

EFFECTIVENESS OF PROJECT-BASED LEARNING (PJBL) IN IMPROVING KNOWLEDGE RETENTION AMONG TECHNICAL AND VOCATIONAL STUDENTS

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ABSTRACT

TVET in Malaysia is becoming more popular as government started a new transformation on technical and vocational education. The establishment of Vocational College (KV) changes the requirements needed for new teachers as KV only seek new teachers with high level of skills and knowledge. Nevertheless, most of the teacher trainees voiced out their concerns as they unable to retain knowledge that they have learned during their study in university. Thus, this study is conducted in order to seek the effectiveness of PjBL in improving knowledge retention among technical and vocational students, who also teachers-to-be for KV. This study was conducted qualitatively by using experimental research design, which using two groups of students. The students from both groups are interviewed in order to seek the effectiveness of PjBL. The findings show that PjBL is able to improve the students' knowledge retention as they able to apply and practice their knowledge throughout the semester. It is imperative for educators to provide best teaching practice for students in order to improve their knowledge retention.

Keywords: *Knowledge Retention, Project-Based Learning, TVET*

INTRODUCTION

Nowadays, TVET is a field of study that gain increased public attention from time to time. This is due to capability of TVET that is able to provide wide scope of job and paradigm shift to Malaysia towards achieving developed nation status (Minghat et al., 2013). Various efforts have been made by the Malaysia in ensuring TVET is able to grow rapidly and get the positive responses from the people of various races. Through the existence of Vocational College (KV) that capable of providing Malaysia Vocational Diploma status to their graduates, a lot of changes have been made to the old system of Vocational and Technical School. In addition, the graduates will be awarded with Malaysian Skills Certificate (SKM) and Certificate of Malaysian Vocational, which are proving the level of skills possessed by KV graduates Ministry of Education Malaysia (2015). Due to these changes, some new criteria have been set for the new teachers that can teach at KV. New teachers not only required to have theoretical knowledge, but they also expected to be equipped with high level of technical skills in doing practical work. In addition, they also must possess at least level 3 of Malaysian Skills Certificate in order to qualify themselves to teach in KV.

As teachers-to-be, they need to ensure they have adequate skills and knowledge before they eligible to teach in KV. Thus, it is becoming a priority for future teachers to master and remember what they have learned at university because it will be able to help them when they wanted to convey knowledge to the students in the KV later. However, there are various problems that have been faced by these teachers-to-be when they become teacher trainee at particular KV. A preliminary study was carried out to look into the problems faced by teacher trainees when teaching at KV. 4 of 5 trainees from KV in Peninsular Malaysia were interviewed. Based on the findings of these interviews, 3 teachers and 4 teachers were informed that they do not have sufficient skills and knowledge to teach the subject given to them. On average, they said they could only remember about 30 percent of which have been studied while at university. The main reason they do not remember what they have learned is that they are not able to remember what they have learned for a long time as they tend to forget everything when a semester ends.

Hence, they found it was difficult to teach and provide teaching materials to students. In addition, the teacher trainees also stated that the hands-on work that they done in the classroom to some extent has helped them to remember the theory and what they have learned in class rather than learning theory only without doing any practical works. However, the practical work done is not very effective in helping them to remember it longer because most of the practical work done is based on manual procedures that have been assigned to them, where requiring them to follow instructions without requiring them to think deeper. It caused them to not be able to relate the theory they have learned with practical work that has been done. However, all respondents agreed that the knowledge and skills that they gained from university are very useful to them in the teaching process.

Based on this preliminary assessment, it is indisputable that the teachers really need the knowledge and skills that they learned from university to retain much longer in their memory. Duration of knowledge and skills retention in one's memory depends on how they learned particular subject. Knowledge and skills retention can be improved through practical work, where students can apply what they have learned. According to Custers (2010), students tend to forget about 25-35 per cent of what they had learned in the last two years and will forget more than 50 per cent in the following year. This is a problem that must be solved by people who educate these students, who will become future teachers.

To enable these students to remember more easily and for a longer period, lecturers need to ensure that the students understand what they have learned (McTighe & Seif, 2013). However, there are many students at the university are likely to remember what they have learned without understanding the concepts of the lessons. Therefore, lecturers need to use the appropriate approach to ensure that students are able to understand particular lesson so that they can remember easily and longer (Klemm, 2007). Klemm also added that these students are not able to apply what they have learned if they do not understand what they have learned. This is consistent with the words quoted from Confucius:

"Tell me and I'll forget, show me and I may remember; Involve me then I'll understand."

Two elements contained in the words above are elements demonstrations and "hands-on" to enable students to remember and understand. This is consistent with studies that have been done by Buddelmeyer (1995) where he has seen the differences in memory retention for the two groups of special education students in remembering procedures for experiment. He found that special education students that has been exposed to demonstrations only just remembering a little steps or procedures for the experiment shown by the teacher, whereas the students who saw the demonstration and did with their own hands are able to remember almost all the steps for the experiment. This research proves that it is important to demonstrate or teach to the students to give an understanding to them and are accompanied by practical work to strengthen their knowledge.

PROJECT-BASED LEARNING (PJBL)

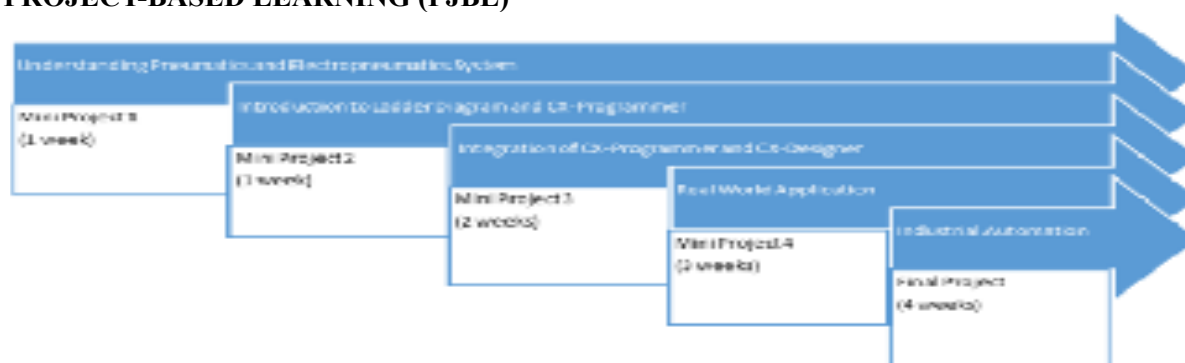


Figure 1. PjBL design for PLC subject

Project-Based Learning (PjBL) is a teaching approach that is known in the field of engineering education (Palmer & Hall, 2011). It was seen as a method which can produce a new situation in the class in which it emphasizes student-centered learning. Through PjBL, students play a very important

role as they are handling for their own learning process. In addition, PjBL approach to learning by doing, or hands-on learning in which students need to solve their problems through projects (Fox, 2013). Indirectly, students can improve the domain of cognitive and psychomotor. In contrast to the approach of Problem-Based Learning (PBL), which focuses on the concept of acquisition of knowledge, PjBL emphasize the application of knowledge in which students are able to use and integrate all the theoretical concepts that have learned to solve the problem through projects.

PjBL for Programmable Logic Controller (PLC) subject was designed in order to cope with the existing problem met and claimed by the students. In order to that, this subject has been improvised in order to give the students a new way of learning. In this subject, the students were required to do four mini projects, which every project is based on the previous knowledge that they learned through this subject every week as shown in Figure 1. The number of knowledge that they need to apply on the mini project will gradually increase as the difficulty of the mini project itself is gradually increased. Through the end of this subject, the students were required to make a final project, which requiring the students to apply and integrate all the previous knowledge that they have learned. This design was established based on Experiential Learning Theory and Constructivism Theory.

METHODOLOGY

This study used experimental research design, in which the design of Post Test Only Control Group will be used to look at the PjBL effect on memory retention of the students. This study consisted of two groups, which were the control group and the experimental group. The control group was not exposed to the treatment, which they learned by using traditional method. As for the experimental group, they were required to undergo PjBL treatment for a semester. The instrument used for this study was interview protocol, which based on qualitative method. Some of the students for both groups were interviewed in the end of the semester in order to obtain their opinion on their knowledge retention regarding the subject. Interviews were conducted until the collected data is saturated, in which requires a total of 13 students from both groups.

The population for this study were consisted of two cohort of second year undergraduate students that undergo Education with Technology (Electronics and Electrical) program, which learned Programmable Logic Controller (PLC) subject during their second year of study. The first cohort (G1) had taken this subject in February 2016 and the second cohort (G2) had taken this subject in September 2016. The instrument for this study was based on interview protocol and a number of students from both groups were interviewed until the data obtained is saturated. In order to obtain saturated data, 6 students from PjBL and 7 students from non-PjBL were interviewed.

RESULTS AND DISCUSSION

The data gained from the interviewed was analyzed using thematic analysis, which produced a few themes as shown in Figure 2. As for the students from G1 (non-PjBL), there are two themes can be generated from the interview. Most of the students claimed that they are easily forget what they have learned in the class and their knowledge retention only last for a week. They claimed that they unable to practice and apply immediately what they have learned in the class and sometime they just follow the procedure and example that written in the given notes. This finding is in line with the study done by Amin and Malik (2013), which found that the amount of knowledge remained after a learning event decreases rapidly if not quickly applied and practiced.

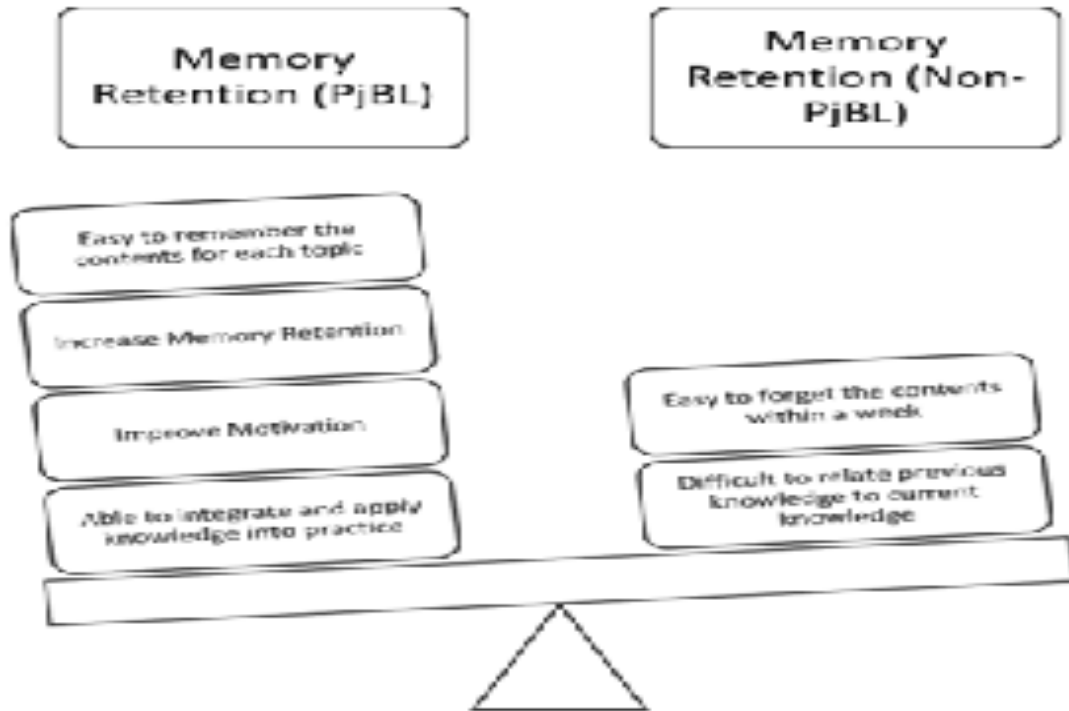


Figure 2. Themes generated from experimental and control groups

Nonetheless, this situation did not happen to the students in G2. The students in G2 claimed that they are easily remember what being taught as the able to apply and practice immediately what they have learned on every mini projects and final project. Moreover, they also stated that they able to improve their knowledge retention since they still remembering what they learned on the first week of the semester. This happened due to the students in G2 are able to apply every topic they learned in each mini project. As they learned more on the content of the subject, the more they need to apply their knowledge on the mini project, which make the difficulty of the mini project increased by week.

According to Karpicke and Blunt (2011), repetitive process of memory retrieval is able to enhance and improve memory retention. By providing such experience to the students, their memory retention can be improved as they need to recall previous knowledge each time they want to make the projects. As for the students in G1, they stated that the exercises given only related to particular content of the subject, which caused them to forget the other content of the subject that they learned previously. Moreover, they also claimed that they have difficulty to relate one topic to another as they only do exercises and examples in class without applying on a real thing.

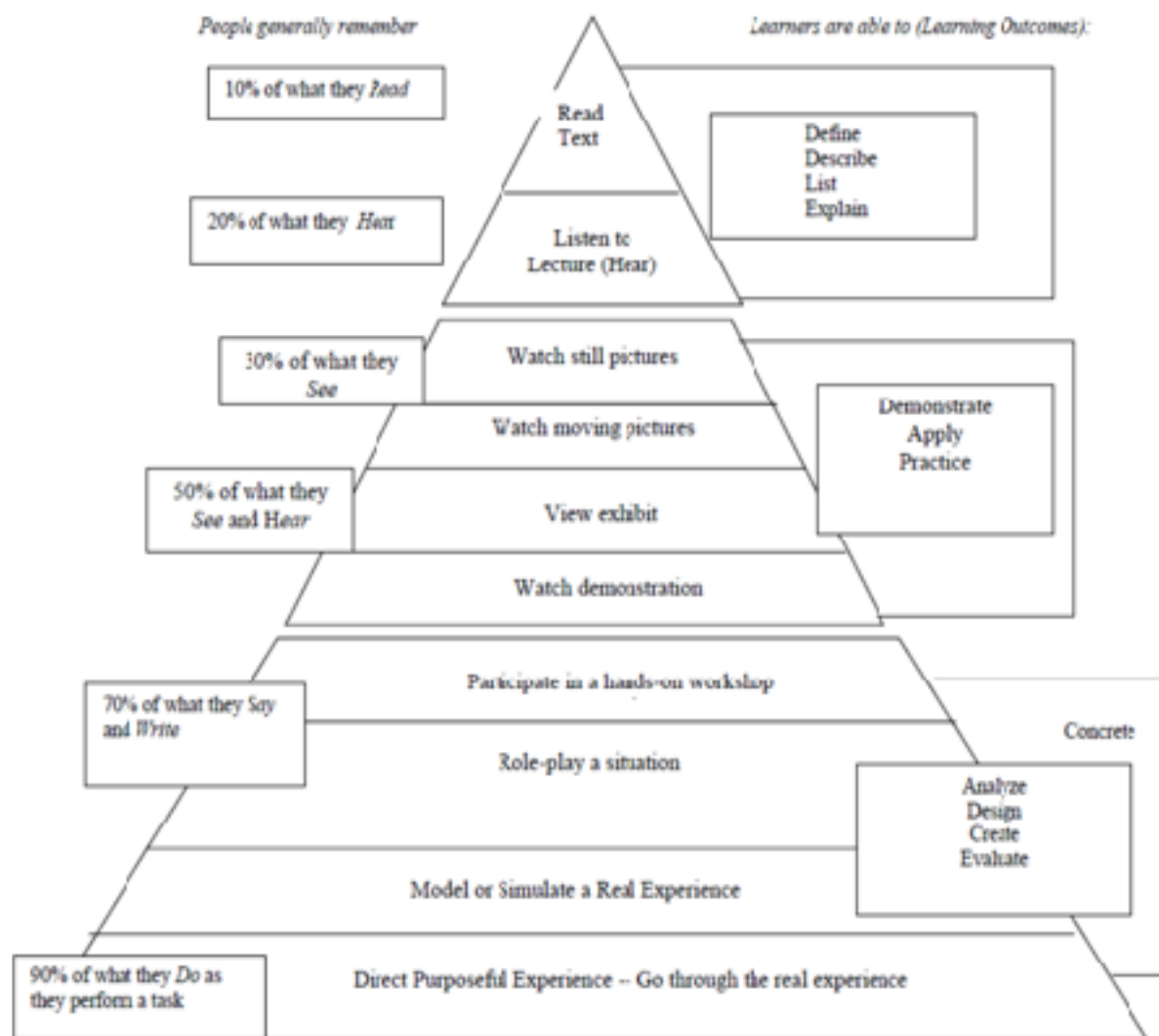


Figure 3. Dale's Cone of experience (Dale, 1969)

This situation can be explained by Dale's Cone of Experience as shown in Figure 3. From the cone, it is clearly shown that people tend to remember 90 percent if they are applying what they have learned in term of real world context. PjBL teaching method that underwent by students in G2 were able to provide hands-on approach and real-world experience, as the students exposed to a number of mini projects and final project that are related to the real-world application such as industrial automation and developing a system of elevator. This situation did not occur on the students in G1 as they only perform normal experiments and exercises, which mainly based on text book and modules. In the same boat, these findings also parallel with a study conducted by Hillman (2011) towards the older adults in term of memory retention. He found that the older adults tend to retain their memory longer if they were learned through hands-on compared to the older adults that learned by viewing the demonstration. Thus, by learning through PjBL which providing hands-on experience in term of real world context, the students are able to retain their knowledge longer than traditional method.

CONCLUSION

Knowledge retention is very important for undergraduate students that want to be vocational teacher as they are critically requires what they have learned in the university. They need to apply the skills and knowledge that they learned into practice when they become a teacher later. In order to improve their knowledge retention, PjBL teaching method is introduced to the students. PjBL is an active learning teaching method that emphasize on hands-on approach, which is designed based on constructivism and experiential learning theory. By adding real world context into PjBL, the students are able to gain new experience of learning, which later can improve their knowledge retention.

PjBL not only can be used for students or in vocational field only, but it is also can be implemented to any age, whether from preliminary school, secondary or even for adult learning. Thus, it is imperative for educators to provide hands-on experience for their students as it proven to be an effective method to improve knowledge retention.

REFERENCES

- Amin, H., & Malik, A. S. (2013). *Human memory retention and recall processes: A review of EEG and fMRI studies. Neurosciences*, 18(4), 330–344.
- Custers, E. J. (2010). *Long-term retention of basic science knowledge: A review study. Advances in Health Science Education: Theory and Practice*, 15(1), 109-128.
- Dale, E. (1969). *Audiovisual methods in teaching*. Dryden Press.
- Fox, T. G. (2013). *Project based learning in primary grades. Master thesis, Northern Michigan University*.
- Hillman, C. N. (2011). *The effects of hands-on learning versus learning by demonstration on memory in community dwelling older adults. PhD thesis, University of Toledo*.
- Karpicke, J. D., & Blunt, J. R. (2011). *Retrieval practice produces more learning than elaborative studying with concept mapping. Science*, 331(6018), 772–775.
- Klemm, W. R. (2007). *What good is learning if you don't remember it? Journal of Effective Teaching*, 7(1), 61-73.
- McTighe, J., & Seif, A. (2003). *Teaching for meaning and understanding: A summary of underlying theory and research. Pennsylvania Educational Leadership*, 24(1), 6-14.
- Minghat, A. D., Yasin, R. M., Subari, K., & Noordina, M. K. (2013). *Strategi kelasterian pembangunan Pendidikan Teknikal dan Vokasional (PTV). In 2nd International Seminar on Quality and Affordable Education*, pp. 493-504.
- Ministry of Education Malaysia. (2015). *Annual report Malaysian Education Blueprint 2013 – 2025. Ministry of Education Malaysia*.
- Palmer, S., & Hall, W. (2011). *An evaluation of a project-based learning initiative in engineering education. European Journal of Engineering Education*, 36(4), 357-365.
- Roediger, H. L., & McDermott, K. B. (1995). *Creating false memories: Remembering words not presented on lists. Journal of Experimental Psychology: Learning, Memory, and Cognition*, 21(4), 803–814.