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JTET

http://penerbit.uthm.edu.my/ojs/index.php/jtet
ISSN 2229-8932 e-ISSN 2600-7932

Journal of Technical Education and Training

Identification of Cooperative Learning Component in Designing Lesson Plan for Building Drawing Subject in Vocational Colleges

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DOI: https://doi.org/10.30880/jtet.2023.15.01.003
Received 21 June 2022; Accepted 11 November 2022; Available online 31 March 2023

Abstract: Cooperative learning is a student-centered learning technique that can be considered a learning strategy for improving student performance both intellectually and in soft skill acquisition. Changes in curriculum structure in vocational institutions, because of the TVET transformation in 2012, have had an unforeseen influence on teaching and learning, whereas in the prior framework, a detailed teaching guideline was supplied compared to the latest structure. Teachers with inadequate knowledge and experience in learning strategies struggled to execute the new curriculum structure due to the lack of depth in these recent curriculum structure. This may be seen in the case of construction drawing subjects, where there were originally 14 main topics but now there are just four. Thus, the goal of this research is to help these teachers by offering a guideline for creating lesson plans that use a cooperative learning strategy. The aim of this paper is to identify and highlight the important component in the creation of a lesson plan using cooperative learning. For this investigation, the fuzzy Delphi technique was used. The main instrument for this study is a questionnaire survey that was developed utilizing a construct identified through literature and the results of a previous needs analysis. A total of 15 expert panels were chosen as the sample, which included university lecturers, vocational college instructors, officers from the Ministry of Education's Technical and Vocational Training Division, and industry representatives. The data was analyzed with the help of Microsoft Excel FDM. Visual skills, Cooperative Student Team Achievement Division (STAD), Power Point, and demonstrations components have been recognized as the major component to include in the lesson plan based on the analysis. With these components identified, a good lesson plan guideline for the next phase of this study can be constructed. It is envisaged that the development of such guidelines would help to elevate the practice of teaching and learning to the next level.

Keywords: Cooperative learning, lesson plan, building drawing, Fuzzy Delphi

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1. Introduction

The transformation of technical and vocational education and training (TVET), which began in 2012, is now in its tenth year. Vocational secondary schools have been upgraded to vocational colleges in stages as part of the Vocational Transformation Plan (PTV), with 15 vocational secondary schools serving as pilots for the initiative. Following the upgrade, several changes were made, including the learning system, reference teaching information, and the transition from using Syllabus Descriptions in vocational secondary schools to using the Vocational College Standard Curriculum or KSKV (Abdul Latif et al., 2020) as a guide to plan and provide Daily Teaching Plans (RPH) for all subjects in vocational colleges, including those subjects of Building Drawing for the Construction Technology Program.

Apart from the revisions in the KSKV teaching information reference, students in vocational colleges must study for two years at the Malaysian Vocational Certificate (SVM) level before progressing to the Malaysian Vocational Diploma (DVM) programme. Students were not introduced to the subject of building drawing as specified in the latest structure of Construction Technology Certificate during their studies at the SVM level, and only studied it in the first semester of study in DVM. Students face challenges because of their lack of basic understanding in building drawing, which they will need to study after completing their SVM studies. It is an issue that the lecturers must face (Mohd Arshad & Mustapha, 2017), and at the same time, there are lecturers who lack abilities in the areas they teach (Ismail K. et al., 2018), which creates a barrier in assisting students in acquiring knowledge in building drawing. This complicates the problem even further because the lecturer's requirement to provide RPH remains in effect in any circumstance, lowering the quality of RPH provided indirectly.

Due to the challenges that arise from the introductions of the KSKV, a more interactive learning approach is deemed necessary to elevate the student understanding in the subject matter and ultimately help the formation of the student drawing skills. One approach that is worth considering is cooperative learning. Cooperative learning approaches can assist in more meaningful learning which consolidate each team member's knowledge and understanding of the topic for a better learning outcome. Cooperative learning is designed so that the learning process can be improved through personal interdependence, individual accountability, equal participation and simultaneous interaction. There are several cooperative learning strategies that can be adapted such as think-pair-share, circle-the-sage, timed-pair-share, agree-disagree lines-up and many more.

In teaching the building drawing subject, vocational college lecturers are bound by the rules and regulations in preparing the RPH as stated in Circular Letter No. 3/1999, which requires every lecturer to provide RPH in their teaching. The truth is that the RPH circular's content is generic in nature, necessitating the inclusion of a statement of substance and objectives in the RPH planning. Because there are experienced lecturers and those who are less experienced in building drawing, the guideline provided in general produces variations in the production of RPH among vocational college lecturers, especially in the field of building drawing.

Making the RPH planning procedure for each instructor, on the other hand, is unique. According to prior research, the preparation of RPH varies depending on the manner of lesson planning and the instructor's expertise and skills (König et al., 2020; Contreras et al., 2020). Making various plans will have various consequences on students (Alada, 2018). Evidence of such variances should be studied carefully, particularly in the topic of building drawing, because it will affect student skills. As a result, there is a need to reduce discrepancies between lecturers in the topic of building drawing in vocational institutions when it comes to RPH development for this subject.

In addition, the preliminary study conducted by the researcher in the need’s analysis discovered that there is a lack of reference material connected to RPH writing guide specifically for the subject of building drawing in vocational institutions pertaining to cooperative learning approach. Six respondents unanimously acknowledged that they did not have any standards for writing building drawing RPH and even more on the cooperative learning strategies itself. As a result, research is needed to fill in the gaps that occur while developing the RPH for building drawing subjects in vocational institutions especially for cooperative learning strategies, so that lecturers' obligations and responsibilities can be carried out properly without jeopardizing the quality of teaching and learning.

2. Cooperative Learning - Student Team Achievement Division (STAD)

The cooperative method Student Team Achievement Division (STAD) is a teaching method introduced by Slavin (2013) specializing in instructional methods that cater to students with different performance levels, working together in small groups for a common purpose until successful. Its advantages are recognized and proven in studies such as (Laa et al., 2017; Jamaludin & Mokhtar, 2018; Gustia et al., 2019; Sutopo et al., 2020) for having elements of positive dependence, responsibility towards friends, increasing interaction and communication in groups and group processing. Furthermore, this approach can enable the students to form positive attitude changes, work in groups, improve academic achievement and produce critical thinking. Although applied in different subjects such as Biology and Mathematics, the use of STAD method has also been used in drawing subjects as in the study of Sutopo et al. (2020) which used STAD cooperative method in mechanical drawing subjects which prove the suitability of STAD method to be applied in various subjects including technical drawing subjects.

Slavin (2013) defines STAD as a type of team learning in which four or five students represent a cross section of the class in terms of academic performance, sex, and race or ethnicity. It is also stated that this strategy is the most basic of all cooperative learning methods and is an excellent starting point for teachers who are new to cooperative learning. As a result, this strategy was selected for this study.

2.1 Daily Lesson Plan (RPH)

The Daily Teaching Plan (RPH) is an official document for all school teachers. The use of Training Session Plans (RSLs) and Daily Lesson Plans have certain importance, but different uses between RSLs compared to RPHs. However, the use of RPH is a priority in KV, as it is provided daily planning throughout the school period compared to RSL which is provided only once in a semester. The changes that have taken place require the improvement of the RPH by creating RPH guidelines which can help facilitate vocational college lecturers to plan accurately, organize and cover all important aspects of teaching, based on the syllabus and course outline provided as a guide to the vocational college lecturers.

In addition, a study from Taskin (2017) explains that RPH is a complex process and influences the quality of effective teaching plans and learning processes by lecturers, further reinforced by Taylan (2018) who stated that lesson plans focused on students, potentially helping teachers build more meaningful teaching. In line with Ihktisas circular 3/1999, the preparation of a good RPH can produce a good quality teaching to students. Properly planned and carried out RPH benefits lecturers and students. Yet the fact is that the preparation of RPHs from different instructors produces different results (Alada, 2018) have created variables in the delivery of this subject.

2.2 Building Drawing

The rebranding of TVET, has changed its status from a technical secondary school to a vocational college (KV). The changes did not affect the role of KV lecturers, as key people in teaching in vocational colleges. However, a study done by Abdul Latif et al. (2020) found that there are issues related to the level of competence among vocational college lecturers. They were found to be affected by the transformation to some extent affecting the quality of delivery and facilitation (PdPc). Indirectly, this affects the achievement of students' objectives in the subject of building drawing, especially for lecturers who are new and less experienced in terms of technical knowledge and skills, especially in the subject.

Upgrading to vocational college, changing reference documents from the use of Syllabus Description to the use of syllabus and course outline provided by BPLTV became the main reference by lecturers in preparing the RPH. However, the main reference change, that is, to some extent affected the planning of lecturers in the subject of building drawing was acknowledged by Abdul Latif et al. (2020) due to a reduction in the number of subtitles in the subject. The fact that the deficiency, which previously had continuity with the titles retained in the Student Syllabus Description, has been eliminated in the building drawing syllabus, this situation has made it difficult for instructors to elaborate and explain the relationship, between the titles of the retained building drawings and the deleted titles in RPH planning to students.

2.3 Initial Investigation

The findings of the initial study found that there are five themes that have existed in this study which contribute to the issues and constraints that occur among lecturers in vocational colleges who teach building drawing. The problems encountered are related to time constraints in preparing lesson plans, lesson plan format is too general, no specific guide provided to instructors for the process of planning building drawings, lecturers in vocational colleges need specific guidance to prepare RPH and lack of teaching materials to use as a subject reference it has also being acknowledged by Mujiarto et al. (2018).

Based on the themes derived from the need's analysis of this study, it proves that there are constraints that exist in vocational colleges related to the teaching planning process for building drawing subject among lecturers, yet it could not be disclosed directly by the lecturers involved, hence, which being highlighted by the interview carried out in this study. This finding provides on the ground reality which proves that there is indeed a need to design and develop guidelines for RPH for the subject of building drawing in vocational colleges.

The findings of the data analysis found that instructors face difficulties in adapting lesson planning to the different abilities of students. This situation makes it difficult for lecturers to identify teaching methods that are appropriate for student differences and requires researchers to identify methods appropriate to the situation and appropriate to the studies done by Hassan et al. (2017) and Sieglov (2019), who agreed that the needs analysis helps detect problems occurring in a study. Apart from that, obtaining answers to the issues that cause the RPH building drawing guidelines needs to be developed in this study.

The findings of relevant findings on the difficulty of instructors to achieve teaching objectives and bound by time constraints, further strengthen the evidence that there is indeed a need to establish guidelines for building drawing RPH based on feedback and consent of six expert respondents in interview data. In addition, there are suggestions from respondents, related to the content of the guidelines that need to be included, with syllabus information and course outline to align with the teaching content of building drawing. Thus, it can help lecturers to improve teaching methods, to suit the different abilities of students.

3. Methodology

Fuzzy Delphi technique has been adopted for this study. Mohd Ridhuan & Nurul Rabihah, (2020) clarified that the Fuzzy Delphi method (FDM) is a method and instrument of measurement that is modified based on the Delphi technique. This method has been explored by several researchers in decades by (Murray et al., 1985). Fuzzy Delphi method as a more effective measurement tool because it can be used to solve problems that have uncertainty for a study (Asra et al., 2014). More effective for problem solving, and it is a method of decision making based on analysis by combining fuzzy theory with Delphi methods.

The sample for the Fuzzy Delphi Method consists of experts in the field. The number of expert respondents is determined by Adler and Ziglio (1996), who put the number of specialists at 10 to 15 if there is a high level of uniformity (homogeneous) among professionals. Based on Adler and Ziglio's statement, 15 expert responses were chosen, all of them working in the field of Building Drawings, Engineering and Architecture Drawings. There are five specialist Building Drawing instructors from the Vocational College, two university lecturers with experience in Engineering Drawing and Architecture, three expert lecturers in the field of education, three TVET curriculum drafting experts (two BPLTV officers and one lecturer involved in TVET curriculum drafters), and two industry experts.

The first cycle starts with the development of the questionnaire survey which has been developed using the construct that has been identified through literature and results from need analysis which has been carried out previously. This questionnaire has been validated by three experts and is found to be valid. The questionnaire consists of 5 parts. Part A contains 4 items of respondent demographic information, Part B contains 23 items from the visual skills elements in the daily teaching plan guidelines for the building drawing subject, Part C contains 9 items from the Student Team Achievement Division (STAD) cooperative method, Part D contains 6 items from the technology element, and Part E contains 4 items from the demonstration element. The questionnaire has been distributed to the sample. Prior to the data analysis, the data has been converted to a fuzzy scale. The procedure of the Fuzzy Delphi technique adapted for this study is as shown in Fig.1.

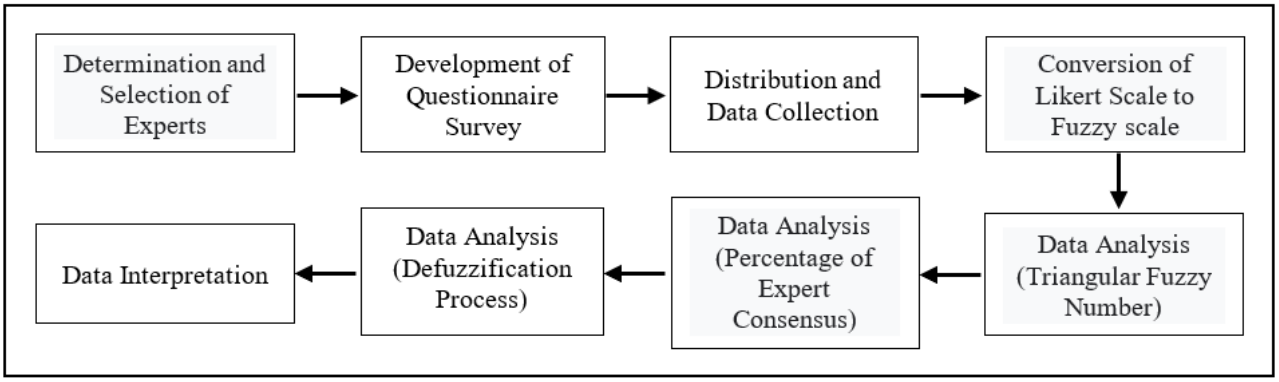

Fig. 1 - Research procedure flow chart Fuzzy Delphi by Ahmad et al., (2017)

The second cycle then involved 15 expert panels which were chosen as the sample, including university lecturers, vocational college instructors, officers from the Ministry of Education's Technical and Vocational Training Division, and industry representatives. The distribution of the expert panel is as listed in Tab. 1.

Table 1 – List of expert panel

Position	Field of Expertise	Experience (Years)	No. (person)	Institution
Associate Professor	Engineering and Construction Drawing	20	1	UTHM
Senior Lecturer	Engineering and Architecture Drawing	20	1	UTHM
IPG Lecturer	Education	20	3	IPGM
Lecturer/ Officers	TVET Curriculum Drafter	10 to 20	3	Universiti/ BPLTV
Industry Representatives	Architecture Drawing	20	2	Architect Firm

Vocational Instructors	Building Drawing	20	5	Vocational College
Total			15	

Data has been analyzed using Microsoft Excel FDM. The Fuzzy Delphi technique will use Fuzzy Triangle numbering and Fuzzy Evaluation @ Fuzzy Score (A). Fuzzy Triangle numbering consists of the average values of fuzzy numbers namely m_1, m_2 and m_3 and is often represented in forms (m_1, m_2 and m_3). That is, m_1 represents the minimum value, m_2 represents the most reasonable value and m_3 represents the maximum value. The three values in the Delphi Fuzzy Triangular can be represented in Fig. 2. which shows a graph of a triangle against a triangular value.

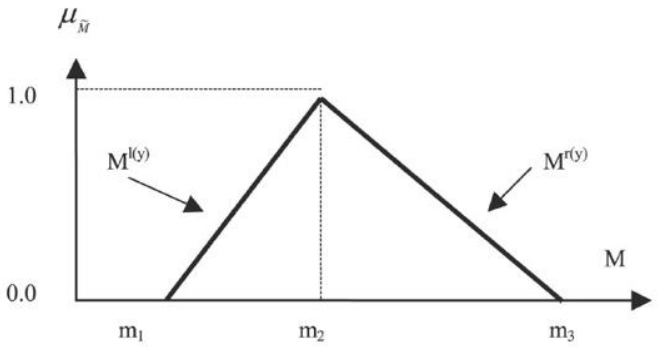

Fig. 2 - Mean triangle graph against triangular value (adaptation from Ridhuan M. et al. 2018)

The next process that needs to be gone through in the data analysis process is the Fuzzy Evaluation Process. This is a process of determining the position (ranking) for each variable and sub-variable. The purpose of this process is to help to see the level of need of a variable and the sub-variables needed. This positioning process will help generate data as needed based on the consensus of experts who act as experts who act as study respondents. There are three formulas that can be used in Fuzzy Evaluation. Researchers are allowed to choose any of these three formulas to determine the ranking in the study. The three formulas selected in this process are as follows:

$$A_{max} = 1/3 * (m_1 + m_2 + m_3) \text{ ……. equation 3.1}$$

$$A_{max} = 1/4* (m_1 + 2m_2 + m_3) \text{ …… equation 3.2}$$

$$A_{max} = 1/6* (m_1 + 4m_2 + m_2) \text{ ……. equation 3.3}$$

Three formulas from equations 3.1, 3.2 and 3.3 are the same. It is proved that inserting a value of one (1) into each value for m_1, m_2 and m_3, will produce the same Fuzzy Score value (A_{max}).

4. Findings and Discussions

Based on the findings from the data analysis, the visual skills element for Orthographic Projection got a Fuzzy Score value of 0.909 to 0.940 in expert agreement, for Geometric Drawing 0.891 to 0.922 and 0.831 to 0.933 in Interpreting Building Drawing Types. From this result, it shows the experts' agreement on all items related to visual skills elements to be included in the design of the Building Drawing RPH Guidelines. The results of the data allow researchers to improve the teaching activities of Building Drawing and to make the planning process of the RPH Guidelines more complete and easier to use by Building Drawing instructors in teaching and learning, group activities, assignments, and training. Therefore, it can help develop visual skills among students with such support activities. Teaching methods for building students' visual skills are in line with studies (Sorby & Haartman, 2000; Sanchit Ingale et al., 2018; Saeed et al., 2017; Sorby et al., 2018; Power & Sorby, 2020) that emphasized visual skills are important for students to master in the subject of engineering drawing.

In addition, the cooperative element of the Student Team Achievement Division (STAD) was modified to be included in each topic in the RPH by emphasizing on student activities in groups. Obtained expert consent for use in the design of the RPH Guidelines with a Fuzzy score value of 0.802 to 0.896 with none of the items rejected by the expert. These findings indicate that the STAD cooperative teaching method is suitable for use in the teaching of drawing, and can also replace the traditional methods commonly used in teaching. The appropriateness of its use is acknowledged by Slavin

(2013), who is a popular researcher who used this method, and proven by Sutopo et al. (2020), who also used the cooperative teaching method of STAD in the subject of Mechanical Drawing. Other studies using this method are done by Jamaludin & Mokhtar (2018) and Casey & Fernandez-rio (2019).

Moreover, the PowerPoint software element was found to be very widely used with studies on it conducted in the country and abroad. Therefore, to complete the design of the elements in the developed RPH Guidelines, the elements have obtained expert consent to be applied in the design of the RPH Guidelines. The lowest Fuzzy score values of 0.798 to the highest 0.844 were obtained with expert consent for PowerPoint software. This finding suggests the experts' agreement that the suitability of this software for use in the design of elements of the Building Drawing RPH Guidelines. The findings of this study are consistent with studies done by Adepeju (2018), Noviyanta & Ngadiyono (2019) and Johnson et al. (2019), where their findings showed that PowerPoint software can help instructors provide a clear picture of any form of drawing to be explained to students visually.

However, the study found, the proposal to include google classroom and WhatsApp as a teaching method in the Building Drawing RPH Guidelines was rejected by all 15 experts in this phase. The findings suggest the incompatibility of the two software for use in the teaching and learning activities of Building Drawing. Expert agreement for PowerPoint software in this study, is in line with the study done by Syed Lamsah Syed Chear (2017), Janssen et al., (2019) and Backfisch et al. (2020) who acknowledged the suitability of this software for use in drawing teaching.

Similarly, for the demonstration element, although it is a common method used in teaching and learning, without evidence from scientific studies, this method becomes less popular. Yet for the subject of building drawing, which is more of a practical training, this element is especially necessary as it has combined knowledge and hand skills (Bairaktrova 2017; Nsanja, 2019). Thus, the demonstration element item has obtained expert agreement with Fuzzy value 0.880 to 0.909, is a high value and proves this element is important to be used by instructors for teaching and learning activities and give a clearer explanation based on the demonstration to students. These findings are also consistent with studies done by Chuang (2018), Budiman & Anne Nurfarina (2019) and McLain (2021).

In conclusion, the demonstration in the teaching of drawing in a practical form, is important because the use of technology and demonstration are interrelated to help students in every step of drawing construction and facilitate students to follow the explanation more clearly from the instructor in the teaching of Building Drawing. The uniformity of the instructor's demonstration to the students, clearly described in the RPH Guidelines, facilitates the instructor to apply in teaching and learning.

5. Conclusions

The results of the study found that there are four elements to be designed in the RPH Guidelines, namely visual skills, cooperative methods, Powerpoint software and demonstrations for the subject of building drawing in vocational colleges. The identification of this component is crucial for the development of the cooperative learning lesson plan guideline. Through the development of the guideline, it is expected that the teaching and learning process for the Construction Technology Program can be enhanced especially for the building drawing subject. In addition, lecturers can be exposed to cooperative learning strategies and attainment of the subject objectives can be standardized in all vocational colleges offering this subject.

Acknowledgment

The authors fully acknowledged Sultan Idris Education University, Sg. Buloh Vocational College and National University of Malaysia for supporting this work.

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