Experimental testing the effect of teaching method with multimedia

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Abstract. The technical drawing is a step that is absolutely necessary to be mastered by the architects in presenting their product in the design development phase. The easy readiness and completeness of information in a drawing determine the quality and timeliness of a project. An incomplete engineering drawing is difficult to read by foreman or craftsman. Building Technology’s subject studies the structure and construction of buildings. As a supporting subject, it plays an important role in the creation of design works of the students. Successful mastery of this subject greatly impacts on courage and design exploration of students in Architecture design courses. This study arranged to measure how far the material online can be understood and comparing the teaching’s result between the normal method (conventional method) with the multimedia method. As the object of research are students of Building Technology classes LA44, LB44, and LD44 at Bina Nusantara University Jakarta. The method used in this research is experimental research. Preliminary data collection is obtained from each work of the student’s assignment. Observation, interview, test through quiz done directly in the classroom and carried out during the odd semester run until the end of the lecture.

Keywords: architecture, building technology, multimedia.

1. Introduction

Building technology is a supporting course in majoring in Architecture. This course contains various technical and material specifications that are very important to be understood by students. But this course is also classified as a difficult course or not easy to be learned. One hand, the learned object is there in surrounding area, in human settlement, in every corner in the city, and other else, but they are already finished built or already clad or wrapped or served. And the other hand, what students need to understand is the concept behind the object and the process during the construction which is cannot be seen directly or appear in the object.

Some topics such as load distribution system from roof top to foundation or soil, joinery works, column and beam system, slab system, and many other structure member that can be analyzed through writing literature. But without sketches and or drawings, it is almost impossible to teach or to explain a topic in structure and construction system. One of the classical learning methods that have been long done in Building Technology learning system up to now is Technical drawing method. An object structure is peeled through a technical drawing and informed with material specification and then analyzed and redrawn by the student. This system is quite effective in depiction, but in fact, there are
still many students who are not able to describe the concept and the system logically. They are in some case are unable to understand the background and problems such as the reason of the use of the chosen materials and their construction system.

To achieve maximum results, some instructional tools are needed. One of the system that important enough to be chosen is to use multimedia as a tool for teaching and learning. The use of multimedia especially in the field of Architecture has long been used in line with the development of AutoCAD software which is the most widely used in the process of Architecture design. Moreover, the work culture Architects who always present the results of his work to clients by using images and other aids, making multimedia a target tool for architects and Architecture students.

The role of multimedia on the other hand helps develop products and teaching systems in industry and education. Rapid technology developments also caused almost all educational institutions use computers as a tool of administration and in the process of teaching and learning.

Multimedia technology can make the work of Architecture becomes more easily to be understood by both Architect and general society. It can also accelerate the process on every design phase and construction process in the field. Multi-media technology can provide a person's understanding of the Architecture quickly, precisely, interesting, effective and efficient.

Besides, multi-media technology is also able to create an interactive communication system that involves many parties, not just 2 parties or two directions but many directions. However, the more important thing is the understanding of how to use the technology more effectively and efficiently and can nurture and issue new ideas in generating and delivering learning materials that allow learners to be motivated to explore the content of learning and so fostering the learning process.

2. Research Area

The Building Technology course is more or less the same as the Building Construction course. This course contains the material or topics about the structure and construction concept and application of a building. In general, learning Structure and construction of buildings for undergraduate level, can be divided into 2 (two) learning concept, firstly learning about the science and secondly learning about the skills.

Science of structure and construction can be obtained through activities: (1) listening in lecturing, (2) understanding, (3) remembering, (4) evaluating. While skills are acquired through activities: (1) observing photo and/or drawing, (2) reasoning, (3) asking, (4) drawing. Learning through science is very important as basic knowledge to be able to create or draw learning objects. Without a basic of understanding of the science, the students will not able to produce technical drawing correctly and align with international architectural drafting standard. They will not also able to know the concept of load, distribution system, material specifications, etc.

Learning activities from science begin with:
(1) Listening activities. This activity is a one-way activity. Whereas in the beginning of learning, students are introduced the topic by lecturer, then they listen and pay attention carefully and thoroughly. From these activities can be identified various information on the topic of structure and construction, but considering the topics on the structure and construction are new things for students then the information is usually not clear enough considered by students. Hence, the level of understanding is usually not high.
(2) Understanding activities. This activity is linked to additional information retrieval activities and other information related to the topic being studied. Other resources of information can be obtained through other experts (other than lecturers), other textbooks, multi-media and internet, etc.
(3) Remembering’s activity. This activity is related to the activities to establish understanding. With the remembered topics, then students have the basic knowledge to analyze structure such as type, shape, dimension, and material specification. Moreover, it can create correct structure design concepts and even make the combination of various structures logically and correctly.
(4) Evaluating activities are activities to test the understanding level and proof theories in learning material. If through listening activities, understanding and remembering have been implemented, it is necessary to evaluate the material on a building object that has been or is being built significantly. If student has found some case in the development process such as materials that are not appropriate with the structure system, or the module of structure is not fit with the material specification, etc, then the student must do re-understanding activities to check whether there is a wrong theory or theory that has not been studied by students. Also, some applications in the field often use different combinations of shapes, materials and concepts so that with this evaluation activity students can better understand the application of theories in the field.

In more detail the steps of learning activities related skills can be described as follows:

(1) Observing. This activity can be done by reading, and/or observing the drawing of structural concept and drawing of construction technique, related to material specifications, combination and construction system or how to mount or combining a material with other material based on the specification or international standard connection system of construction, technical drawing standards, etc.

(2) Reasoning. This activity is carried out through lecture delivery activities by lecturers, class discussions and working group. This reasoning activity is related to a combination of topics.

(3) Questioning. This activity is digging up additional information from lecturer as well as from other resources such as field experts. This activity allows the student to communicate directly with lecturers in the classroom or experts or others who are considered to have sufficient competence in the field of structure and construction.

(4) Making or producing drawings. This activity is the final stage of learning for skill learning. The process of building construction drawings trains the students to be well trained and skilled in presenting construction drawings following international standards of Architectural drawing and standards of construction ‘s document such as aanwijzing or Term of Reference, tender of project, as well as drawing process as-built drawings.

Based on the description above, this research is done as part of the learning of science and skill side.

By entering the keyword Building Technology 1 with the author wiyantara wizaka at www.youtube.com the page will appear as seen as above. The student must afterwards provide comments or questions in the comment field (Figure 1, 2 and 3).
The material is created using the ArchiCAD BIM software so that learning objects, in this case, columns and beams can be viewed and learned through a 3D view that facilitates a more realistic object.

3. Methodology of testing
The study started with 2 testing steps. Firstly it was to determine 3 topics from the Building Technology course that will be used as material for testing. The first topic is Column and beam module, the second is wall construction, and the third is joinery & extrusion works. Both three topics delivered manually or conventionally with the help of limited multi-media i.e. powerpoint software only in lecturing session. After that the student doing their assignment and hand it out one week later. We then check all the drawing out and analyze all the elements such as size, form, material specification, joint system, and technical drawing.

In this stage, we gave a tentative score and then the multi-media material that should be downloaded on the internet (www.youtube.com) and local network in binusmaya.binus.ac.id. We gave them improvement session for two weeks before they have to hand it out again after they watched multi-media material. This experiment began with an explanation of the concept of applied research as well as the objectives to be achieved that delivered lecturing session. Afterwards, students are required to prepare their devices to access the material with Laptop / Notebook or Smartphone.

Students then get a technical explanation first then start paying attention to the material uploaded at www.youtube.com. For the presentation session, only several students are selected in a random way to be asked to explain all the materials that have been studied via the internet and their gadget. Students were also required to reiterate the material along with the sketches (Figure 4).
After the students get the material that uploaded on the channel www.youtube.com, they have 2 weeks to learn about the topics and they can repeat the learning process as much as they need. Afterwards, they have to explain some points as illustrated below:

- Type of structure for low-rise buildings (2-4 floors)
- Type of material structure used
- The type of used column module and beam, wall and doors and windows and the reason why it designed.
- Detailed connection of columns and beams, wall and doors and windows.
- Space created by their design of columns and beam and wall structures.
- Effect of column modules and beams, wall type, doors and windows on building façade

Students will be asked to implement all the chosen element is their technical drawing according to what they have learned from multi-media material. Presentation for each student takes up to 1.5 hours.

4. Results and Discussion

After going through the testing phase or assessment of the above process, it is found that almost all of them understand the purpose of this experimental study. But there are nearly 30% of the group of students who doubt that learning through multimedia will provide a significant understanding (Figure 5). This group tends to argue that learning Building construction should be done in an active system or two-way interaction system like assistance with lecturers. Learning method with multimedia though quite interesting and clear, but it is not interactive enough due to the one-way interaction system. This means that when students have a problem such as still do not understand or want to ask something, they can directly get answers as experienced when the discussion directly with the lecturer in the time of assistance. Almost 70% said that their understanding of the topics increased after watching multimedia material over and over again (Figure 6). 15% stated more understand but not clear enough. And 5% stated less clearly.

![Research's Goal](image)

**Figure 5.** Basic preparation and knowledge

A. Can understand and agree that this research is one way to measure the success of learning
B. Understand but doubt if the results can reflect the success of learning
C. Do not understand if the results can reflect the success of learning
D. Do not understand at all
Figure 6. Level of skill
A. Very helpful in the process of understanding and easy to use
B. Quite helpful but a little difficult to use and to access internet
C. Not enough help and somewhat difficult to use multimedia and access the internet
D. Don’t know how to use multi-media and how to connect to the internet.

Figure 7. Average score of student’s assignment

Topics that used as experiment materials:
1. Column and beam module. The material is uploaded in www.youtube.com
2. Wall construction. Wall construction contains material of Bearing wall and Non-bearing wall. The material is downloaded from the local network system as shared material.
3. Joinery & Extrusion works. Contain material of wooden doors and windows such as type from its operational system, door and windows leaf, installment. The material is shared in binusmaya website as digital enrichment.

Presentation by students

This activity is intended to measure how far the students can explain their structure concept, their logical thinking of structure design, technical specification and materials. After the presentation, it found the result data as follows:
A. Oral presentation
There are 70% of students who are able to explain the chosen type of structure, the type of chosen material, module of column and beam, the connection in general (not in detail), the effect of the column module and the beam to the façade, clearly and correctly, while the 30% of students can explain some of the topics only.

B. Presentation by Technical drawings
Testing the level of understanding of students through technical drawings is measured in the technical drawing of the plan, section, elevation, column and beam module, slab and flooring, wall and joinery/extrusion works, roof truss and roof cover. All these drawings are drawn in students assignment and the result show that there are 70% of students who can draw plan correct and complete, 70% able to draw section correct and informative, 80% able to draw elevation correct and informative, 80% able to draw column and beam module correctly, 80% able to draw slab system in one and two way system, 85% able to draw flooring, 80% able to draw wall construction, 70% able to draw joinery & extrusion works, 70% able to draw roof truss and roof covering, 75% able to draw Mechanical & Electrical distribution scheme (conceptual).

5. Conclusion
This study, although experimental and includes only a small part of the topic and the number of students, the results continue to contribute understanding and new methods in creating various variations that can teach the material structure and building construction in a way that is easier for both teachers and students.

Although multimedia is very creative and interactive, however developing a teaching method depend on the structure of teaching material the most. Good structure of course outline as well as other online resource should lead student step by step from the easier topic to the hardest topic, and the joy must be always kept in all process. The skill can be easily gain in fun atmosphere. Even more, the creative way can be more developed and applied in the future. The collaborative way in this research is the only one that enrich the new way in teaching and learning method.

Lecturing of project examples in the field must be packed in a very interesting, interactive and integrated directly with the theory so that the process of understanding continues from theory to application in the field.

In the future, after we made this workshop, we realize that there are possibilities and still many way to do any variation and combination in architecture teaching and learning method especially in structure and construction topic. Our workshop is only one from many possibilities today and maybe arise with any kind of variation and combination in the future.

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