# THE RELATIONSHIP BETWEEN LEARNING STYLE PREFERENCE FOR COMPUTER DRAWING AND LEARNING OUTCOMES IN A COMPUTER AIDED DESIGN COURSE AT A COMPUTER TRAINING CENTER IN TAIWAN

Fang Chao Yang[1]

Richard Lynch[2]

**Abstract:** The purpose of this study was to explore the relationship between learning styles and learning outcomes of 141 engineering drawing students at a computer training center in Taiwan. This study employed a quantitative research methodology employing both a questionnaire as well as examination scores to address the research objectives. There were five parts included in this study. First, the Learning Style Inventory categorized the learners' learning preferences into four dimensions: perception, input, processing and understanding. Second, the learners' learning styles were compared according to gender. Third, the learners' learning styles and their learning performance were compared. Fourth, the study also compared the learners' learning outcomes between new and current students. Fifth the relationship between the number of times learners repeated the engineering drawing course and their learning performance was computed. Overall, there were eight findings of the study: 1) the most preferred learning style of both female and male students was sensing, visual, reflective and global; 2) there was no significant difference in learning style preference between males and females; 3) there was no statistically significant relationship found in the degrees of the input, processing and understanding learning styles and grade - however, there was a correlation between the perception learning style and grade; 4) the number of male students who were willing to take the exam right after the course was greater than that of female students - however, the average grade of females was higher than that of males; 5) as for learning style preferences between new and current students, new students preferred to learn sequentially and current students were global learners; 6) the number of times students repeated the course did not affect their learning outcomes; 7) in terms of demographic factors and learning style preferences, no statistically significant differences were found; 8) no significant differences were found between demographic factors and learning outcomes.

**Keywords:** Learning Style Preference, Learning Outcomes

## Introduction

Original Equipment Manufacturer (OEM) is a world famous form of Taiwanese manufacturing. It uses a specific form of subcontracting in which a supplier or the manufacturer produces components of a product or the finished product for a customer. Then the customer or retailer makes the product under its own brand name through its distribution channels (Hobday, 2001, as cited in Hsu & Liu, 2006). According to the Ministry of Economic Affairs of Taiwan (Wei, 2009), Notebook computers such as Asus and Acer, LCD Monitors such as HP, Dell, Acer, Lenovo and ViewSonic, and PC motherboards such as Gigabyte are the top three OEM industries in Taiwan. Since the 1980s' the widespread cooperation between Taiwanese manufacturers and Japanese companies has brought the transfer of knowledge, skills and technologies to Taiwan. Japanese companies also help Taiwanese manufacturers to set up the manufacturing equipment and provide technical workers' training. It has also developed the nurturing of manufacturing talent in Taiwan as an industrial based training style.

Until the 1990s', on the basis of the consideration of economic cost and the mature skill development of Taiwanese engineers, the OEM industry in Taiwan gradually developed into an ODM (Original Design Manufacture) format, whereby the suppliers design, produce and integrate the products in order to supersede the former production model which followed the customers' design. The need for engineers to keep improving a design step by step necessitated the increased development of the capacity for drawing and diagramming which plays an important role in the quality of national engineering construction in Taiwan (Kang, Tai & Wang, 1994).

Engineering drawing is one of the most important activities during the process of Research & Development (R & D), manufacturing, quality control and sales of a product. It can be understood as a kind of language that expresses the concepts and ideas of designers, and it is also a communication between each stage of the supply chain of the products including manufacturing and selling until the products arrive to the final customers. Thus, drawing is a valuable tool for industrial manufacturing organizations which can be used to record ideas, exchange views, make production plans, and publicize the product.

The Computer Training Center (CTC) provides the training that enables students to learn the basic knowledge and skills within a short period of time. However, every learner has various personal characteristics, backgrounds, and maturity; thus people have different ways of thinking

[1] M.Ed. Candidate in Curriculum and Instruction, Graduate School of Education, Assumption University, Thailand biscocoya@yahoo.com

[2] Ph.D., Assistant Professor, Program Director of M. Ed. In Curriculum & Instruction, Graduate School of Education, Assumption University, Thailand richardlynch2002@yahoo.com

and learning. This is called individual differences. In order to adapt education from traditional group-oriented processes, individualized or differentiated teaching and learning have become the basic principle of education. This means that teaching procedures must adapt to the individual differences of students, so they can obtain the training benefits most efficiently and effectively (Chang, 2012). Therefore, if learners understand their own learning style their learning development will be enhanced. The study of students' learning styles can give educators an important direction to improve their own teaching styles and efficacy.

The main purpose of the assessment of learning outcomes is for both instructors and learners to understand the status of the achievement of learning goals, so that they may then, as necessary, adjust the teaching/learning plans. However, not all learning outcomes are caused by intellectual factors alone. Other factors affect learning outcomes such as study habits, learning strategies, achievement motivation, personality traits, and environmental factors. Therefore, this study focused on students' learning styles in order to determine if they influenceed to students' learning outcomes.

**Objectives**

The purpose of this study was, first, to identify the preferred learning styles of students learning AutoCAD at CTC Taiwan according to their gender. Then to determine the significance of the relationship between learning styles and learning outcomes, to determine the significance in learning preferences between the new students and those repeating the course and finally to determine if there was a significant relationship between the number of times students repeated the AutoCAD course and their learning outcomes at CTC Taiwan.

**Literature Review**

There are various factors which are known to affect students' learning performance, and individual differences are commonly used to explain student learning. They include two domains: interindividual differences and intraindividual differences. Interindividual differences compare one student with another, including factors such as age, intelligence, or nationality. Intraindividual differences compare an individual student's abilities, including language ability, mathematics ability, memory or reasoning ability. The formation of individual differences is quite complex. It includes hereditary, environment, or individual internal factors and when these factors interact with each other they may constitute different conditions (Shao & Pi, 1999).

To further describe students' individual differences, these various kinds of individual differences will be categorized into biological, social and cognitive differences. Biological differences are the physiological factors of the individual such as age, gender, or even vision. Social differences are mostly the external factors such as culture, family economic status, or relationships among classmates and with teachers. Finally, cognitive differences refer to some aspects of human ability or personality dimension that influence how people mentally process information, such as intelligence, spatial ability, learning styles, motivation, self-esteem or interests. This study focused only on cognitive differences represented here by learning styles.

Studies of engineering learnng styles have been dominated by the Kolb's Learning Style Inventory (LSI), the Myers-Briggs Type Indicator (MBTI), the Felder-Soloman Index of Learning Styles (ILS) and the Dunn and Dunn Learning Style Model. They were all inspired by Carl Jung's theory of psychological types. The ILS consists of four dimensions to address how information is perceived and processed, thus students can understand their own learning needs and also instructors can adjust their teaching methods to meet the learning needs of students (Chen & Lin, 2011).

Felder and Silverman (1988) developed their learning styles model for two reasons: "to capture the most important learning style differences among engineering students; and, to provide a good foundation for engineering instructors to design a teaching approach that would address the learning needs of all students" (Felder & Spurlin, 2005, p.103).

Engineering students' learning difficulties happen quite often because of the mismatch between the learning styles of engineering students and the teaching styles of engineering instructors. Teaching is the interactive process between teachers and students; therefore, if a teacher wants to promote effective learning, he or she must not only possesses the teaching skills, but must also understand the students' individual differences, so that they can make learning easier which will lead to better achievement under appropriate teaching styles (Felder & Silverman, 1988).

The following is the description of the four dimensions of the Felder-Silverman Learning Styles Model (FSLSM Felder & Silverman, 1988) and the examples of AutoCAD course students of CTC in Taiwan:

1. Sensing-Intuitive: refers the type of information learners preferentially perceive. Sensing learners mostly observe, perceive and gather information through the senses. They like facts, data and experimentation, and they are good in memorizing, have the patience to grasp subtle aspects and do not like acourse that has nothing to do with reality. For example, sensing learners in AutoCAD courses prefer to see how teachers draw a model by using AutoCAD. They may verify the correct tools and processes to draw the model, and try to memorize and apply to their own drawing. Intuiting learners are more adept at mastering new concepts, principles and theories. They have better understanding of abstract formulas and they do not like the courses that require memory and general

computing. For example, intuiting learners in AutoCAD courses prefer to understand the concepts and principles of how to draw a model by using AutoCAD. They may try to find their own way by using the principles and not just follow and imitate teachers.

2. Visual-Verbal: Visual learners are good in remembering what they see and they prefer pictures, charts, graphs, films or field demonstrations. Verbal learners are good in remembering what they hear, and what they discuss with others. They prefer learning by written or oral description (Felder & Silverman, 1988).For example, visual learners in an AutoCAD course may prefer to read the notes with many figures or pictures or watch demonstration videos; However, verbal learners in an AutoCAD course prefer to learn by group discussion or oral-explanation by instructors.
3. Active-Reflective: Active learners like hands-on and experiences, cooperate with others, and try to discuss, explain and test new information. They cannot bear just to sit in classroom and listen to the lecture; they prefer more positive participation.Reflective learners prefer theories and learn individually; they tend to investigate the new information and thoroughly thinkit through. They require opportunities for independent thinking in order to digest the lecture content; they avoid taking the initiative to speak (Felder & Silverman, 1988). For example, active learners in an AutoCAD course prefer to discuss or share their experiences or knowledge with instructors or their classmates, and can further discuss the possibility of applying new information they learn into their work. Reflective learners in an AutoCAD course prefer to think about the principles and theories by themselves; they prefer to define the problems and consider the principles which they can use to solve drawing problems by themselves.
4. Sequential-Global: Sequential learners tend to find the answers step-by-step, using linear-thinking to solve problems. They are good at convergent thinking and analysis, which means they may try to learn by gathering relevant information that surrounds a topic. They will get better learning achievement when they fully understand the learning materials that are presented in a logical, ordered progression and these materials must move from easy to complex and difficult steadily. Global learners tend to learn in bits and pieces or by using intuitive leaps thinking, which is opposite from sequential learners. It is difficult to explain how they solve problems, because they seem to jump to here and there to find the main points of solution. Thus, they are better at the model of divergent thinking which means they may not consider only one way but a variety of ways to get a solution; thus, they have creativity and a broadvision (Felder & Silverman, 1988). For example, sequential learners in an AutoCAD course prefer to learn sequential lectures from instructors and books. They utilize information about the drawing software, the tool bars, the functions of each tool and which tool can used to draw which figure, and so on. However, global learners in an AutoCAD course prefer to learn by problem solving demonstration. When they see a model, they may consider about what tools or functions can be used to draw that model and learn the information from the process. Therefore, they may jump from this chapter to that chapter to gain the information they need.

**Conceptual Framework**

Based on the theories presented above, Figure 1 is the conceptual framework of this research.

(See Figure 1 on the next page)

**Method/Procedure**

This study was a quantitative study which used both descriptive and inferential statistics. The descriptive statistics were used to investigate the preferred learning styles of both male and female students by utilizing a questionnaire. The inferential statistics were used to investigate significant differences of preferred learning style by genders and also to determine of there existed a significant relationship between students' learning style preference and learning outcomes. Moreover, the inferential statistics were used to investigate significant differences of preferred learning style by how many times students repeated the course, and also to determine is there was a significant relationship between course repeat times and students' learning outcomes. A research questionnaire, which included a demographic section, was used. In terms of the students' learning outcomes, the AutoCAD 2012 International Certified Professional Examination was used to assess students' learning outcomes, and students' exam grades was assessed, with school permission, through the authorized server from Autodesk. The survey was conducted during the period of March to June of 2013 at the Computer Training Center branches in southern Taiwan through distribution and collection of the ILS questionnaire and examination scores.

Several studies have analyzed learning styles by using Kolb's experiential learning theory. However, according to Chang (2004), there was no statistically significant difference in learning achievement between elementary students with different learning styles in synchronous Computer Supported Cooperative Learning by using Kolb's inventory. Chou (2005) also discovered

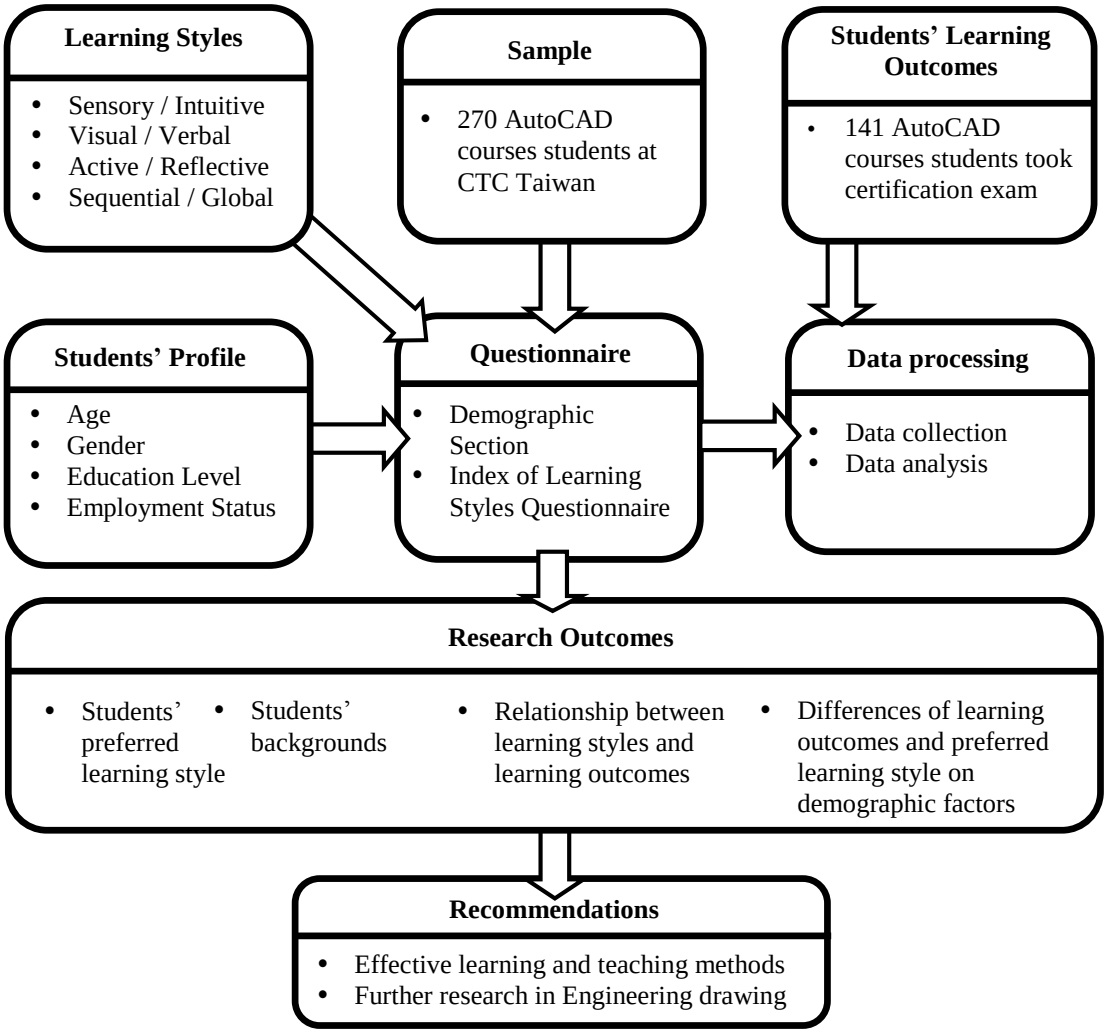


**Figure 1: Conceptual Framework**

from her research about Network Behavior that there was no significant difference of network behavior by different learning styles through using Kolb's inventory; however, based on Soloman & Felder's learning style inventory, most of the network behavior showed significant differences in learning style.

Therefore, this study used the Index of Learning Styles Questionnaire (ILS) developed by Soloman & Felder (1991) to find out the preferred learning styles for the students of the AutoCAD curriculum in the Computer Training Center of Taiwan. According to Felder & Spurlin's research (2005), the internal consistency reliability coefficients of the ILS is between .55~.77. The values of the coefficients for each dimension are as follows: Sensing-Intuitive and Visual-Verbal both more than .70, Active-Refelctive .61 and Sequential-Global .55. All the values of each dimension exceed the suggested values of Tuckman (1999, as cited in Felder & Spurlin, 2005), which means is the instrument is acceptable for attitude assessments. Table 1 showed the internal consistency coefficients determined in six previous studies and in this study:

**Table 1: Cronbach Alpha Coefficients of Different Studies (adapted from Felder & Spurlin, 2005 and Huang, Lin & Huang, 2012 and the Current Study)**

| Sen-Int | Vis-Verb | Act-Refl | Seq-Glob | n | Source |
|---|---|---|---|---|---|
| 0.56 | 0.40 | 0.65 | 0.67 | 141 | Current Study |
| 0.65 | 0.56 | 0.51 | 0.41 | 284 | Van Zwanenberg et al. (2000) |
| 0.72 | 0.6 | 0.56 | 0.54 | 242 | Liversay, Dee, Nauman, and Jr. Hites (2002) |
| 0.76 | 0.69 | 0.62 | 0.55 | 584 | Spurlin (2002) |
| 0.70 | 0.63 | 0.60 | 0.53 | 557 | Zywno (2003) |
| 0.77 | 0.76 | 0.61 | 0.55 | 448 | Litzinger, Ha Lee, Wise & Felder (2007) |
| 0.64 | 0.60 | 0.56 | 0.58 | 219 | Huang, Lin & Huang (2012) |

In this study the ILS was distributed to 141 students registered in AutoCAD 2012 curriculum at the 19 branches of Computer Training Center in the southern area of Taiwan. The questionnaire included forty-four items with eleven itemsfor each learning style dimension and each items had two response options. These two options represented the opposing endpoints of each learning style and the scale took the dichotomy of the structural design. The ILS score ranged between -11 to 11, with the more extreme the number, the more strongly the learner tended toward a certain tendency. For example, a score of -11 and -9 in active/reflective dimension, represented a very strong tendency of reflective; a score of -7 and -5 indicated a moderate tendency of reflective; and a score of 1 and 3 signaled a mild tendency of active. Table 2 shows the item numbers for each learning style preference. The respondents selected one option of the item. If respondents choose answer "a", then the analysis of that dimension would be plus one point (going to the left hand side); if respondents choose answer "b", then the analysis of that dimension would deduct one point (going to the right hand side). The final score would never be zero (Lee, 2007).

**Table 2: Table of Specification for the Index Learning Style Questionnaire (Huang, 2012)**

| Learning Styles | Item No. | Analysis |
|---|---|---|
| a. Sensory (+)<br>b. Intuitive (-) | 2, 6, 10, 14, 18, 22, 26, 30, 34, 38, 42 | a ← →b<br>11 9 7 5 3 1 -1 - 3 -5 -7 - 9 -11 |
| a. Visual (+)<br>b. Verbal (-) | 3, 7, 11, 15, 19, 23, 27, 31, 35, 39, 43 | a ← →b<br>11 9 7 5 3 1 -1 - 3 -5 -7 - 9 -11 |
| a. Active (+)<br>b. Reflective (-) | 1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 41 | a ← →b<br>11 9 7 5 3 1 -1 - 3 -5 -7 - 9 -11 |
| a. Sequential (+)<br>b. Global (-) | 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44 | a ← →b<br>11 9 7 5 3 1 -1 - 3 -5 -7 - 9 -11 |

AutoCAD is a serial curriculum including three stages: Foundation Courses, Certification Courses, and Specialization Courses. The Foundation Courses provide 12 hours of 2D basic course, 15 hours of 3D basic course, and 15 hours of 3D advanced course. Students must at least finish the 12 hours of 2D basic course and then study the Certification Courses. The 3D basic and advance courses are free elective course that students can study after the Certification Course and before Specialization Course (Gjun Information Co.,Ltd., 2013). The AutoCAD 2012 Certified Professional Examination was used to assess students' learning outcomes in this study. It is a lab on-site exam and the exam questions are randomly selected from the Autodesk exam. The exam questions divide into two parts which are the theoretical basis of the test (disciplines - multiple choice questions) and operating drawing test (subjects - Fill in the blanks). It is used to assess students' comprehensive abilities such as the abilities to operate independently and to solve problems independently. The result of the certification exam is available immediately upon completing the examination (Autodesk, Inc, 2013). The total number of exam questions is: multiple choice, 50 questions and fill in the blanks, 50 questions. Students get two points for each correct answer, but minus one point for each incorrect answer. Therefore, the passing grade of disciplines is 79 out of 100 and for subjects is 77 out of 100.

**Findings**

According to the research objectives, the main findings of this study were:

- Research Objective 1. The majority learning style of the 141 respondents of this research could be characterized as sensory, visual, reflective and global for both male and female students. Sensing learners represented about 76% of the total; visual learners represented about 82% of the total; reflective learners represented about 55% of the total and global learners represented about 52% of the total.
- Research Objective 2. There were no statistically significant differences found in the degrees of processing learning style between genders.
- Research Objective 3. There was no statistically significant relationship found in the degrees of the input, processing and understanding learning style and grade. However, there was a correlation between the perception learning style and grade.
- Research Objective 4. There was a significant difference between new and repeat students in terms of understanding learning styles, with repeat students preferring global learning and new students preferring sequential learning.
- Research Objective 5. There was no significant relationship between the number of times students repeated the course and their learning outcomes, which means the students' learning outcomes were not directly affected by the number of times they repeated the course.

Apart from the main findings, there were 2 important additional findings of this study.

- Additional Finding 1. The total respondents of this research were 270, and this research used 141 as the sample because not all of the respondents took the exam right after the course. Fifty-nine percent of the male students took the

international certified exam right after the course as did 47% of the female students. The mean grade of the female students' exam score was slightly higher than that of the male students.

- Additional Finding 2. There were no statistically significant differences found in the degrees of students' preferred learning styles on demographic factors including age, education level and employment status as well as no statistically significant differences were found in the degrees of students' learning outcomes on demographic factors.

**Discussion**

The findings were different than those initially made by Felder & Silverman (1988). Felder & Silverman (1988) proposed most engineering students as visual, sensing and active, and global learners (as the subgroup 1 learner). The average results of the 141 ILS scores for this study are summarized together with other studies' results in table 18. The table structure is similar to that used in a table by Felder and Spurlin (2005), with A, S, Vs, Sq and N standing for Active, Sensing, Visual, Sequential and Number of students.

**Table 3: Reported Learning Style Preference in Percentages**

| Sampled Population | S (%) | Vs (%) | A (%) | Sq (%) | N (%) | Reference |
|---|---|---|---|---|---|---|
| Computer Training Center Taiwan | 76 | 83 | 45 | 48 | 141 | |
| Females | 72 | 85 | 47 | 49 | 47 | This Study |
| Males | 78 | 82 | 44 | 49 | 94 | |
| Overall DIT engineering students surveyed | 73 | 93 | 63 | 62 | 405 | O'Dwyer, A. (2010) |
| Average of Engineering Students below | 63 | 82 | 64 | 60 | 2506 | |
| Iowa State, Materials Engr. | 67 | 85 | 63 | 58 | 129 | |
| Michigan Tech, Env. Engr. | 63 | 74 | 56 | 53 | 83 | |
| Ryerson Univ., elec. Engr. | 65 | 88 | 59 | 62 | 338 | |
| Tulane, Engr. | 54 | 86 | 59 | 52 | 437 | Felder & Brent (2005) |
| Univ. of Western Ontario, Engr. | 59 | 80 | 69 | 67 | 858 | |
| Univ. of Limerick, Mfg. Engr. | 78 | 91 | 70 | 58 | 167 | |
| Univ. of Michigan, Chem. Engr. | 57 | 69 | 67 | 71 | 143 | |
| Univ. of São Paulo Engr. | 74 | 79 | 60 | 52 | 351 | |

Table 3 indicates that most engineering students in previous studies as well as the current study were sensing and visual learners. Also, the results indicated the percentage of sensing and visual learners between this study and the reference studies was not much different. However, the differences in the processing and understanding learning style dimensions can be found when comparing the results between this study and the reference studies. As the results of reference studies show, most of the students were active and sequential learners and the average ratio was more than 60%; the respondents of this study were more reflective and global than the average for the reference studies' students.

These different findings of the current study may derive from differences of culture and learning environment. Western culture and societal values are usually more individualistic and prefer inductive methods of training. Western students, while being independent learners, also understand the value of collaborative interaction, tending to join group work, to discuss in class and engage in project work with others. In contrast, Taiwanese students generally prefer to work alone and process information introspectively because of the traditional culture and deductive method of training. Moreover, the learning environment might be the reason of the difference on understanding learning style. The students of these reference studies were undergraduate school students, who took daily courses in school. However, the students of this study go to class twice or three times a week. Thus, the different mode and environment of learning might have affected the students' preference for the understanding learning style.

Beside students' preference learning style, the learning mode of students in CTC might affect their learning outcomes. However, there was no significant relationship between the number of times students repeated the course and their learning outcomes which found in this study. The reasons students retook this course might be: lacking of confidence or students realized their ability was not enough to take the exam. Therefore, it was possible that students who repeated this course and students who did not will get the same grade level for their exam. There was no apparent evidence found in this study, thus we may rely the future study to get broaden and deepen findings for this argument.

**References**

Autodesk, Inc. (2013). *Autodesk training & certification*. Retrieved from http://usa.autodesk.com/adsk/servlet/index?siteID=123112&id=14238655

Chang, C. H. (2012). *Educational psychology: Theory and practice of three orientations*. (1st ed.). Taipei: Tung Hua Book Store.

Chang, W. H. (2004). *The impacts of learning styles on elementary students in synchronous computer supported cooperative learning*. (Master's thesis, National University of Tainan, Tainan, Taiwan).

Chen, C. & Lin, M. C. (2011). Learning styles and student performance in java programming courses. *International conference on frontiers in education computer science and computer engineering: The 2011 World Congress in Computer Science, Computer Engineering, and Applied Computing*, P.53-58. Retrieved from http://world-comp.org/p2011/FEC3196.pdf

Chou, F. C. (2005). *The development of web-based portfolio system and research on network behavior in different learning styles & cognitive styles*. (Master's thesis, National Taipei University of Education, Taipei, Taiwan).

Felder, R. M. & Silverman, L. K. (1988). Learning and teaching styles in engineering education. Engineering Education, 78(7), 674-681. Retrieved November, 14 2012 from http://www4.ncsu.edu/unity/lockers /users /f/felder/public/Papers/LS-198 8.pdf

Felder, R.M. & Spurlin, J. (2005). Applications, reliability, and validity of the index of learning styles. Int. J. Engng Ed. Vol.21, No.1, pp.103-112. Retrieved from: http://www4.ncsu.edu/unity/lockers/users/f/felder/public/ILSdir/ILS_Validation(IJEE).pdf

Gjun Information Co.,Ltd. (2013). *Course detail of autocad basic course*. Retrieved from http://www.pcschool.com.tw/campus/course/CourseDetail.aspx

Hsu S. C. & Liu W. H. (2006). *The predicament of Original Equipment Manufacturer: The myth of Taiwanese industrial restructuring.* Annual Conference of Taiwanese Socciological Association, Taipei.

Huang, V. (2012, April 11). [Web log message]. Retrieved from http://social-brains.blogspot.com/2012/04/index-of-learning-styles.html

Kang, F. M., Tai, W. H. & Wang, C. M. (1994). National Science Council Research Project.The study of the knowledge construction requirement for Taiwan's industrial technical manpower [Author's translation]. (NSC82-0111-S-003-059)

Lee, C. M. (2007, June 19). [Web log message]. Retrieved from http://flowdavid.blogspot.com/2007/06/felder-silverman-learning-styles-odel.html

Lin, Y. L. (2006). *The influence of personality traits and learning styles to learning performance*. (Master's thesis, Chaoyang University of Technology, Taichung City, Taiwan).

O'Dwyer, A. (2010). Analysis of engineering students learning styles on level 7, level 8 and level 9 programmes. *Proceedings of the International Symposium on Engineering Education*, Retrieved from http://www.thehealthwell.info/node/634150

Shao, R. Z. & Pi, L. S. (1999). *Educational psychology*. (1 ed., Vol. 1, p. 632). Taipei: Wu Nan Book Publishing Company.

Soloman, B. A. & Felder, R. M. (1991). Retrieved from http://www.engr.ncsu.edu/learningstyles/ilsweb.html

Wei, C. C. (2009). Market Intelligence & Consulting Institute, Industrial Economics and Knowledge Research Center . *Retrospect and prospect of Taiwan's IT hardware industry in the first quarter of 2009*. Retrieved from http://mic.iii.org.tw/aisp/reports/reportdetail_register.asp?docid=2659&rtype=freereport