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Modeling of Cooperative/Collaborative Learning Technique: A case study of interior architectural program

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Abstract

This research presented a model of cooperative/collaborative learning technique which leads to learning efficiency of students continued from a previous research (Porntip, 2012). Objectives were to study and find out patterns of study groups of a class room case study that would have effects on the student learning efficiency. Formulating the model and data analysis, researcher used Structural Equation Modeling (SEM) for explaining the effects on the efficiency of a group of students. A theoretical subject case study of the Interior Architecture Program in the Faculty of Architecture, Maharakham University was used in this research. Results and recommendations were discussed in this research.

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Keywords: Cooperative/collaborative learning technique; interior architecture; student learning efficiency

1. Introduction

Much of architectural education is concerned with developing students in order for them to become well rounded, competent and imaginative designers of buildings and the spaces between them (Andrew, 2005). Teaching-learning methods in theoretical subjects of interior architectures in academic institutions are focused on transferring the theories to students for integration with other subjects, especially design subjects. There are many problems in the learning process in the classrooms of the theoretical subjects such as low effectiveness of student learning, period of study more than one hour/period, physical environment within the classrooms where were one-way teachings by an instructor, etc. These causes lead

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to shortage of student concentration (boring) in the classes. Therefore by using collaborative/collaborative learning technique is a direction to develop the teachings-learning to be higher efficiency of the students. In the previous research (Learning Efficiency in Theoretical Subjects of Interior Architecture by Cooperative/Collaborative Learning Technique by Porntip, 2012), researcher found that responsibility and past academic performance of students cooperated with organized teaching-learning by an instructor, provided teaching facilities and physical environment within the classroom where supported to cooperative/collaborative learning technique would have a positive effect on student learning efficiency (Porntip, 2012). Moreover, by the researcher's teaching experiences the researcher believed that arranging study groups by mixing students based on past academic performance of the students would have more support to higher student learning efficiency especially students who have low past academic performance because they talked and shared their knowledge and experiences to each other during the group activities. This issue leads to a question that how could we arrange the study groups or patterns what would have the most student learning efficiency. This research presented a model of the cooperative/collaborative learning technique which confirmed how the technique affecting student learning efficiency of in a theoretical subject of an interior architecture program by using Structural Equation Modeling.

1.1. Research objective

- To study factors and its measurement of the student characteristics, cooperative/collaborative learning technique, and student learning efficiency in a theoretical subject of an interior architecture program.
- To develop a Structural Equation Model (SEM) for explaining the factors influencing (cause-effect) the student learning efficiency in the subject.
- To recommend how to improve the teaching - learning in the theoretical subjects of the interior architecture program through the cooperative/collaborative learning technique in order to achieve the student learning efficiency.

1.2. Scope of study

The scope of this research covered a study of student learning efficiency by using cooperative/collaborative learning technique in a case study of a theoretical subject of an interior architecture program. The subject case study was "Interior Architecture Design Concept and Criteria 2 (CC2)" for 2nd year students of interior architecture program in Faculty of Architecture Urban Design and Creative Art, Mahasarakham University, Thailand. The research took the form of a longitudinal study carried out over a period of one semester. The subject was in 2nd semester of 2012 (during Nov. 2012-Feb. 2013). Population was 45 students who registered in the subject. During the period of study, teaching technological facilities and physical environment within the classroom were controlled as the cooperative/collaborative learning technique for all the study periods.

2. Literature review

In 1956, "Bloom's Taxonomy" was created under the leadership of educational psychologist Dr. Benjamin Bloom in order to promote higher forms of thinking in education, such as analyzing and evaluating, rather than just remembering facts (rote learning). "The Bloom's Taxonomy" identified three domains of educational activities or learning (Bloom, 1956) included:

- Cognitive, mental skills (Knowledge)
- Affective, growth in feelings or emotional areas (Attitude or self)

- Psychomotor, manual or physical skills (Skills)

Instructors often refer to these three categories as KSA (Knowledge, Skills, and Attitude). This taxonomy of learning behaviors can be thought of as “the goals of the learning process”. That is after a learning episode, the students should have acquired new skills, knowledge, and/or attitudes (Bloom, 1956).

Carroll (1974) presented a research related to five factors of successful teaching-learning management including (1) learner’s aptitude, (2) learner’s intelligence, (3) learner’s perseverance, (4) quality of instruction, and (5) learning opportunities. The first three factors related to the learners themselves while the factor four and five related to teaching-learning managements and processes. Delors (1998) stated that learning objectives of the learners for new decade are learning to know, learning to do, learning to live together, and learning to be.

Cooperative/Collaborative Learning Technique: Collaborative learning is an educational approach to teaching and learning that involves groups of learners working together to solve a problem, complete a task, or create a product (Marjan and Seyed, 2011). Marjan and Seyed (2011) stated that collaboration is a philosophy of interaction and personal lifestyle where individuals are responsible for their actions, including learning and respect the abilities and contributions of their peers. In all situations where people come together in groups, it suggests a way of dealing with people which respects and highlights individual group members' abilities and contributions. Cooperative learning is viewed as a tool for preparing students to work in teams as required in various employment settings, in the home, and in the community when there is a need to combine energies and work towards a common goal (Doymus, 2007). Cooperative learning is a learning approach that, they are helping each other learn about an academic subject, creating small mixed groups of students in the classroom in accordance with a common purpose and the groups (Burcin et. al., 2012). Burcin et. al. (2012) stated that the learning together method is a technique developed by D.W. Johnson and R.T. Johnson. The most important features of this technique are the existence of the group goal and sharing the opinion and materials, division of labour and the group reward. During the first applications to put out a single product working in groups, sharing ideas and materials, asking each other their questions before the teacher has supplied to be rewarded. In the teaching-learning process of an architectural program, the cooperative/collaborative learning technique might be used in the study process for talking and sharing their knowledge and experiences to others during the group activities of students and an instructor.

Longman Dictionary (2013) recorded “characteristics” is a quality or feature of something or someone that is typical of them and easy to recognize. Characteristic is a distinguishing feature or attribute of an item, person, phenomenon, etc., usually divided into three categories; physical, functional, and operational. Students approach learning tasks with various aptitudes and prior experiences. Aptitudes include general abilities, task-specific skills, interests, attitudes, and personality characteristics (Cronbach and Snow, 1977). Schunk (1985) stated that students also differ in their prior educational experiences, such as the number of schools attended, types of teachers they have had, and amount of time spent on various subjects. It should be noted that aptitudes and prior experiences are interdependent. “Student characteristic” in the previous research by Porntip (2012) could be measured by two measurement variables included past academic performance (GPA or previous relate subjects) and student responsibility score.

In the Wiki-Based Encyclopedia (2013) recorded “efficiency” in general describes the extent to which time, effort or cost is well used for the intended task or purpose. It is often used with the specific purpose of relaying the capability of a specific application of effort to produce a specific outcome effectively with a minimum amount or quantity of waste, expense, or unnecessary effort. Efficiency has widely varying meanings in different disciplines. Efficiency can be expressed a result as a percentage of what ideally could be expected, hence with 100% as ideal case (Wiki, 2013). Porntip (2012) presented “Student

Learning Efficiency” in a theoretical subject of an interior architecture program could be measured by two measurement variables included total score and final score of students in the subject.

The Theoretical Subject: “Interior Architecture Design Concept and Criteria 2” (CC2) is a required subject in Bachelor of Architecture (B Arch) Program in Interior Architecture Faculty of Architecture Urban and Creative Arts, Mahasarakham University. Contents of the subject are controlled by the Architect Council of Thailand (ACT). CC2 is a continued subject from Interior Architecture Design Concept and Criteria 1 (CC1), which means CC1 is pre-requisite subject of CC2. CC1 and CC2 are basic subject category of the Interior Architecture Program according to ACT in approving a license of architect profession. Descriptions of CC2: Principle and theory relate to interior architectural designs. Concepts and criteria in the designs, basic design process of interior architectures including project descriptions, design programming, conceptual design frameworks, Post Occupancy Evaluation (POE), interior architectural design criteria in public or large scale buildings such as museums, theaters, hospitals, hotels, shopping malls, plaza are discussed in case studies.

Structural Equation Modeling (SEM) is a multivariable statistics technique which seeks to explain the relationship among multiple variables. The SEM uses various types of model to understand the relationship among observed variables and latent variables. Researchers can apply SEM for quantitative test on their hypothesis model. Moreover, it is provided how sets of variables define constructs and how these constructs are related to each other (Schumacker and Lomax, 2010). The hypothesized model can be tested statistically in a simultaneous analysis with the consistency of the collected data.

Byrne (2010) did the conclusion of the differentiation of SEM with older multivariate applications. Firstly, as SEM is more on a confirmatory (i.e. hypothesis-testing) rather than an exploratory approach, SEM lends itself to analyze the data for inferential purposes. In contrast, most other multivariate applications (i.e. factor analysis, exploratory) focus on descriptive by nature which is difficult on hypothesis testing. Secondly, traditional multivariate procedures are incapable for assessing and correcting measurement error. The mistakes can be avoided when applying SEM analysis. Thirdly, SEM can analyze both observed and unobserved variables which traditional multivariate procedures are capable in observed measurement only. Finally, there are no alternative methods for modeling multivariate relations, estimating interval indirect effects all of which are available in SEM analysis.

After evaluation of the literature mentioned above and the previous research (Porntip, 2012), this research proposed a conceptual model. The model consisted of three interrelated constructs or factors, which are student characteristic, cooperative/collaborative learning technique, and student learning efficiency. All the three constructs of the model as well as the hypotheses related to these constructs were described below (Figure 1).

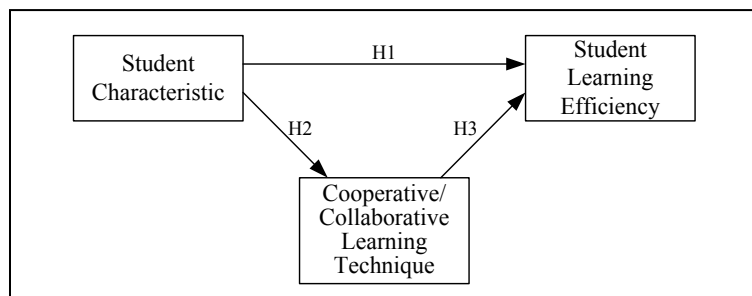


Fig. 1. Conceptual research model

Based on the above literature, the research hypotheses were formulated as follows:

H1: Student characteristic has a direct positive effect on student learning efficiency.

H2: Student characteristic has a direct positive effect on cooperative/collaborative learning technique.

H3: Cooperative learning technique has a direct positive effect on student learning efficiency.

3. Research methodology

The study was carried out from forty-five students who registered in the subject “Interior Architecture Design Concept and Criteria 2 (CC2)” for 2nd year students of interior architecture program in Mahasarakham University Thailand. The research included five main steps: formulating conceptual research framework and hypotheses, measurement design, data collection, data analysis, and research conclusion.

3.1. Measurement design

Measurement tools in this research were a student score list, the list included past student’s GPA score, past student’s CC1 score (CC1: interior architecture design concept and criteria 1), student responsibility score, assignment scores (assignment 1-8), report scores (report 1 and 2), student final examination score, and total student CC2 score. All scores were converted to be ratio scale measurement (0 to 100%).

3.2. Data collection

The quantitative data collection, the scores were carried out with the forty-five students who had registered in the subject. There were three parts (factors) of data collection in this research:

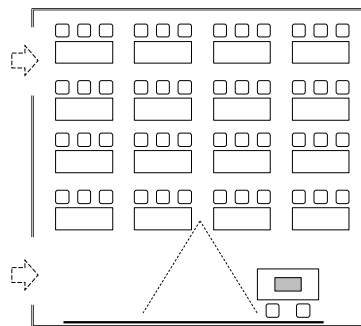
- *Student Characteristic*: this part consisted of three measured variables: past student’s GPA score, past student’s CC1 score (CC1: Interior Architecture Design Concept and Criteria 1, CC1 is pre-requisite of CC2), and student responsibility score during the period of study.
- *Cooperative/Collaborative Learning Technique*: this part consisted of ten measured variables with three patterns of assignments (individual, paired, and group assignment) as shown in Figure 2: assignment 1 to 8 and report 1 & 2 of student performance in the CC2 as shown in Table 1. All periods of the study, teaching facilities and classroom environment were controlled as the cooperative/collaborative learning technique by the researcher.

Table 1. Measured variables of cooperative/collaborative learning technique

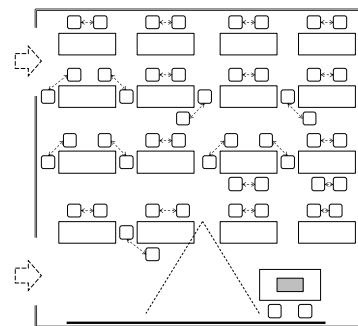
Factor	Measured Variable	Pattern of Assignment
Cooperative/Collaborative Learning Technique	Assignment 1	Individual
	Assignment 2	Paired
	Assignment 3	Paired
	Assignment 4	Individual
	Assignment 5	Group
	Assignment 6	Group
	Assignment 7	Individual
	Assignment 8	Individual
	Report 1	Group
	Report 2	Paired

Remark: the paired and group assignments were arranged by mixing between low, medium, and high past academic performance (GPA) of the students

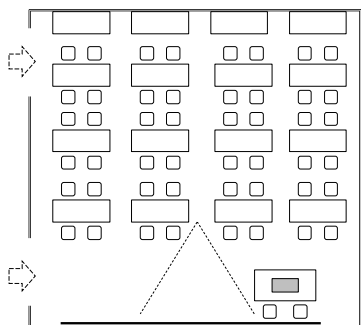
- *Student Learning Efficiency*: this part consisted of two measured variables: final examination score and total score of student performance in the CC2. Because the final examination score is final indicator of individual student learning efficiency while the total score is a result indicator of individual student learning efficiency in the CC2.
- *Classroom Environment & Teaching Facilities*: all periods of the study, teaching facilities and classroom environment were controlled as the cooperative/collaborative learning technique by the researcher. A classroom was used for this research. It was high flexibility in moving chairs and tables for all teaching-learning activities of the subjects. Three classroom patterns of assignments (individual, paired, and group assignment) were shown in Figure 2. Type A was a classroom pattern for listening to the instructor lecturing and doing individual assignments. This pattern, chairs of all the students would be seat and looked at the same direction to the front room. It was a regular pattern for general teaching-learning in the faculty. Type B was a classroom pattern for paired assignments. This pattern, the chairs and tables would be moved by the students in order to join the paired assignment activities of the paired students or partners. Type C and D were classroom patterns for group assignments (group of four to six students). These patterns, the chairs and the tables would be moved by the students to their groups for doing the activities.



Type A: Classroom pattern for individual assignments

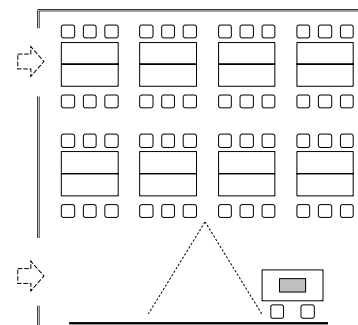


Type B: Classroom pattern for paired assignments



Type C: Classroom pattern for group assignments

(Group of four students)



Type D: Classroom pattern for group assignments

(Group of six students)

Fig. 2. Classroom pattern for the cooperative/collaborative learning technique

3.3. Data analysis

A statistical program was used to analyze raw data gathering from the data collection. The Statistical Package for Social Science (SPSS) Version 17.0 and a SEM program were employed in this study for data analysis. Researcher inputted the data into a personal computer by using the software for the data analysis; the data included the 3 parts from the data collection. A SEM was formulated graphically according to the conceptual research model and its measurement variables (the scores).

4. Results

The forty-five students of this research were 20 male and 25 female, the average age of all forty-five students was 20 years. To check the internal consistency in the collected data, the reliability was tested. Conbach’s Alpha had been worked out, the Conbach’s alpha values for all the constructs (factors) were above 0.8 (>0.7) and the Conbach’s alpha value for all the collected data was 0.828 (>0.7). After running the model in the software, the following output had been obtained .The results were shown as Figure 3. The fit of the structural path were evaluated. Results showed a fairly good fit ($\chi^2 = 207.28$, $df = 87$, $\chi^2/df = 2.38$, $p = 0.15$, $RMSEA = 0.05$, $NFI = 0.957$, $IFI = 0.969$, $GFI = 0.964$ and $CFI = 0.968$) of the structural model. Overall the structural equation parameter estimates provide empirical support for the entire hypothesis proposed was shown in Table 2.

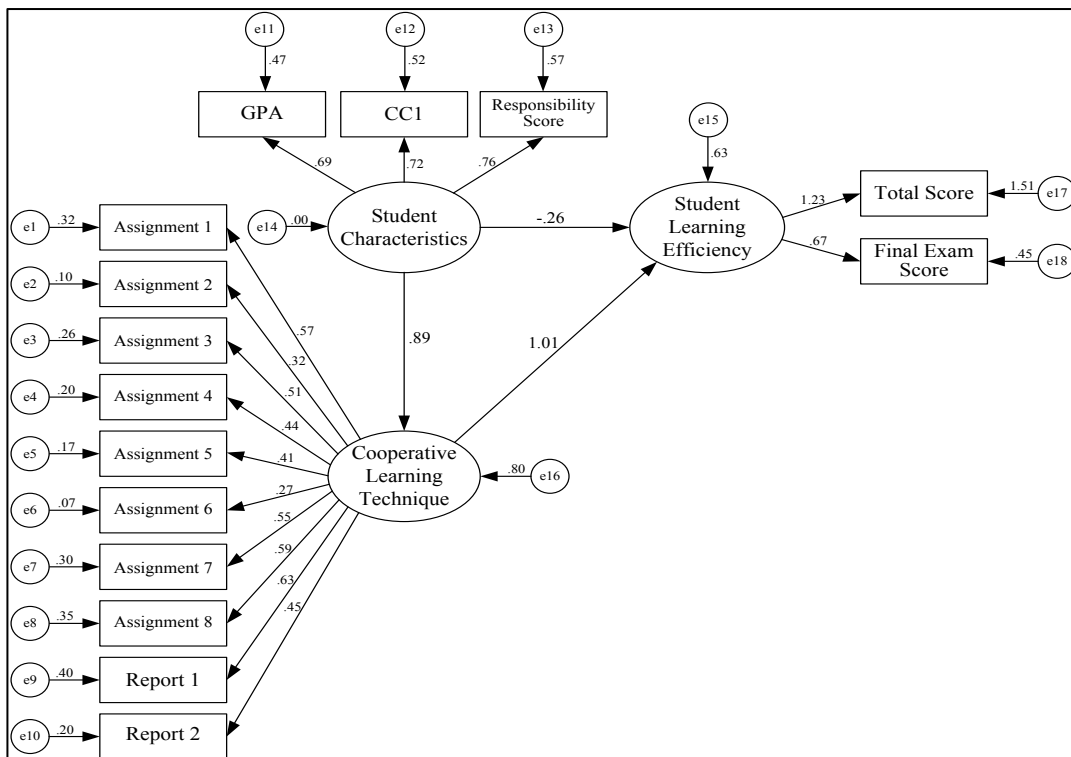


Fig. 3. Structural equation model of cooperative/collaborative learning technique

Table 2. Research hypotheses results of structural equation modeling

Hypothesis	Dependent Variable (Factor)	Independent Variable (Factor)	Path Coefficient	P (<0.05)	Hypothesis Supported
H1	Student Efficiency	Student Characteristic	-0.26	0.549	No
H2	Cooperative/Collaborative Learning Technique	Student Characteristic	0.89	0.004	Yes
H3	Student Efficiency	Cooperative/Collaborative Learning Technique	1.01	0.05	Yes

The results of this research showed in statistics values that the student characteristic had not a significant direct positive effect on the student learning efficiency (H1 was rejected), the student characteristic had a direct positive effect on the cooperative/collaborative learning technique, and the cooperative/ collaborative learning technique had a direct positive effect on the student learning efficiency as shown in Figure 3 and Table 2.

5. Conclusions and recommendations

This research presented a model of cooperative/collaborative learning which leads to learning efficiency of students (continued from a research topic of learning efficiency in theoretical subjects of interior architecture by cooperative/collaborative learning technique by Porntip, 2012). Researcher had formulated a SEM for explaining the factors influencing (cause-effect) the student learning efficiency in the theoretical subject of the interior architecture program case study, by the three factors included student characteristics (3 measurement variables), cooperative/collaborative learning technique (10 measurement variables) and student learning efficiency (2 measurement variables). Its measurement variables were presented in the design measurement and the data collection (section 3.1 and 3.2).

By the results, researcher concluded that the student characteristic had an indirect effect on the student learning efficiency through the cooperative/collaborative learning technique. Therefore, the cooperative/collaborative learning technique was a key important method for student learning efficiency in the theoretical subjects of the interior architecture programs. The final model in this research was shown in Figure 4. Collaborative/cooperative learning is an educational approach to teaching and learning that involves groups of students working together to solve a problem, complete a task, or create a product. Arranging study groups by mixing students based on past academic performance of the students would have more support to higher student learning efficiency especially students who have low past academic performance because they talked and shared their knowledge and experiences to each other during the group activities.

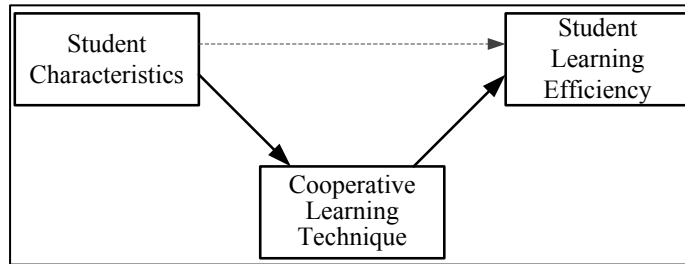


Fig. 4. Cooperative/collaborative learning model

Conclusion in this research is an improvement for the teaching-learning in the theoretical subjects of the interior architecture program through the cooperative/collaborative learning technique in order to achieve the student learning efficiency. The instructors should provide teaching facilities and physical environment within the classroom where support to the cooperative/collaborative learning technique. Moreover, the instructors should study and know their student backgrounds (past academic performance, GPA) in order to mix the students based on the background in the paired and group assignments are arranged by mixing between low, medium, and high past academic performance (GPA) of the students. Recommendation for future research is how the student characteristics and cooperative/collaborative learning technique affect to the student learning efficiency in “practical subjects” in the interior architecture program or other programs through the cooperative/collaborative learning technique.

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