The students were divided into the high-score group and the low-score group by their scores on learning attitudes in the learning adaptation scale. The results of the covariance analyses, the score of 30 being the critical point and intelligence being the covariance, showed that the adjusted mean of the low-score group was 13.66 and that of the high-

score group was 18.39. There were significant differences ($p<.05$) between these two groups in learning effects, showing that students with better learning attitudes had better effects on learning than those with worse learning attitudes.

One result deserving attention was that the educational backgrounds of the family heads also influenced the learning effects of the students. The results of the ANOVA showed that there were significant differences in effects on learning ($F=2.74$, $p<.05$) among students whose family heads were of five different educational backgrounds: college, junior college, senior high school, junior high school, and elementary school. And the posterior comparisons of Tukey's method showed students whose family heads were of the junior high school educational level had more positive effects on learning than those whose family heads were of the college level.

Computer attitudes also had significant relations with learning effects. The pre-learning computer attitudes, after the exclusion for the factor of intelligence, were found to have deeply influenced the learning effects. And results of the covariance analyses showed that, regardless of the scores on pre-learning computer attitudes or the factors of computer attitudes which included confidence, educational application, anxiety, necessity of curricula, and usefulness, the learning effects--that is, the improvement scores--of those who got high scores were significantly better than those who got low scores. The following table represents the results of the covariance analyses of the factors of pre-learning computer attitudes and learning effects.

Table 2. Abstract table for the covariance analyses of the factors of pre-learning computer attitudes and learning effects

	Total	Confidence application	Educational application	Anxiety	Necessity	Curricula Usefulness
F-value	22.49	20.86	19.19	6.22	11.84	18.76
Sign.	.000	.000	.000	.014	.001	.000
Adj. mean of high-score group	16:83	16.92	16.66	15.03	16.04	16.66
Adj. mean of low-score group	2.18	2.77	2.44	6.54	5.23	2.89

2. The data analyses of the experimental group

Students of the experimental group learned the curricula in the computer classroom at school. The covariance analyses, after the exclusion of the influence from intelligence, significantly showed that students who had better learning attitudes had better learning effects than those who had worse learning attitudes ($F=4.70$, $p<.034$), thus the adjusted mean of learning attitudes for the high-score group was 25.67 while that for the low-score group was 19.45

The factor of learning environments on the tests of learning adaptation also influenced the post-learning computer attitudes of the experimental group. By learning environments is meant the influence that environments may have on learners. Such environments included the household, material and psychological environments, school's architecture and equipment, the curricula instruction and teacher-student relationship, and peer relationship. There were significant differences in the changes in post-learning computer attitudes between the high-score and low-score groups of students. The changes in post-learning computer attitudes came from the mean difference between the pre-learning and post-learning scores. And the results of the T-test showed that students feeling less capable of adapting themselves significantly had more positive changes of attitudes than those who were more capable of adapting themselves ($T=3.01$,$p<.01$). The environmental factors also influenced student anxiety about computers. The results of T-test showed that students feeling less capable of adapting themselves significantly had less post-learning anxiety about computers than those who were more capable of adapting themselves ($T=2.06$, $P<.05$).

3. The data analyses of the control group

Students of the control group brought the disks home and learned the curricula in their own homes for four weeks. The results of the covariance analyses, in which intelligence was selected as the covariance, showed that, after the

influence of the intelligence factor had been excluded, students who were more adaptable mentally and physically should better learning achievement ($F=11.59$, $p<.001$).

As for the changes in computer attitudes, students who had worse total scores in learning adaptation, after having used the mullet-media for self-learning, had more a positive attitude towards computers ($T=2.36$, $p<.05$). The main items of changes in computer attitudes were the enhancement of the attitude toward computer usefulness and the strengthening of their attitude about computer necessity in the curricula.

In addition, there were also significant differences between students with different learning attitudes and of different mental and physical adaptation with respect to their attitude about the necessity and usefulness of computers in the curricula. Students who had worse learning attitudes gave more positive responses concerning their attitudes toward the necessity of computers in the curricula ($t=3.47$, $p<.001$), while students of worse mental and physical adaptation gave more positive responses as to their attitudes toward the usefulness of computers in the curricula ($t=2.10$, $p<.05$).

4. Comparisons between the experimental and control groups

The results of the covariance analyses showed that the effects on learning for students in the experimental group were higher than those for the control group ($F=16.57$, $p<.001$). For a detailed understanding of whether there were any effects from an interaction between different learning methods and learning adaptation, two-factor analyses of variance were employed and the results showed that, as far as changes in computer attitudes were concerned, an interaction between different learning methods and different learning environments existed. The simple main effects analyses showed that, in the group of students who better adapted to learning environments, there were significant differences in changes in computer attitudes between the experimental group and the control group, with the attitudes of the experimental group apparently tending to descend, the average score in computer attitudes going down 3.38. Yet, while in the experimental group, students of different learning environment adaptation showed significantly different variations in their computer attitudes; students of worse learning environment adaptation seemed to give significantly positive responses, with their average scores in computer attitudes going up for 5.9.

IV. Findings

Wtih cautious analysis and comparison the major finding were organized in terms of initial objectives guiding this investigation.

1. Learning achievement with multi-media CAI

a. The parents' education background influences the students' learning effects.

b. The different places, at which the students learned, have different learning results.

c. The students' attitude toward computer influences their learning achievement greatly.

d. The students' physical and psychological adaptability influences their learning achievement.

e. Those who have better adaptability on learning enviroment have better learning results while learning at home.

2. Attitude change toward computer after learning with CAI

a. Students' computer attitude changing after learning was influenced by thier parents' educational background.

b. The students' adaptability toward learning enviroments will affect their attitude change after multi-media learning.

c. In this experiment study it shows that the student computer attitude tend toward negative.

V. Conclusions

This study found that both students' mental and physical adaptation and their learning attitudes influenced their learning achievement in employing the multi-media curricula. Mentally and physically adapted students--students with strong self-control, stable emotions, and healthy bodies--tended to show better learning achievements. At the same time, students who got better scores on learning attitude from the adaptation scale tended to show more positive learning effects. These two findings reminded us that excellent mental and physical adaptation and learning attitudes were the necessary conditions for improving learning achievement in learning multi-media curricula.

The educational backgrounds of the family heads of students were also one of the influential factors in this study. As for learning effects, students whose family heads were on the junior high school level showed better effects on learning than those whose family heads were on the college level. This was probably due to the attitudes that the family heads had towards their sons' or daughters' employment of multi-media curricula. More investigations may be conducted to understand the exact process of influence of educational backgrounds.

Effects on student learning were also deeply influenced by their computer attitudes. The results showed that students who had higher scores in pre-test (or pre-learning) computer attitudes showed significantly better effects on learning than those who had worse computer attitudes. Therefore, the cultivation and development of active and positive learning attitudes should be the important factor in reinforcing and enhancing learning effects.

The learning environments also influenced students' computer attitudes. After the study of multi-media curricula at school, students with worse environmental adaptation tended to have more positive variations in computer attitudes, meaning that the students tended to give more affirmative responses. Based on this, it would not be difficult to deduce that students with worse capabilities in

environmental adaptation are suitable for multi-media computer assisted instruction. At the same time, students with, totally, worse capabilities in learning adaptation, after using multi-media computer assisted instruction for learning, tend to be more positive and active towards computer attitudes.

As for the environments for employing the curricula for learning, studying them at school had better effects on learning than studying them at home. Probably because of the specific goals and targets of learning the curricula in computer classrooms at school, students were more concentrated on learning,which resulted in more evident and apparent positive learning effects.

V. Suggestions

Information technology has made rapid progress, the levels of employment are wider and wider, and the application of information technology is also a necessary phenomenon tendency. It may be understood from this study that multi-media computer assisted instruction may assist students with worse environmental adaptation to learning. These students, after they have studied the multi-media curricula will become more positive and active. Thus correct and affirmative computer attitudes are again one of the main factors that influence learning. As for the expectation that multi-media computer assisted instruction can have excellent effects on student learning, not only should student capabilities in mental and physical adaptation be strengthened, but student knowledge of computers should also be enhanced to establish their confidence with computers,to make them less fearful and anxious about computers, and to help them develop good computer attitudes if computers are to fully exert their function of instructive assistance.

Nowadays there is quite a number of junior high school students whose learning achievement is poor and whose bottleneck in learning remains blocked. It seems that the students who adapt to learning more poorly can be given multi-media computer assisted instruction to promote their learning attitudes and to enhance the effects on their learning. If this is done, there will be a flatter road for those students who are ill-adapted to learning.

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