



Effects of Digital Teaching on the Thinking Styles and the Transfer of Learning of the Students in Department of Interior Design

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Along with the constant advance of information technology and the rapid development of the Internet, the diverse functions and characteristics of e-learning break through lots of limitations in traditional instruction. Properly integrating e-learning design with Internet activities could enhance students' learning effect, and applying digital technology to assist in teachers' instruction is a future trend of instruction. A nonequivalent experimental design is applied to the quasi-experimental research in this study, in which total 162 students in three classes in National Taipei University of Technology, Tung Fang Design Institute, National Yunlin University of Science and Technology in Taiwan are selected as the research subjects for the 16-week (three hours per week) experimental teaching research. The research results conclude that 1. thinking styles present significant effects on transfer of learning, 2.e-learning shows remarkable effects on transfer of learning, 3.liberal thinking styles reveal the best effect on promoting far transfer under e-learning, and 4.conservative thinking styles appear the best effect on promoting near transfer under e-learning. At the end, conclusions and suggestions are proposed in this study, expecting to provide teachers with some assistance in the teaching methods.

Keywords: thinking styles, transfer of learning, near transfer, simulation

INTRODUCTION

The rapid progress of technology, especially the boom of the Internet in past years, has resulted in the rapid increase on information production and the

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changeable learning methods to generate the era of knowledge economy and meticulous division. In such an era, actively instructing or guiding students “learning how to learn” and “cooperating with others” is inevitable. With the rapid development of multimedia computers and the Internet in past years, utilizing world-wide-web for planning the learning environment has become the future trend.

Such an e-learning environment not only could break through the limitations to time and space, but could also provide favorable interpersonal interaction interface so as to offer a convenient platform for network project-based learning.

Aiming at traditional instruction which would easily form “inert knowledge”, the theory of situated learning in past years’ stresses on the abilities of authenticity, problem-solving, and transfer of learning.

Moreover, the research or practical investment in transfer of learning in business circles is astonishing. In past years, more than 200 billion US dollars were spent on employee training in North American areas, while the expenses on acquired knowledge, skills, and abilities which could be transferred to tasks were merely 10% of above amount (Sung& Hwang, 2013). Apparently, both schools and enterprises consider transfer of learning as an important but hard-to-solve problem. From the theory of mental self-government, thinking styles play a critical role in learning, and mixing people with different thinking styles together could result in better cooperative outcome; such as a government requiring executive, legislative, and judicial mechanisms to develop the maximal efficiency. It is simply the theoretical inference, but has not been verified with research. The industrial transformation in Taiwan has increased the demands for design work so that the design education is gradually emphasized (Hsueh and Huang, 2014). In regard to the cultivation of individual design capability, curricula are required for the complete practice of design procedure and the training of problem-solving capability in the design education so as to cultivate the students with the capabilities of analysis, creation, and product design. Design is the comprehensive performance of individual creativity and experiences. A person with creative thinking styles and characters does not necessarily well perform on the design creation. This study intends to understand the properties of thinking styles being able to present better design performance to efficiently organize and plan suitable design, generate preferable creation effectiveness, and promote the quality of design. What is more, there has not been a study on the effects of learners’ preferred ability, thinking styles, on transfer of learning. This study therefore would like to explore the effects of e-learning on department of interior design students’ thinking styles and transfer of learning.

LITERATURE AND HYPOTHESIS

E-learning

E-learning was first proposed by Jay Cross in 1990 (Duncan, 2010) and then stirred the global interest in e-learning. E-learning acquires digital materials through wire or wireless network for online or offline learning activities. Al-

State of the literature:

- Focus on popularization of environmental education; enhance the people's awareness of environmental protection.
- Environmental education is an innovative course.
- To explore theoretical success factors of the Professional Knowledge of Seed Teachers in Environmental Education

Contribution of this paper to the literature:

- The factors of Social Responsibility, Environmental Sustainability, Citizen Participation, Textbook Selection and Teaching, and Environmental Education have a considerable influence on understanding environmental protection.
- To develop Environment seed teachers' professional ability, it will help improve the effectiveness of environmental policies to promote.
- Fostering seed teachers in environmental education must be considered as a long-term goal because ongoing education related to environmental protection facilitates gradually changing people's adverse habits and solving environmental problems.

Mansour & Al-Shorman (2012) defined e-learning as any electronic learning and teaching and the process of learners acquiring all information by using online technological instruments to implement the learning. Simply speaking, e-learning was a learning method through online technology. Gambrell (2011) defined e-learning as learning and teaching activities through network or other digital contents and the implementation of a brand-new learning method by thoroughly utilizing learning environments with brand-new communication mechanisms and rich resources through modern information technology. Such a learning method would change the function of teachers and the teacher-students relationship in traditional instruction to further change the instructional structure and essence. In short, digital and “learning” was to reinforce learning with information communication technology (Johnson & Adams, 2011). Courts & Tucker (2012) further defined e-learning as delivering learning contents with technological channels, including information technologies of network, computers, and multimedia, to achieve the instructional objective. Comparing e-learning with traditional instruction, there is a major difference in the connotation. E-learning is learner centered and stresses on learners’ active learning, teachers playing the role of counselors, materials with adaptive and diverse design, teaching sites and aids being changed from whiteboard and paper materials in a physical classroom to the application of computers, network, and multimedia.

Referring to the example of LearnLinc classroom, Popov et al. (2014) proposed three digital teaching models. (1) Asynchronous model: When a student logged in a system, the system would show the previous personal records of the student, who could preview the materials or review the previous contents. (2) Synchronous model: In this system, a teacher needed several control functions to control students’ learning processes so that the students could be guided to learn. (3) Mixed model: A teacher could design an interactive learning course with the mix of original synchronous and asynchronous learning models in a virtual classroom.

Thinking styles

Jones et al. (2011) pointed out thinking styles as the preferred method of a person thinking or dealing with affairs. It was not the ability or the personality, but was between both; therefore, two people with equivalent abilities could present distinct performance (Cukusi et al., 2010). Thinking styles in the viewpoint of mental self-government referred to people selecting the most comfortable management pattern from several methods for the management of daily activities. Researchers further explored thinking styles and personality and found out certain degree of overlap of the two (Evcim & İpek, 2013). Basically, styles differ from people and are not good or bad; the point is to match styles with environments and thoroughly develop personal strengths. Alptekin & Karsak (2011) described the major theory about thinking styles, as following.

(1) Styles were not abilities, but the method a person used to applying the ability. The match of styles and abilities could complement each other. (2) People’s styles were not single-dimensional, but multi-dimensional. (3) People with same styles would reveal different degrees. (4) Styles were the result of socialization, which could be taught, changed, and measured. (5) There was not a fixed standard for styles; the evaluation differed from time and places. (6) People presented the flexibility with various styles (Pérez-López et al., 2010). Referring to Kuo & Chao (2014), the tendency of thinking styles is divided into liberal styles and conservative styles in this study. People with liberal styles prefer crossing fixed rules, thinking outside the existing program, and pursuing changes. People with conservative styles, on the other hand, would like to follow existing rules and programs, reduce changes, avoid uncertainties, and prefer familiar affairs both in life and at work.

Transfer of learning

Hassan & Abdolreza (2013) considered “transfer of learning”, also called transfer of training, as the expansion or generalization of learning results that it was the effect of a type of learning on another type of learning (Kuo & Chao, 2014). Transfer of learning has been regarded as the ultimate goal of instruction, and the achievement of such a goal is considered as the instruction which can hardly be overcome (Fletcher & Shaw, 2012). Cullen et al. (2013) regarded transfer as a type of instruction, which was designed to teach students how to apply the learned knowledge and skills to a different context. Although transfer of learning was hard to achieve, it was the core of problem-solving, creative thinking, and other high-level mental processes (e.g. invention, art output) and the economic source of learning time and energy, as it could effectively reduce or seriously increase time and energy for learning new subjects (Peter & Timothy, 2011). In terms of organizational knowledge transfer, it is considered as the process of a unit being influenced by the experience of another unit (Sumadio & Rambli, 2010). In a workplace, transfer of learning is defined as trainees being able to effectively apply the acquired knowledge or skills from educational courses to the tasks (Spek et al., 2011). In sum, transfer of learning refers to an individual or a group being able to effectively and continuously apply the acquired knowledge, skills, and attitudes in the learning environment to the other learning or working situation. Chan & Unsworth (2011) proposed near transfer and far transfer as a different classification, which emphasized the degree of transfer of learning. Near transfer referred to solving problems with similar properties or executing learned skills in real context similar to the learning environment. Williams & Romero (2011) explained such transfer as the high similarity between learning and application situations, as low-road transfer which could easily learned. Far transfer indicated the ability to solve different types of problems under the condition different from the past learning environment. In other words, a learner should present the ability to decontextualize learning and to apply the extracted general principles and rules to new contexts. For instance, learning two-digit addition could help learn multiplication; a chess player could self-generalize some principles and strategies to cope with new games. Such transfer required a learner exceeding the surface characteristics of an affair and discovering the common principle between different situations and phenomena, as high-road transfer which was hardly achieved. Such a common classification is used in this study (Wu & Kuo, 2014).

Research hypothesis

Yakubova & Taber-Doughty (2013) stated that both teachers and students presented the unique thinking styles; a teacher performed on the teaching behaviors to become the teaching style, and a student performed on the learning activities to form the learning style. Coleman et al. (2012) discovered that conservative thinking styles could effectively predict the performance of assignment which focused on analyses, liberal thinking styles could predict the evaluation of creativity-centered performance, paper-based tests could benefit conservative thinking styles but was unfavorable for liberal thinking styles, and students with liberal thinking styles appeared the best performance on independent operation. A lot of studies revealed the similar results. In regard to learners’ thinking styles, locus of control, self-efficacy, motivation, and job involvement are the possible factors in transfer of learning (Montt, 2011). Gifted students and ordinary students show differences on thinking styles; the former tends to liberal thinking styles, while the latter tends to conservative thinking styles (Hoy, 2012). Thinking styles present moderate correlations with learning styles, and those with conservative thinking styles show higher academic achievement (Davies & Hewer, 2012). It is important for a learner being able to abstract knowledge. Some researchers argued that a learner would generate transfer of learning after really comprehend and familiarize learning

contents. Accordingly, academic performance is not completely determined by intelligence, while thinking styles show primary correlations. In spite of considering a student's intelligence, an educator should not ignore the effect of students' thinking styles. The following hypotheses are therefore proposed in this study.

H1: Thinking styles present significant effects on near transfer.

H2: Thinking styles show remarkable effects on far transfer.

The external factors in transfer of learning contain learning climate, teacher support, learning environment, and instruction design (Moss & Jewitt, 2010). Besides, the higher similarity between learning context and transfer context, the more easily transfer of learning is generated. For example, when using computer simulation for mobile or airplane driving training, the similar contexts or objects and skills could facilitate transfer of learning in real operation contexts. Accordingly, learning culture, learning climate, teacher support, and the similarity between learning and transfer in teaching or working environments could remarkably affect transfer of learning. In an instruction, explaining with diverse examples or practicing different types of problems could assist in transfer of learning (Forrer et al., 2014). Especially, the student-centered instruction design, such as enquiry and action learning (EAL), problem-solving learning (PBL), role playing, critical incident analysis, and video simulation, encourages students to actively explore the problems in the real world, cooperate learning with others, and apply science and technology to reduce learning barriers and enhance transfer of learning (Hsiao & Rashvand, 2011). E-learning could deliver learning contents and achieve instructional objectives with enquiry and action learning (EAL), problem-solving learning (PBL), role playing, critical incident analysis, and video simulation through the assistance of information technology, including network, computers, and multimedia.

In this case, the following hypotheses are proposed in this study.

H3: E-learning reveals notable effects on near transfer.

H4: E-learning appears significant effects on far transfer.

H5: Liberal thinking styles present the best effect on promoting far transfer under e-learning.

H6: Conservative thinking styles show the best effect on promoting near transfer under e-learning.

RESEARCH METHOD AND SUBJECT

Research subject and research design

To effectively achieve the research objective and test the research hypotheses, the quasi-experimental research with nonequivalent experimental design is preceded in this study. Total 162 students in three classes in National Taipei University of Technology, Tung Fang Design Institute, National Yunlin University of Science and Technology in Taiwan are selected as the research subjects, where a class (54 students) is taught with asynchronous digital instruction, another class (54 students) is taught with synchronous digital instruction, and the other class (54 students) is taught with mixed digital instruction. The experimental teaching research is preceded three hours per week (total 48 hours) for 16 weeks.

Measurement of research variable

E-learning

Referring to Popov et al. (2014), learning achievement is divided into (1)asynchronous model, (2)synchronous model, and (3)mixed model.

Thinking styles

Referring to Kuo & Chao (2014), the dimensions contain (1) liberal thinking styles and (2) conservative thinking styles.

(1) Transfer of learning

Referring to Chan & Unsworth (2011), the dimensions include (1) near transfer and (2) far transfer.

Analysis method

Analysis of Variance is applied to discuss the differences of e-learning in students' thinking styles and transfer of learning and further analyze the effect of thinking styles on transfer of learning.

ANALYSIS RESULT

Analysis of Variance of Thinking styles on transfer of learning

Analysis of Variance is utilized for exploring the difference of thinking styles in transfer of learning. Table 1 shows that thinking styles present significant differences on near transfer and conservative thinking styles show higher near transfer than liberal thinking styles do. H1 is therefore supported. Thinking styles also reveal remarkable differences on far transfer, and liberal thinking styles appear higher far transfer than conservative thinking styles do that H2 is supported.

Table 1 Analysis of Variance of thinking styles

Variable		F	P	Scheffe post hoc
Thinking styles	Near transfer	7.752	0.000**	Conservative > liberal
	Far transfer	8.324	0.000**	Liberal > conservative

* Stands for $p < 0.05$, ** for $p < 0.01$

Analysis of Variance of e-learning on transfer of learning

Utilizing Analysis of Variance for discussing the difference of e-learning in transfer of learning, e-learning presents notable differences on near transfer, and mixed model shows higher near transfer than asynchronous model and synchronous model do, Table 2, that H3 is supported. E-learning also reveals significant differences in far transfer, and mixed model appears higher far transfer than asynchronous model and synchronous model do that H4 is supported.

Table 2. Analysis of Variance of e-learning

Variable		F	P	Scheffe post hoc
E-learning	Near transfer	10.334	0.013*	Mixed > synchronous, asynchronous
	Far transfer	11.638	0.007**	Mixed, synchronous > asynchronous

* Stands for $p < 0.05$, ** for $p < 0.01$

Analysis of the effect of thinking styles on transfer of learning under e-learning context

Analysis of Variance is applied to discuss the differences of e-learning and thinking styles in transfer of learning, and Two-way Analysis of Variance is used for exploring the interaction between e-learning and thinking styles to verify the promotion of transfer of learning. In Table 3, the integration of digital instruction with conservative thinking styles and mixed model appears the highest near transfer, while the interactivity of digital instruction with liberal thinking styles and

mixed model shows the highest far transfer, Figure 2. The remarkable interaction is obviously shown in Figure 3. H5 and H6 are supported.

Table 3. Analysis of Variance of thinking styles on transfer of learning

Variable	Near transfer			Far transfer		
	F	P	Scheffe post hoc	F	P	Scheffe post hoc
Thinking styles	7.752	0.000**	Conservative >liberal	8.324	0.000**	Liberal >conservative
E-learning	10.334	0.013*	Mixed>synchrous. asynchronous	11.638	0.007**	Mixed. Synchronous>asynchronous
Thinking styles*e-learning	16.733	0.000**	13>12>23>22>21>11	21.481	0.000**	23>12>13>21>22>11

* stands for $p<0.05$, ** for $p<0.01$

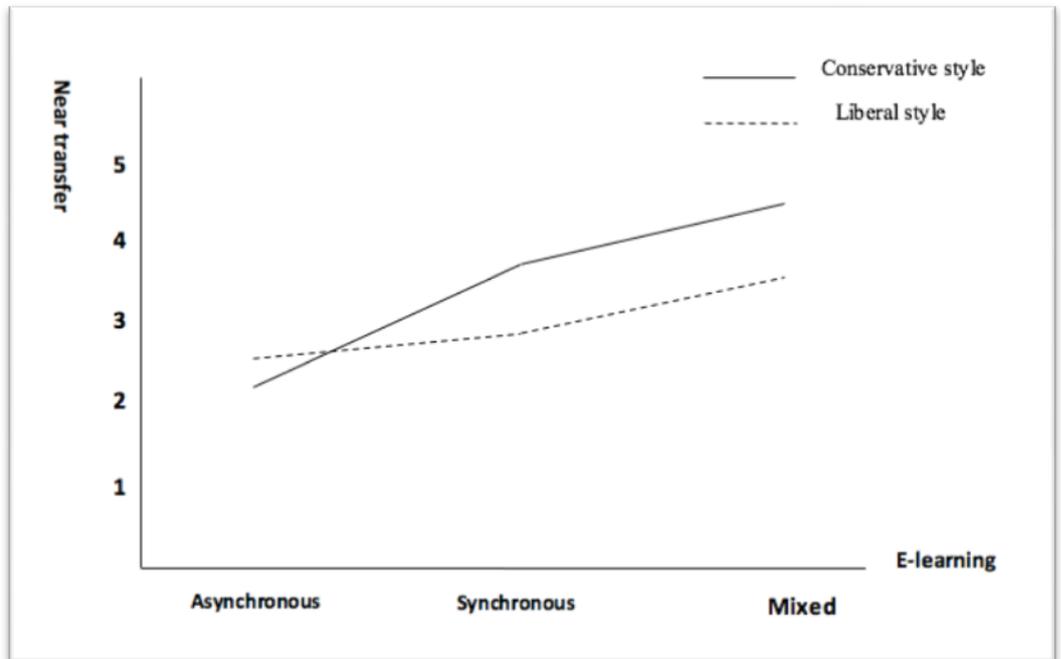


Figure 2: Margin mean

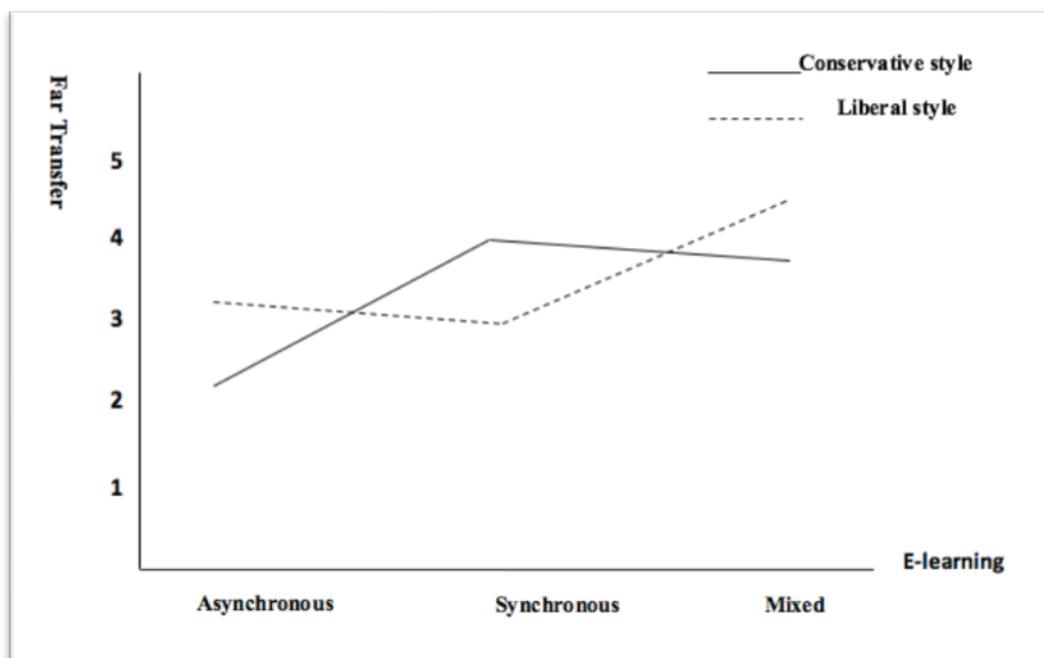


Figure 3: Margin mean

CONCLUSION

This experimental research intends to discuss the effect of thinking styles on department of interior design students' transfer of learning. The research results show that liberal thinking styles are the most suitable thinking disposition for e-learning. Apparently, research on thinking styles appears different results on teaching environments. It proves that there is not a fixed good or bad standard for thinking styles and the evaluation would differ from time and places. In this case, simply regarding cooperative learning as a panacea is not correct. The optimal learning method should have department of interior design students in each group present distinct thinking styles. The research results are concluded as following. (1) Mixed model outperforms synchronous model and asynchronous model on near transfer. (b) Mixed model outperforms asynchronous model on far transfer. Accordingly, the research results verify researchers' points of view. Furthermore, thinking disposition would change with contexts (Sternberg, 1997). In the literature review, most research on thinking styles was preceded under traditional education environments. Since e-learning reveals great differences with traditional teaching environments, it is not surprising to acquire distinct conclusions when studying thinking styles in different environments. Besides, a lot of research pointed out the critical role of thinking styles in department of interior design students' learning (Zhang, 2001). However, research on thinking styles in e-learning is rare when e-learning is getting popular. The research believes that such research would become more popular.

SUGGESTION

1. High-level learning abilities are required for e-learning so that department of interior design students could be competent of learning. Students participating in e-learning should have basic abilities in computers and basic concepts about the Internet so as to perfectly control the learning. In this case, it is suggested that a

teacher should educate students with knowledge and abilities related to e-learning in order not to affect the learning outcome.

2. Taking department of interior design students' learning processes in e-learning environments as the data, the learning model acquired from data mining is the useful information for planning and proceeding e-learning. A teacher should well utilize it and constantly accumulate the prior experiences to enhance the learning outcome and promote department of interior design students' transfer of learning. What is more, a teacher engaging in e-learning should be acquainted with improper applied instrument in the e-learning environment so as to properly guide students.

3. When proceeding e-learning design, instruction, and evaluation, a teacher should take department of interior design students' thinking styles into account, such as understanding department of interior design students' thinking styles, helping department of interior design students understand personal thinking styles, designing diverse teaching activities, and adopting multiple evaluation approaches, so as to induce department of interior design students with various thinking styles to develop the talent.

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