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EFFECTS OF COMPUTER-ASSISTED INSTRUCTION ON LEARNING SATISFACTION: A CASE STUDY ON G1 PUPILS USING IPAD

For education, it is an important issue to integrate information technology into instructions. With the functions of multimedia, the integration of texts, graphs, audio, images, video, and animation could enhance students' leaning motives and promote instructional efficacy and learning satisfaction. By reviewing domestic and international literatures, this study aims to discuss the relationship between computer-assisted instruction and learning satisfaction. G1 pupils using iPad in 20 elementary schools in Chiayi City were selected as the research subjects. With questionnaire survey, the collected data were proceeded by factor analysis, reliability and validity analyses, and regression analysis with SPSS 14.0. The outcomes were concluded as follows: (1) computer-assisted instruction and learning environment for learning satisfaction showed significantly positive correlations; (2) computer-assisted instruction and teachers and instructions for learning satisfaction presented remarkably positive correlations; (3) computer-assisted instruction and curriculum and materials for learning satisfaction revealed notably positive correlations; (4) computer-assisted instruction and administrative service for learning satisfaction showed significantly positive correlations. The outcomes were further discussed for the reference for academia; suggestions for future research were also proposed.

Keywords: computer-assisted instruction; learning satisfaction; iPad; elementary school.

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ВПЛИВ КОМП'ЮТЕРИЗОВАНОГО ВИКЛАДАННЯ НА ЗАДОВОЛЕНІСТЬ НАВЧАННЯМ: НА ПРИКЛАДІ ВИКОРИСТАННЯ ІПАД УЧНЯМИ ПОЧАТКОВОЇ ШКОЛИ

У статті йде мова про те, що у сфері освіти важлива інтеграція інформаційних технологій у викладання. З використанням функцій мультимедійних пристроїв інтеграція текстів, графіків, аудіофайлів, зображень, відео і анімації здатна мотивувати учнів до навчання і підвищити ефективність викладання і задоволеність навчанням. Надано огляд літератури, обговорено відношення між комп'ютеризованим викладанням і задоволеністю навчанням. Суб'єктами дослідження були вибрані учні 20 початкових шкіл міста Цзяї, які використовують iPad. Дані, отримані методом анкетування, піддано факторному аналізу, аналізу надійності і точності, аналізу регресії за допомогою SPSS 14.0. Результати дослідження свідчать, що: 1) комп'ютеризоване викладання і середовище навчання показали значно позитивні кореляції із задоволеністю навчанням; 2) комп'ютеризоване викладання, вчителі і викладання представили помітно позитивні кореляції із задоволеністю навчанням; 3) комп'ютеризоване викладання, розклад і матеріали показали помітно позитивні кореляції із задоволеністю навчанням; 4) комп'ютеризоване викладання і адміністративні послуги показали значно позитивні кореляції із задоволеністю навчанням. Далі ці результати проаналізовано з відсиланнями на інші наукові дослідження, також запропоновано напрями для подальших досліджень.

Ключові слова: комп'ютеризоване викладання; задоволеність навчанням; iPad; початкова школа.

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ВЛИЯНИЕ КОМПЬЮТЕРИЗОВАННОГО ПРЕПОДАВАНИЯ НА УДОВЛЕТВОРЕННОСТЬ ОБУЧЕНИЕМ: НА ПРИМЕРЕ ИСПОЛЬЗОВАНИЯ IPAD УЧЕНИКАМИ МЛАДШЕЙ ШКОЛЫ

В статье идет речь о том, что в сфере образования важна интеграция информационных технологий и преподавания. С использованием функций мультимедийных устройств интеграция текстов, графиков, аудиофайлов, изображений, видео и анимации способна мотивировать учеников к обучению и повысить эффективность преподавания и удовлетворенность обучением. Дается обзор литературы, обсуждено отношение между компьютеризованным преподаванием и удовлетворенностью обучением. Субъектами исследования были выбраны ученики 20 начальных школ города Цзяи, использующие iPad. Данные, полученные методом анкетирования, подверглись факторному анализу, анализу надежности и точности, анализу регрессии с помощью SPSS 14.0. Результаты исследования показывают, что: 1) компьютеризованное преподавание и среда обучения показали значительно положительные корреляции с удовлетворенностью обучением; 2) компьютеризованное преподавание, учителя и преподавание представили заметно положительные корреляции с удовлетворенностью обучением; 3) компьютеризованное преподавание, расписание и материалы показали заметно положительные корреляции с удовлетворенностью обучением; 4) компьютеризованное преподавание и административные услуги показали значительно положительные корреляции с удовлетворенностью обучением. Далее эти результаты анализируются с отсылками на научные статьи, также предложены направления для дальнейших исследований.

Ключевые слова: компьютеризованное преподавание; удовлетворенность обучением; iPad.

Introduction. The development of information technology not only shortens the distance between people, but also changes the delivery of information and knowledge acquisition. In such an information technology era, network has become a major tool for acquiring knowledge. The form of knowledge could also be presented with digitalized multimedia (Chang, 2009). With the instantaneousness, marketability, convenience, abundance and diversity, the acquisition of knowledge could be as easy as a flip, without being restricted by time and space. The form of knowledge is not simply the texts in books.

In present educational reform, the development of information technology has greatly impacted the change of learning methods and tools (Chang, 2009; Hodgins & Conner, 2000). With the emergence of Internet multimedia in recent years, instructional activities have been developed and closely integrated with information technology. Moreover, the popularity of iPad has made it a new option for computer-assisted instruction. Particularly, computer-assisted instruction with tablets has been applied to several curriculums that the combination of learning and information technology becomes more significant. Computer-assisted instruction with iPad has now become a primary trend in instructions at schools.

Literature review.

I. Computer-Assisted Instruction. Hicks & Hyde (1973) regarded computer-assisted instruction (CAI) as the teaching materials being directly presented through the applications of computers and the instructional process by controlling individualized learning

environments. Lin (2009) indicated that computer-assisted instruction as a computer-based instructional media could help the instructions and assist students in learning materials to achieve the programmed instructions of individualization, remedial teaching, and mastery learning. Instructions include teaching and learning that computer-assisted instruction is referred to both teaching and learning (Chiu, 2011). The most effective methods for computer-assisted instruction are summarized below (Chang & Chu, 2008).

(1) Tutorial is often used for one-to-one instructions. With the large storage and fast speed of computers, various complex answers could be designed in the materials to analyze students' responses and offer suitable feedback. (2) Drill and practice allows enhancing some new technologies, newly learned technology or familiarity through repeated practice where computers could still offer positive and negative feedback. (3) Simulation is the abstraction or the simplification of a real situation or process. In the simulation, participants often play a role and interact with related people or affairs. The level to simulate real situations is selectable. For instance, both airlines and military apply computer-based simulators to reduce the real flights for trainings (Chu, 2010). (4) Instructional games allow learners, in a relaxing and interesting environment, challenge for an objective through the rules. (5) Problem-solving helps learners solve problems through the designed data or information in computers. During the problem-solving process, pupils could learn the contents and acquire the logistic thinking skills.

II. Learning Satisfaction. When studying self-oriented learning and learning satisfaction, Lee (2011) classified learning satisfaction into instructions, curriculum materials, learning environment, school environment, and teacher-student relationship. Huang (2011) divided learning satisfaction into instructions, curriculum contents, learning outcomes, interpersonal relationship, learning environment, and school administration. Lin (2009) regarded students' learning satisfaction as students' feelings or attitudes to learning activities in the learning process. Lin (2009) classified satisfaction into institutional support, educational background promotion, curriculum materials, and peer relationship. Wei (2010) studied learning satisfaction of the members of Tainan city community college and divided learning satisfaction into instructions, curriculum contents, learning environment, and administrative service.

Based on Wei (2010), this study classified learning satisfaction into learning environment, administrative service, teachers and instructions, and curriculum contents. By integrating the definitions in different research, the dimensions are explained as follows. (1) Learning environment narrowly contains physical space and broadly refers to all physical and social environments related to learning. According to the previous statements on learning environment, it is considered to cover whatever could affect learning achievement, psychological and physical environments which could enhance learners' growth and development, and the emotional, social and cultural states. In this study, the environment was referred to physical learning environment, such as space, equipment, size, seat arrangement, ventilation, and noise. (2) Teachers and instructions refer to students' satisfaction with teachers, teachers' personality traits, instructions, teaching styles, and attitudes. (3) Curriculum and materials indicates students' satisfaction with curriculum and materials, which are considered the relations with learners' aspiration to knowledge and daily use. (4) Administrative service refers to learners' satisfaction with the service

attitude and efficiency of staff, the enrollment procedure, and the emphasis on learners' opinions.

III. Relationship between Computer-Assisted Instruction and Learning Satisfaction. Wang (2009) found that computer-assisted instruction could assist teachers or students in learning, promote the quality of teaching environments, and the effects and learning satisfaction. Chang & Peng (2010) discovered that in the process of applying computers to instructions, students agreed with the instruction effects of CD software and learning satisfaction, and teachers were more confident of enhancing learning satisfaction in the experiences. Chen (2009) proved the effects of Internet-based instructions, especially when they could supplement the insufficiency of materials and teaching methods in traditional classes. Pshegusova & Chislova (1996) discovered that multimedia could enhance the interaction, communication, and cooperation in instructions as well as construct the learning situations to promote learning satisfaction. Reinking & Watkins (2000) showed that successful applications of multimedia could change the instructional environment in classes and help students enhance independent reading ability and promote learning satisfaction.

According to the above points of view, the following hypotheses were further proposed in this study.

H1: Computer-assisted instruction and learning environment for learning satisfaction presented significantly positive correlations.

H2: Computer-assisted instruction and teachers and instructions for learning satisfaction demonstrated remarkably positive correlations.

H3: Computer-assisted instruction and curriculum and materials for learning satisfaction showed notably positive correlations.

H4: Computer-assisted instruction and administrative service for learning satisfaction revealed positive correlations.

4. Demographic variables. Singh (1990) found that demographic variables, except gender, did not appear to show explanation. Based on the above research, the following hypotheses were further proposed.

H5: Gender presents moderating effects on the correlations between computer-assisted instruction and learning satisfaction.

H6: Subjects reveal moderating effects on the correlations between computer-assisted instruction and learning satisfaction.

H7: Family background has moderating effects on the correlations between computer-assisted instruction and learning satisfaction.

Research method.

I. Research framework. Having organized domestic and international research on computer-assisted instruction and learning satisfaction, the research framework was proposed for discussing the correlations.

II. Research subject and sampling. With random sampling, G1 pupils using iPad in 20 elementary schools in Chiayi City were selected as the research subjects. The pupils using iPad, their parents, and the teachers were given questionnaires. Within the total 600 copies, 386 valid ones were retrieved, with the retrieval rate of 64%. Each retrieved copy was regarded as a valid sample.

Analyses and discussions.

I. Factor analysis of computer-assisted instruction. The dimensions and questionnaire for computer-assisted instruction scale were referred to Chang (2008). With fac-

tor analysis, 5 dimensions were received with the Cronbach α reliable 0.88 (tutorial), 0.84 (drill and practice), 0.87 (simulation), 0.86 (instructional games), and 0.90 (problem-solving). After principle component factor analysis and oblique rotation, the questionnaire could explain the variance of 78.422%.

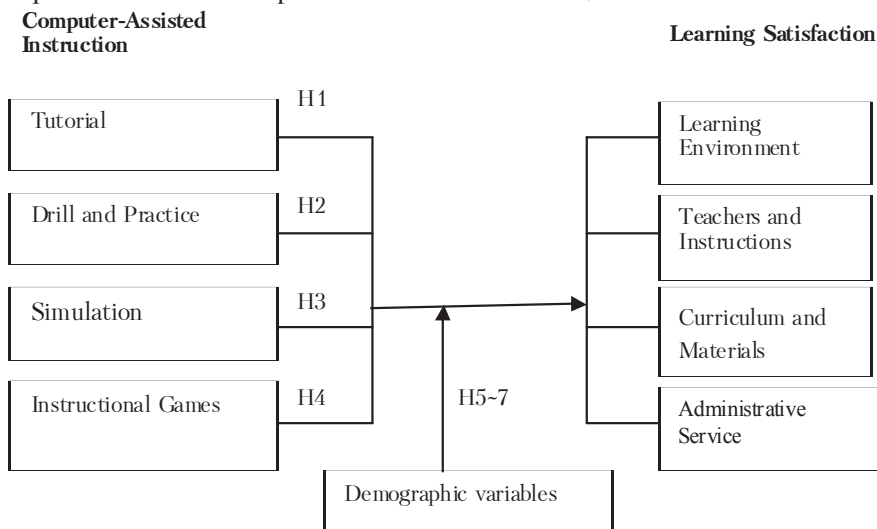


Figure 1. Research Framework

II. Correlation analysis of computer-assisted instruction and learning environment for learning satisfaction. With multiple regression analysis to test H1, the results show the significant effects of tutorial ($\beta=0.164$, $p<0.05$), simulation ($\beta=0.172$, $p<0.05$), and instructional games ($\beta=0.183$, $p<0.05$) on learning environment, Table 1, H1 was partially agreed.

III. Correlation analysis of computer-assisted instruction and teachers and instructions for learning satisfaction. With multiple regression analysis to test H2, tutorial ($\beta=0.213$, $p<0.01$), drill and practice ($\beta=0.157$, $p<0.05$), simulation ($\beta=0.168$, $p<0.05$), instructional games ($\beta=0.172$, $p<0.05$), and problem solving ($\beta=0.206$, $p<0.01$) show remarkable effects on teachers and instructions, Table 1, H2 was agreed.

IV. Correlation analysis of computer-assisted instruction and curriculum and materials for learning satisfaction. With multiple regression analysis to test H3, tutorial ($\beta=0.165$, $p<0.05$), drill and practice ($\beta=0.176$, $p<0.05$), simulation ($\beta=0.192$, $p<0.05$), instructional games ($\beta=0.153$, $p<0.05$), and problem solving ($\beta=0.188$, $p<0.05$) present outstanding effects on teachers and instructions, Table 1, H3 was agreed.

V. Correlation analysis of computer-assisted instruction and administrative service for learning satisfaction. With multiple regression analysis to test H4, problem solving ($\beta=0.159$, $p<0.05$) revealed notable effects on administrative service, Table 1, H4 was partially agreed.

VI. Moderating effects of demographic variables. After analysis of variance, the empirical results showed that gender presented remarkable effects on tutorial

($p < 0.01$), instructional games ($p < 0.01$), and problem-solving ($p < 0.01$), subjects revealed significant effects on tutorial ($p < 0.01$), drill and practice ($p < 0.01$), and instructional games ($p < 0.01$), and family background appeared to have notable effects on tutorial ($p < 0.05$), simulation ($p < 0.01$), and problem solving ($p < 0.01$), Table 2.

Table 1. Multiple Regression Analysis of Computer-Assisted Instruction and Curriculum and Materials for Learning Satisfaction

| Independent variable | Learning Satisfaction (Dependent variable) | | | |
|-------------------------------|--|---------------------------|--------------------------|------------------------|
| | Learning Environment | Teachers and Instructions | Curriculum and Materials | Administrative Service |
| Computer-Assisted Instruction | | | | |
| Tutorial | 0.164* | 0.213** | 0.165* | 0.112 |
| Drill and Practice | 0.119 | 0.157* | 0.176* | 0.124 |
| Simulation | 0.172* | 0.168* | 0.192** | 0.133 |
| Instructional Games | 0.183* | 0.172* | 0.153* | 0.142 |
| Problem Solving | 0.106 | 0.206** | 0.188* | 0.159* |
| F | 9.189 | 11.273 | 14.814 | 17.543 |
| Significance | 0.000*** | 0.000*** | 0.000*** | 0.000*** |
| R ² | 0.177 | 0.206 | 0.227 | 0.248 |
| Regulated R ² | 0.161 | 0.193 | 0.211 | 0.232 |

Note: * $p < 0.05$, ** $p < 0.01$.

Table 2. Moderating effects of demographic variables on the relations between computer-assisted instruction and learning environment

| Strategy | Gender | Subject | Family background |
|---------------------|------------|------------|-------------------|
| Tutorial | $p < 0.01$ | $p < 0.01$ | $p < 0.05$ |
| Drill and Practice | $p > 0.05$ | $p < 0.01$ | $p > 0.05$ |
| Simulation | $p > 0.05$ | $p > 0.05$ | $p < 0.01$ |
| Instructional Games | $p < 0.01$ | $p < 0.01$ | $p > 0.05$ |
| Problem Solving | $p < 0.01$ | $p > 0.05$ | $p < 0.01$ |

With analysis of variance, the empirical results show that gender revealed outstanding effects on tutorial ($p < 0.05$), drill and practice ($p < 0.05$), simulation ($p < 0.05$), and instructional games ($p < 0.01$), subjects have significant effects on drill and practice ($p < 0.05$), simulation ($p < 0.05$), instructional games ($p < 0.05$), and problem solving ($p < 0.05$), and family background showed remarkable effects on tutorial ($p < 0.05$), simulation ($p < 0.01$), and problem solving ($p < 0.05$), Table 3.

Table 3. Moderating effects of demographic variables on the relations between computer-assisted instruction and teachers and instructions

| Strategy | Gender | Subject | Family background |
|---------------------|------------|------------|-------------------|
| Tutorial | $p < 0.05$ | $p > 0.05$ | $p < 0.05$ |
| Drill and Practice | $p < 0.05$ | $p < 0.05$ | $p > 0.05$ |
| Simulation | $p < 0.05$ | $p < 0.05$ | $p < 0.01$ |
| Instructional Games | $p < 0.01$ | $p < 0.05$ | $p > 0.05$ |
| Problem Solving | $p > 0.05$ | $p < 0.05$ | $p < 0.05$ |

With the analysis of variance, the empirical results revealed that gender displayed outstanding effects on tutorial ($p < 0.05$), simulation ($p < 0.01$), instructional games ($p < 0.05$), and problem solving ($p < 0.01$), subjects presented notable effects on drill and practice ($p < 0.01$), simulation ($p < 0.05$), instructional games ($p < 0.01$), and problem solving ($p < 0.05$), and family background showed remarkable effects on simulation ($p < 0.01$) and problem solving ($p < 0.01$), Table 4.

Table 4. Moderating effects of demographic variables on the relations between computer-assisted instruction and curriculum and materials

| Strategy | Gender | Subject | Family background |
|---------------------|------------|------------|-------------------|
| Tutorial | $p < 0.05$ | $p > 0.05$ | $p > 0.05$ |
| Drill and Practice | $p > 0.05$ | $p < 0.01$ | $p > 0.05$ |
| Simulation | $p < 0.01$ | $p < 0.05$ | $p < 0.01$ |
| Instructional Games | $p < 0.05$ | $p < 0.01$ | $p > 0.05$ |
| Problem Solving | $p < 0.01$ | $p < 0.05$ | $p < 0.01$ |

With the analysis of variance, the empirical results displayed that gender showed significant effects on tutorial ($p < 0.01$), drill and practice ($p < 0.01$), simulation ($p < 0.01$), instructional games ($p < 0.05$), and problem solving ($p < 0.01$), subjects presented notable effects on tutorial ($p < 0.01$), simulation ($p < 0.05$), and problem solving ($p < 0.01$), and family background revealed outstanding effects on drill and practice ($p < 0.01$), simulation ($p < 0.01$), and problem solving ($p < 0.01$), Table 5. According to the above analyses, H5, H6, and H7 were partially agreed.

Table 5. Moderating effects of demographic variables on the relations between computer-assisted instruction and administrative service

| Strategy | Gender | Subject | Family background |
|---------------------|------------|------------|-------------------|
| Tutorial | $p < 0.01$ | $p < 0.01$ | $p > 0.05$ |
| Drill and Practice | $p < 0.01$ | $p > 0.05$ | $p < 0.01$ |
| Simulation | $p < 0.01$ | $p < 0.05$ | $p < 0.01$ |
| Instructional Games | $p < 0.05$ | $p > 0.05$ | $p > 0.05$ |
| Problem Solving | $p < 0.01$ | $p < 0.01$ | $p < 0.01$ |

Conclusions and suggestions. Summing up the data analyses and research conclusions, suggestions for the practical applications of computer-assisted instruction and learning satisfaction and future research are proposed below:

(1) Learning environment: computer-assisted instruction with Ipad allows students' learning environment be distant and ubiquitous. In this case, it is suggested that interactive multimedia materials and web pages could be designed into curriculum to reinforce individual information capability and apply the instructional resources at schools so that students could present the capability for e-generation. Meanwhile, students could autonomously learn without being restricted by space and time that students could control the learning time and be satisfied with the demands to promote the learning effects and learning satisfaction.

(2) Teachers and instructions: The application of computer-assisted instruction with iPad could achieve remote and ubiquitous instructions. It is therefore suggested to design implementation plans for students to record the using time of subsidiary materi-

al and propose suggestions that it can be a bidirectional communication between teachers and students. The function of recording learning process and after-learning tests could become an intangible constraint and competition among student peers.

(3) Curriculum and materials: computer-assisted instruction could show simulated phenomena and processes for students to receive the instinctive, imagery, and active knowledge. Teachers could demonstrate the contents, make them diverse and active, stimulate students' learning motives and diverse learning resources, and promote learning satisfaction. In this case, computer-assisted instruction with iPad has uncompetitive advantages. When applying computer-assisted instruction with iPad, indescribable and incomprehensible materials, which cannot be presented by other media, could be lit up with computer-assisted instruction with iPad.

(4) Administrative service: Schools could immediately transmit information to students with iPad, and teachers could deliver lesson-related information to students. It not only saves the resources, but also prevents students from missing relevant information because of locations.

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