Educational Benefits of Multimedia Skills Training

By Tsung juang Wang

"The primary goal of skills training is to provide youth with practical techniques and skills based on professional knowledge rather than manufacture well-trained basic operators."

Abstract

The use of multimedia technologies in education has enabled teachers to simulate final outcomes and assist students in applying knowledge learned from textbooks, thereby compensating for the deficiency of traditional teaching methods. It is important to examine how effective these technologies are in practical use. This study developed online learning-teaching resource platforms using Flash multimedia, providing interactive and integrated features in an easy-to-use user interface, in order to discuss Computer-Aided Drawing (CAD). The study utilized a teaching experiment with a non-equivalent pretest-posttest control group design to test and discuss students' professional cognition, operating skill cognition, and level of learning satisfaction during the learning process. No significant differences emerged between the groups in regards to professional cognition or operation skills cognition. However, a significant difference in learning satisfaction was noted, indicating that the coursework with multimedia Flash produced greater satisfaction than with traditional learning methods. Results are explained in detail and recommendations for further research provided.

Keywords: *architectural education; teaching; learning; e-Learning; educational technology; CAD; Flash; cognition*

The technical and vocational educational system has played an important role in the development of the Taiwanese economy, producing a great number of skilled professionals who have contributed to the nation's rapid development. Indeed, the technical and vocational systems have the greatest impact on economic growth among the various types of educational systems available because they focus on providing the skilled personnel needed to foster economic development and national construction.

Teaching a trade is the core of these educational systems, with drill and practice being the most commonly used methods for helping students become accustomed to certain actions and skills through repeated trainings and operations until they can correctly complete the actions/skills on their own. However, with respect to skills learning, students view many of the instituted practices as burdensome and redundant. Many do not understand the need for practice, while the lack of feedback they receive after practice makes them dislike the vocation itself. Thus, many traditional methods have failed to satisfy students accustomed to modern technologies.

According to Lim (2007), digital technologies will lead to a revolution that will not only change how students learn, but will also determine what they learn and with whom—a phe-

nomenon that has and will continue to affect the technical and vocational educational sector. Thanks to the development of the computer and the Internet, many predict an evolutionary change in the education system. Information technology (IT) already plays a critical role in current approaches to education (Tondeur, van Braak & Valcke, 2007). The primary goal of skills training is to provide youth with practical techniques and skills based on professional knowledge rather than manufacture well-trained basic operators. Therefore, it is necessary to change and integrate the teaching methods and the application tools utilized in the technical and vocational education sector in order to improve the traditional—and repetitive—practice methods (Dawson, Forster, & Reid, 2006), respect students' wishes and the differences/challenges of each individual (Van der Meij & De Jong, 2006), increase interactions between teachers and students, and enhance students' interest in learning (Battalio, 2007; Van der Meij & De Jong, 2006).

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The sustainable development of technical and vocational education is based on the combination of technologies and skills that will enable graduates to deal with this modern, computerized, and technological society. Thus, technical and vocational education can no longer confine itself to traditional teaching methods. This situation leads to the main issue facing technical and vocational education systems that hope to modernize their programs: how to combine traditional teaching methods with modern technologies.

IT can help the technical and vocational education sector achieve its goals, enabling teachers to apply novel information technologies while preserving the quality of instruction in order to fulfill the idea of teaching and learning through the application of computer artificial intelligence (Li, Tsai, & Tsai, 2008; Hernández, Pardo, & Kloos, 2007; Vera, Cobos, Félez, Sánches-Naranjo, & Pinto, 2006; Mesenzani, Schael, & Albolino, 2003), multimedia technologies, and networks (Li et al., 2008; Vera et al, 2006), thereby creating a personalized, diversified, and comprehensive teaching environment.

The Internet provides opportunities for the educator to rethink the concept of learning (Benson, Johnson, Taylor, Treat, Shinkareva, & Duncan, 2005), design new learning strategies, develop a learning environment (Koubek & Salvendy, 1999; Benson et al., 2005), and verify the learning concepts and strategies used (Stone, 2007; Lim & Chan, 2007). As such, the education market has witnessed a sudden explosion of teaching and learning software and platforms. However, there are problems with much of the software produced.

Most of the software developers lack teaching experience, and the products often fail to include theoretical background. Moreover, the software presentations and interfaces are too distracting. According to Sadik (2008), when computer designers try to make the materials livelier, they actually have a negative effect on the learners, because the animations and colorful pictures will detract from the students' learning ability. Norton and Hathaway (2008) further assert that the strongest enhancement for a student is the knowledge that he or she can learn and experience a higher level of achievement and success. Therefore, it is necessary to increase the efforts being put forth in regard to the quality of instructional software.

This study utilized IT-based teaching platforms in vocational courses to design a learning environment based on students' individual learning differences. Flash software was used as the teaching resource platform because Flash has integrated and interactive features and an easy-to-use user interface. Teaching experiments were conducted using the software developed in order to understand students' learning satisfaction during the learning process.

The subsequent analyses can be used as references for future course planning or the integration of teaching materials for practice courses. Teachers can design and improve the practice courses in universities based on these results. Additionally, these results can be used as a reference for additional teaching materials used for students' skill development.

Rationale for a Computer-Based Multimedia Learning Platform

A multimedia learning platform has the following strengths:

Personalized education. Learning and teaching with the assistance of technologies benefit both students who are able to process information easily and students who need more time to learn and digest study content (Tsai, Hwang, Tseng, & Hwang 2008; Shen et al., 2008; Caruso,

2008). In addition, students can complete the instructional goal through self-learning in instances where teachers are not able to provide individual consultation (Tsai et al., 2008; Shen et al., 2008).

Flexibility of time and space. The multimedia learning platform allows students to suspend and revisit study material at their convenience and within a flexible time frame (Hughes, McLeod, Brown, Maeda, & Choi., 2007).

Comfortable for a variety of personality types. A multimedia learning platform environment is impartial. The introverted student, for example, has the opportunity to function in a comfortable learning environment that provides privacy and independent operation (Trujillo, 2007), without pressure from classmates or a professor. In addition, the features of the multimedia learning platform include courses or question repetitions so that students have more opportunities for self-learning.

A well-developed instrucational multimedia platform is a collective effort by educators, teachers, students, and programmers (Trujillo, 2007), and can be used by most teachers to reduce time and effort. A multimedia platform can also be applied for practice of potentially dangerous practical experiments or the use of difficult-to-obtain teaching materials. Many studies conducted in Taiwan mention that instructional multimedia platforms include the following features with respect to learning applications:

More concrete learning experiences. Dale (1946) introduced the famous Cone of Experience to explain that the human learning experience is based on three aspects: practice, observation, and thought. Multimedia learning platforms combine concrete ideas and abstractions, with teaching conducted through image presentation texts, numbers, and audio presentations in sequence. This is a representative model and is a theoretical method in addition to practical instruction methods.

Diversified teaching materials. The multimedia platform provides diversified teaching materials through text, music, pictures, and animation, which can provide assistance to students' cognitive development.

Effective motivation. The attractive live designs and audio and flash effects included in a multimedia platform can attract interest and encourage student edification.

A hyperlinked learning method. The multimedia platform provides dynamic learning patterns through hyperlinks instead of a non-linear learning method, which aides in the acquisition of additional and related information.

Dedicated teaching materials. Due to the high cost of instructional multimedia platforms, the designers apply effort and resources toward designing and planning the content of the platform as opposed to individuals teaching without specific goals.

Enhancement for traditional learning methods. The instructional multimedia platform incorporates the interactivity of the traditional learning platform as well as personalized learning, mass production, immediate test feedback, and flexibility of time and space, allowing improvement upon learning speed.

Based on the above, it is possible to summarize the rationale of applying a multimedia learning platform to skills learning as follows:

Personalized teaching. The features of a personalized teaching platform include immediate feedback (IT to human) and self-controlled learning schedules (human to IT). The multimedia learning platform allows students to learn at any time, without emotional factors affecting the learning schedule. The multimedia resources can also be used as preparation material for study. Students may be able to learn skills at their own pace, having their individual learning demands satisfied.

Effective teaching materials. Presentations using multimedia applications can encourage student learning and effectively integrate a variety of media elements. The multimedia learning platform can also simulate situational applications, allowing students to understand the subject more easily and observe its relevance. With respect to preparation of teaching resources, the high cost of production and widespread service area of a multimedia learning platform provides assurance that more time and effort will be spent on evaluating the selection and arrangement of teaching materials. The hyperlinks included in teaching material increase overall effectiveness and range of subject comprehension.

High quality teaching and broadened education for students. The multimedia platform eradicates the human factors present in traditional teaching activities, so the teaching scenario and process provides a more stable environment. Negative factors caused by a teacher's psychological status or other aspects are decreased, and a certain level of instructional quality is assured. In addition, a multimedia platform allows students to learn during convenient times and under optimal conditions.

"This study utilized IT-based teaching platforms in vocational courses to design a learning environment based on students' individual learning differences."

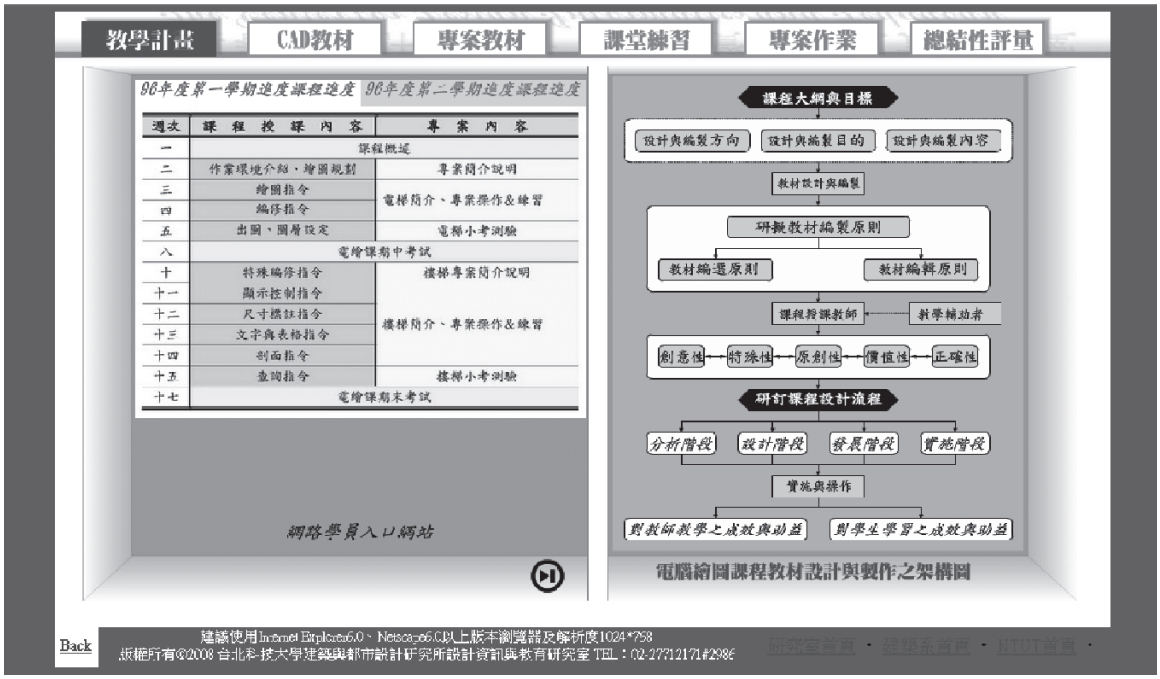

Figure 1: Platform for the System of Flash Courseware

Simulated learning scenarios. In technical and vocational fields, the acquisition and practice of many skills may be dangerous or risky, or the cost of training and practice may be too high. In these cases, the multimedia platform can simulate the actual scenario without the risks or damages economically.

Reduced psychological obstacles. Some students may be afraid of asking questions in real time due to psychological factors, such as embarrassment or shyness, leading to ineffective learning. The multimedia platform can reduce these factors by providing a neutral response, private space, and reduced pressures from teachers and classmates. In this sense, the multimedia platform creates a more comfortable learning environment.

Repetitive learning and immediate feedback. The multimedia platform may enhance learning effectiveness through immediate feedback. In a traditional teaching setting, the learning effectiveness of students is related to the teaching attitude and methods of individual teachers. The multimedia learning platform provides opportunities to learn and practice repetitively.

The Design and Development of a Multimedia Skill-Learning Platform

The design and development of a multimedia skill-learning platform, such as computer-aided courses, focus on a curriculum and the learning of the concepts necessary for a particular field of study (Li et al., 2008; Banks & Faul, 2007; Ferdig & Dawson, 2006). The developers of a computer-aided teaching program should have knowledge of the field, the computer technology necessary to teach the field and a comprehensive understanding and respect for different cultural and social environments. The concepts that should be applied in computer-aided teaching design include:

1. constructive learning
2. scenario learning
3. case study experience
4. apprentice learning
5. cooperative learning
6. subject learning
7. story learning

Because these seven concepts are independent of each other, an effective approach would be to integrate these concepts into the process learning for any particular subject.

Many studies have suggested that an instructional multimedia platform should include tutorials, drill and practice, simulation, instructional games, problem solving, dialog inquiry, and tests (Trujillo, 2007; Ferdig & Dawson, 2006; Gunasekaran, McGaughey, & McNeil, 2004).

In this study a multimedia skill-learning platform was designed and applied, creating instruction for architectural design. The platform integrated case studies and architectural concepts that taught students to create architectural drawings and designs.

Flash is icon-based software. Icons are the basic elements of the system. Each icon serves a

Figure 2: System features for the tutorial-based multimedia learning platform

certain function, for example, showing pictures, playing audio, initiating interactive talking, or making decisions. The icons are interlinked to each other to constitute an interactive, multimedia system. Based on this and following the goals of teachers and the level and demands of students, the system was arranged into six main sections (from left to right, teaching plan; CAD instruction; project instruction; in-class practice; project assignment; evaluation) (Figure 1).

Teaching Section. The main object of this section is to teach skills and commands, focusing on the designs and skill applications in the service core of architecture. Each unit will integrate with detailed descriptions of commands and steps to operate the case graphs. Through the dedicated arrangement of each learning unit, students will understand the meaning of each command. Also, different drawing cases will be presented for students' reference. This is a teaching system integrated with related learning units and complete service core designs and skills. The system uses module-based tutorial design pattern to discuss and solve the problems that may be encountered during architectural design and construction drawings. Students can understand the principles and methods of service core design through problem solving, or working on projects. During the teaching process, the designed and final results will be shown to motivate students to inquire further into the subject. From the design point of view, the system has the features of both the tutorial-based multimedia learning platform and simulation-based multimedia learning platform and the dialog inquiry function (Figure 2 and Figure 3). The main functions on the interface include:

1. Previous Page – move back to the browsed previous page, with the hyperlinks to other units
2. Next Page – move the browsed next page, with the hyperlinks to other units
3. Home Page – return to the first page of this unit
4. Last Page – jump to the last page of this unit

Figure 3: System Features for the Simulation-Based Multimedia Learning Platform

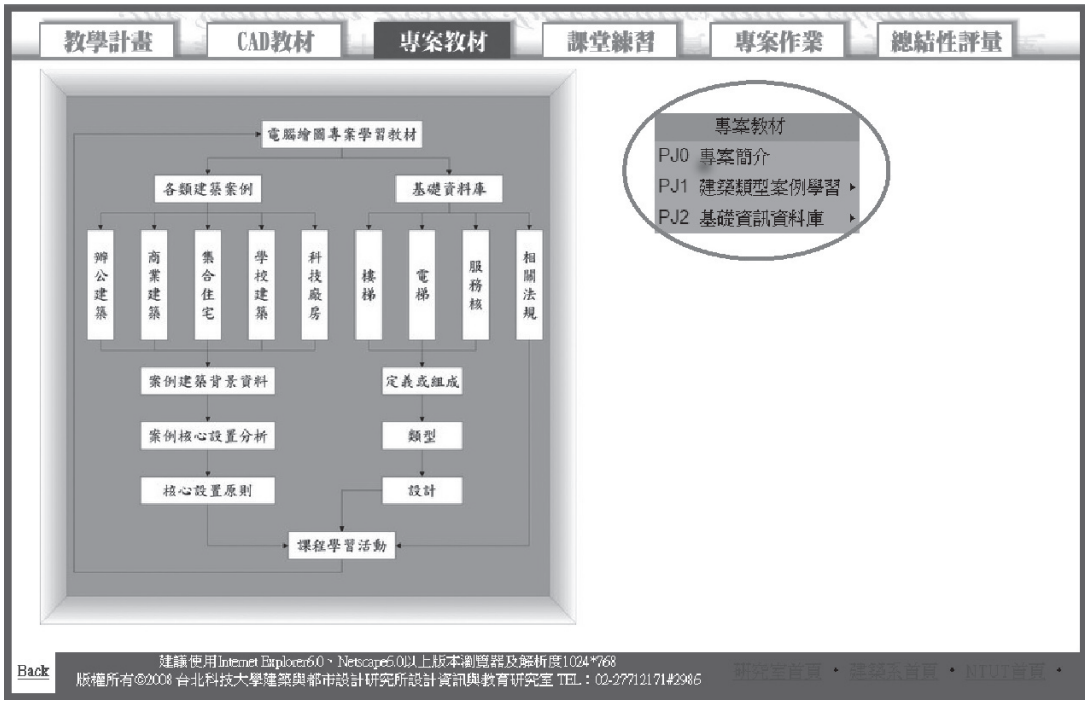

Figure 4: Teaching Section and Related Knowledge Areas

5. Process – review a page that has been browsed before
6. Search – find some contents in this unit
7. Quick View – move to the first page of other units
8. Related Knowledge – move to the related knowledge
9. Skills Guidance – move to the contents of service core designs
10. Exit – bring up a dialog box with the option to exit, restart, or cancel
11. Other – show hyperlinks in the contents of this unit in order to link to other knowledge descriptions when the mouse icon becomes a finger.

Related Knowledge. This section is correspondent to the commands practicing and constructive service core element design in the Teaching Section, providing all knowledge required there in a tutorial design pattern. The "Return to Teaching" icon is added to allow students to switch between the Teaching Section and Related Knowledge. When the user wishes to switch between the Teaching Section and Related Knowledge areas, it is possible to track the page he or she has visited before, in order to avoid starting all over again (Fig. 4). Thus, this study designs the system from the user's point of view to evaluate the overall arrangement of courses and to eliminate the waste of time and repeated reading.

Demonstration of commands practicing and constructive service core elements section. Commands and constructive service core elements exercises are provided in this section, along with the problems to be solved. The user bases his or her practice on the professional knowledge and methods of elements drawings or refers to the knowledge provided in the Related Knowledge section to solve the service core elements design and practical problems. In this section, the result from the design and the design requirements are presented as well, so the teachers and students can have some references in service core elements exercises and designs.

Tests. During teaching, teachers often use some tests to evaluate the results and progress of the students' education, which would also be used as a base of teaching schedule and teaching improvement. The tests and questions can be modified from time to time. The test system integrated in multimedia skill learning platform can achieve the above mentioned goals. Tests are the easiest and simplest medium to evaluate the effectiveness of teaching techniques. However, considering that the level of test difficulty should be consistent among classes, the questions must be modified, and the question numbers must be changed, it is necessary to evaluate and change the questions when designing a test-based multimedia skill-learning platform. On the selection of questions, it is possible to integrate drawings or command operations into the tests in the form of animations to stress the application of skills and professional cognitions. Regarding test feedback, proper encouragement or incentives shall be provided by animations and points for questions answered correctly. For incorrect answers, the correct answers shall be given. Moreover, it is necessary to use random numbers in program design to make the same questions with different answer orders, to prevent students from memorizing test answers.

From the above, in this study, the design and development includes case study and project learning concepts, and encouragement to students for self-construction. In the teaching arrangement, the practical commands exercises and constructive service core elements design

skills are used to guide the students to apply the knowledge they have acquired within the tutorial design pattern, which is included in the system (Figure 5). In addition, on the test design, random numbers are used on questions to prevent students from memorizing the orders of questions and answers, and provide a reliable test result. The ultimate purpose for acquisition of skills is to allow the students to draw and design by themselves and have a chance for actual practice and application in order to master their skills. As a result, the drill and practicing design pattern is required to reach this target. In other words, the multimedia skill learning platform designed and developed in this study includes more than one learning concept and design patterns. The criteria used in this system are most common and accepted for both teachers and students in teaching activities.

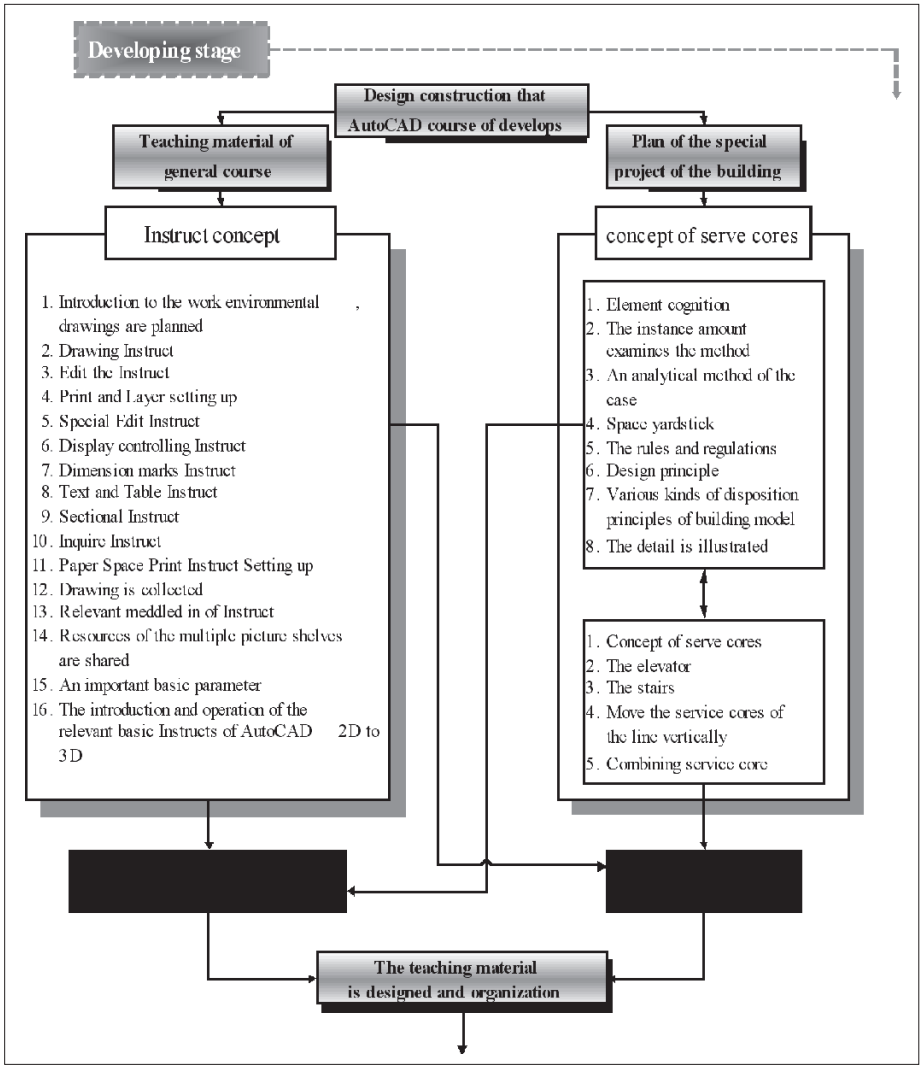

Figure 5: Research design and development

Experimenting with the Instructional Media Developed

Using the media developed, teaching experiments were conducted. The design of the experiment is based on the nonequivalent pretest-posttest control group design. The subjects in this study are university students in CAD practice courses. The teaching experiment started on February 22, 2006. The experiment group was taught with a multimedia learning platform and the control group was taught with traditional teaching methods. Before the experiment started, both groups were given a pre-test. Then, a controlled learning scenario was provided and the experiment began. After the education and training were completed, a post-test and questionnaire for satisfaction were conducted in order to find differences between the groups of students.

Instrumentation and deployment. Questionnaires were developed for this study that addressed issues of general learning, skill development and learning satisfaction. The instruments were statistically tested for validity and reliability using techniques including t-tests examining critical ration, and Cronbach's alpha. The analyses indicated the instruments are both valid and reliable.

48 sophomore students enrolled in a Computer-Aided Drawing course were asked to participate in the experiment. Dwyer (1980) and Suppes (1980) suggest methods to determine "the effect" of a technology "x" on a particular learning or the development of a specific skill. The focal point was to compare the effect of a class with the use of multimedia learning platform course (experimental group) and a class with the use of traditional teaching methods (control group). The idea was to prove that learners using multimedia online courses can learn more, faster and better than non technological ways of learning. The students were randomly separated into two groups, Group A (control group) and Group B (experimental group), each containing 24 students.

Data Analysis. The data collected from teaching experiment were collected and analyzed by SPSS statistical analysis software. The study uses a t-test and Pearson Product-moment Correlation for validity. Kuder-Richard-

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son reliability KR 20 and Cronbach α and ANOVA are used to discuss the difference between the experiment group and the control group. 17 completed questionnaires were collected the traditional teaching group, and 19 completed questionnaires were collected from multimedia platform group.

With regard to professional cognition and the learning effectiveness, there was no significant difference on both pretest and post-test analysis for both the experiment group and control group. In the area of skill operation cognition, there is no significant difference in the analysis for each item and on both pretest and post-test for both groups. As for learning satisfaction, there is a significant difference on total variation (F9.683, $p<0.01$), indicating that students had greater satisfaction with the instructional multimedia platform than with the traditional teaching method.

Students found the multimedia learning platform more acceptable than a traditional teaching method ($F=5.470$, $p<0.05$). In addition, students believe that it is easier to operate with multimedia learning platform than with traditional teaching methods ($F=5.201$, $p<0.05$), indicating that the multimedia learning platform is more acceptable to students.

Students reported a preference to the teaching materials in the multimedia learning platform to the materials from textbooks ($F=5.819$, $p<0.05$). Students also think that it is very easy to learn the teaching materials from the multimedia learning platform ($F=4.851$, $p<0.05$), and the learning targets can be obtained from these materials ($F=5.066$, $p<0.05$)

Students agree that the multimedia learning platform can provide more supports than the traditional teaching method ($F=7.468$, $p<0.01$), particularly on assisting them achieve the learning goal ($F=4.568$, $p<0.05$), and the multimedia learning platform can provide more opportunities for self-learning ($F=8.571$, $p<0.01$).

Students agree that the teaching materials in the multimedia learning platform provide a personalized learning opportunity ($F=10.068$, $p<0.01$), that with the multimedia learning platform students can study following their own learning process ($F=5.427$, $p<0.05$), and that the multimedia learning platform encourages students to learn actively ($F=7.718$, $p<0.01$). With the multimedia learning platform, students can have a comfortable learning space and do not need to wait for other students ($F=6.405$, $p<0.05$). Other benefits reported were that students can obtain feedback and enhance skills immediately, students are be able to know the learning results ($F=6.405$, $p<0.05$), and the approaches to solve problems are be provided with learning platform ($F=12.235$, $p<0.01$).

Students agree that the multimedia platform is helpful in their professional courses ($F=6.608$, $p<0.05$). However, there is no significant difference between the students in the multimedia platform and those in the traditional teaching method on service core architectural drawing and design professional knowledge. Nevertheless, students give credit to the multimedia platform on service core architectural drawing and design skills ($F=5.471$, $p<0.05$). The students especially appreciate the supports from the multimedia platform on service core architectural drawing and design ($F=10.551$, $p<0.01$).

Conclusions and Suggestions

The study indicates there is no significant difference between students who learned under a traditional teaching method and students who studied with the multimedia platform with respect to professional cognition or skill operation cognition. It is mainly because, in addition to the limited time of study, the students had never participated in any core architectural design course. Although the basic principles of design and drawing are those the students had learned before, the students are not able to show their creativity and capability within the short amount of time. This may be the reason that no significant difference can be found during the experiment. Still, the traditional teaching method has its advantages.

There is no considerable difference between the experiment group and the control group with regard to future learning goals. This may be be-

cause the subjects in this study are sophomores, and some students may not decide to follow a career involving architectural drawing and design skills in the future.

In summary, both the multimedia platform and traditional teaching methods have their own advantages and features. With regard to personalized teaching, the multimedia platform is significantly different providing immediate feedback and student control of the learning process, since they "don't have to wait for others" and can proceed with more self-control compared to the traditional teaching method. Data indicate that the multimedia platform can satisfy students' demands for personalized learning.

Regarding the validity of teaching materials, the multimedia learning platform motivates and allows students to become more eager to learn, "encourages students to learn actively," provides materials that are easier to understand, and teaches so that the students "understand the learning targets." It is believed that the multimedia learning platform used in this study shows some benefits over the traditional teaching materials.

Regarding teaching quality, students agree that the methods used in the multimedia platform are more helpful than traditional teaching methods and that they could more easily "identify the proper learning method" and "achieve the learning target." The support materials for students also "provided a chance for self-learning." The multimedia learning platform was not affected by teachers' emotion or other factors, and the overall teaching quality can be assured, compared with the uncertainty of this factor with the traditional teaching method.

Regarding learning scenarios, is it easy to create a simulated situation under the multimedia learning platform that would allow students access to more information and "provide supports to overcome the difficulties" when they arise. This study also simulates actual service core architectural drawing and design so students have the chance to see the service core in the building.

Generally, students can accept the application of the multimedia platform on skill learning, as they found that "it is easy to operate," and agree that the multimedia learning platform developed in this study is helpful for skill development in areas including drawing, "knowledge and cognition of service core unit elements," and "service core design." This suggests recommending use of instructional multimedia platforms in skill learning fields. However, there is no significant difference regarding professional cognition and skill cognition.

The multimedia learning platform provides immediate feedback and solutions for problems. Moreover, the multimedia learning platform is not affected by time or space; through Internet or uploading, students can have repetitive learning opportunities, and the comprehensiveness of the multimedia learning platform can be extended.

Discussion: Suggestions for Professional Practice

The multimedia platform can trigger students' learning interests, provide opportunities for self-paced learning, and provide proper supports and feedback. However, students should not be attracted solely by potential distracters such as animation and audio feedback. Moreover, while students are using the multimedia platform, it is important to have interaction with teacher and classmates.

At some level, the multimedia learning platform can replace traditional teaching materials for teachers. However, the multimedia platform does not provide a substitute for a teacher's role of coaching during students' learning processes. Teachers should have an open mind regarding the multimedia platform and try to integrate their own experiences and skills into the platform to make the platform more comprehensive (Badge, Dawson, Cann, & Scott, 2008).

From an instructional multimedia platform developer point of view, the complete platform should not be limited to a single design pattern (such as tutorial, simulation, games, tests, drill, and practice). A complete platform should be a complex variety of different patterns. It is beneficial to have teachers or educators involved in the development of the multimedia platform. The best situation is one in which teachers plan and develop the platform to ensure that the materials meet actual teaching requirements. According to the questionnaire results of the study, there is greater satisfaction among students using a multimedia teaching method. Students have a higher acceptance of multimedia teaching than the traditional method, and they believe that, compared with the traditional teaching method, it is easier to learn with the multimedia. Students prefer multimedia materials more than those of traditional textbooks. They believe it is easier to learn with multimedia teaching materials and is easier to understand the learning goals.

Multimedia teaching can provide more assistance to students than traditional teaching methods can. There is a significant difference in providing students with self-learning opportunities.

Students believe that multimedia learning helps their professional development. However, on the professional knowledge of service core architectural drawing and design, there was no significant difference between multimedia teaching and traditional teaching method. Nevertheless, on the learning of objects and drawing skills for each unit and integration learning of elevators, stairs, and restrooms, most students confirm the effectiveness of the multimedia method; students especially appreciate the assistance on service core designs.

Suggestions for Future Studies

During the process of developing the experiment between the multimedia learning platform and the traditional teaching, some study constraints and problems were discovered that are worth discussion for future studies:

1. This study uses Macromedia Flash V.8.0 to develop the software. In order to acquire animations and icons, a lot of time was spent on processing in Photoshop. For future studies in this field, programmers should pay attention to the graph formats and software to avoid wasting time. The study focused on a "unit," providing hyperlinks to related knowledge and skill practices; this is a good approach for consideration. There is no need for researchers to design the entire multimedia platform.
2. Researchers should be careful about limits such as time, expense, and effort, and obtain the related software and supports as early as possible. With regard to the teaching experiment, they should pay attention to the time on task. Students should be provided with sufficient time to think and respond. As for learning content, before developing the multimedia platform, it is necessary to understand teachers' opinions and suggestions, and to analyze and understand students' ability levels.
3. Due to administrative restrictions, this study could not conduct a test to random subjects. Hence, quasi-experimental design was used. It is suggested that those conducting future studies obtain administrative support first, obtaining as many samples as possible from different universities to achieve more accurate and precise results. In addition, with regard to the evaluation tool for skill learning, it is possible to test the skill one by one and design a skill evaluation checklist for evaluation. Furthermore, some qualitative studies should be conducted with interviews and observations to obtain more detailed information.

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