

## **Students' Perceptions in Implementation Problem-Based Learning (PBL) for Heating, Ventilation and Air Conditioning (HVAC) System Course**

**Syafiq Syazwan Mustafa<sup>1\*</sup>, Fatimah Yusop<sup>1</sup>, Ashraf Abdul  
Rahman<sup>1</sup>, Kamaruzaman Musa<sup>1</sup>, Kamarul Aini Sari<sup>1</sup>, Syamil  
Ismail<sup>2</sup>, Anis Shazzuani Aziz<sup>2</sup>**

<sup>1</sup>Department of Civil Engineering Technology, Faculty of Engineering Technology,  
Universiti Tun Hussein Onn Malaysia, 84600 Pagoh, Johor, Malaysia

<sup>2</sup>Department of Mechanical and Manufacturing Technology, Unit Refrigeration and  
Air-conditioning Technology, Setapak Vocational College, 53300 Kuala Lumpur,  
Malaysia

\*[mohdsyafiq@uthm.edu.my](mailto:mohdsyafiq@uthm.edu.my)

DOI: <https://doi.org/10.30880/hsp.2022.02.02.001>

Received 1 July 2022; Accepted 29 November 2022; Available online 15 December 2022

**Abstract:** Problem-based learning (PBL) is recognized as one of the most effective strategies for interactive learning. The technique has the potential to enhance the existing learning paradigm in order to accommodate 21st century learning. The aim of this study is to identify the students' perception in implementation PBL for HVAC system course. The questionnaire with five question text have been distributed to 16 students that attended for the HVAC system course. The result indicates the positive perception in PBL implementation according to the percentage. PBL can be a good activity in class and align with the student-centered learning.

**Keywords:** Problem-based learning, Perception, HVAC system course

### **1. Introduction**

Education refers to a long-term investment in human resources that is critical to the world's existence of human civilization. Practically, all countries see education as critical and primary in terms of national and state development. Education also has provided individuals with information and skills, hence boosting efficiency growth and bringing wealth to the country. In this context, the effective teaching and learning are important to ensure the education system can be developed holistically and these processes need to be generated in pleasurable learning environment. Previous study has revealed

---

\*Corresponding author: [mohdsyafiq@uthm.edu.my](mailto:mohdsyafiq@uthm.edu.my)

2022 UTHM Publisher. All rights reserved.

[publisher.uthm.edu.my/periodicals/index.php/hsp](http://publisher.uthm.edu.my/periodicals/index.php/hsp)



that an effective teaching style is one of the aspects that has a significant impact on students' learning performance [1]. The use of a variety of teaching methods and tactics may assist students in problem solving, understand theory, and using information and abilities to solve problems. The quality of learning can be increased by the effective content delivery and being able to motivate students to participate actively.

The 21st century learning framework anticipates 4C skills, which include critical thinking and problem-solving skills, communications skills, collaboration skills, creativity and innovation skills [2]. Adoption of more student-centred learning is essential to respond the call of 21st century learning. Problem Based Learning (PBL) is a learning approach that is oriented to students and aligned with 21st century learning. Besides, it can improve student achievement and critical thinking. Wahyu et al. (2018) investigated the implementation of PBL for improvement student academic's achievement and creativity on the topic of electrolyte and non-electrolyte solutions [3]. The result presented there was a relationship between academic success and creative thinking in the moderate group. PBL is recommended and can be applied on the learning process to develop academic achievement and creativity of students. This also in line with the finding by Paryanto et al. (2020) where the PBL improved the Mechanical Engineering student's achievement for the Vocational high school in Indonesia [4]. On the other hand, PBL also drives in critical thinking development for student. Narmaditya et al. (2018) studied the implementation of PBL and it impacted the critical thinking for senior high school students [5]. The Structure Observed Learning Outcome (SOLO) Taxonomy, which includes restructural, Unistructural, Multi structural, Relational, and Extended Abstract thinking levels, is used to describe the degree of critical thinking. The result revealed the critical thinking increased and improve ability to solve the problems and making conclusion. Marhamah and Jannah (2020) also studied the effective of PBL on creative thinking with the lesson study pattern. The findings of the study showed that a PBL combined with a lesson study pattern has an impact on creative thinking abilities [6]. PBL widely recognized of one of the innovation approaches with the active learning based on the social constructivism concept [7]. The learning approach of PBL focuses on solving issues in everyday life; these features encourage students to learn more actively while also increasing their potential. This approach has aided in the development of students' abilities in self-directed learning, critical thinking, teamwork, leadership traits, and collaborative learning [8]. On the other hand, the application of this strategy has the potential to transform traditional lecture-based learning (LBL) into PBL.

A paradigm changes from teacher-centered to student-centered is required to engage students and help them acquire useful skills. The changes in industry and global trend leading to move the paradigm towards student centered. PBL is one of the useful approaches to obtain the student-centered learning and it became the foundation of modern education. However, the perception among student for implementation PBL is essential to obtain the view of student. The student perception and feedback towards PBL in academic sessions are valuable in improving teaching style and effective PBL implementation.

## **2. Materials and Methods**

PBL is implemented in a process-oriented manner [9]. Groups of five to six students need to be created. Pictures and video are provided as a trigger in PBL activity. The group of students need to identify the fact, idea, learning issue and action plan (FILA) based on problem trigger given as shown in figure 1. The activity is given 1 week before synchronous learning using Universiti Tun Hussein Onn Malaysia Academic online resources (Author). Every group required to share the outcome by identifying solutions to issues, study resources on assigned assignments, make presentations, and create a portfolio to be delivered at the end of the semester.

 <b>Problem Based Learning</b> <small>FAKULTI TEKNOLOGI KEJURUTERAAN</small> <small>UNIVERSITI TUN HUSSEIN ONN MALAYSIA</small>			
<b>Heating Ventilating and Air Conditioning System (Assignment 1)</b>			
<b>Trigger of PBL activity</b>			
			
<p><b>In environment knowledge, give solution about this problem?</b></p> <ol style="list-style-type: none"> <li>1. Video : <a href="https://drive.google.com/file/d/1FAM-FHcDswtRTVFIkOi8dvwGCLm7uTX/view?usp=sharing">https://drive.google.com/file/d/1FAM-FHcDswtRTVFIkOi8dvwGCLm7uTX/view?usp=sharing</a></li> <li>2. Discussion and brainstorming anything based on figure given (20 minutes).</li> <li>3. Group 5-6 persons</li> <li>4. Any strategies to overcome the issues?</li> <li>5. Present in Fila table.</li> </ol>			
<b>Pilot-Test Problem (FILA Table)</b>			
Facts	Ideas	Learning Issues	Actions (Resources Needed)

**Figure 1: Trigger of PBL Activities**

Heating, ventilation and air conditioning system (BNB 31203) is the course that have been selected in this study. This course needs to be taken in 3rd year for program Civil Engineering Technology (Building Services) and 16 students’ enrolment for semester 1 session 2021/2022 which male (11) and female (5). The PBL activity is based on lecture plan in chapter 3 which is ventilation and indoor air quality. The students were first informed about the study's aims and the questionnaire was distributed via google form. The items in questionnaire are prepared based on literature review and the author own experiences [10]. A 5-point Likert scale was used to assess students' levels of satisfaction. The Likert scale represented an ascending sequence of score (1, 2, 3, 4, and 5 correspondingly for Fully Disagree, Disagree, Undecided, Agree, and Fully Agree). After receiving the replies from the students, the data was entered and compute in the percentage.

### 3. Results and Discussion

This section explains and evaluates the result from the questionnaire. The subheading corresponds to a specific question (Q) from the questionnaire. There are 5 question text have been asked to the students:

Q1: PBL gave you direct responsibility for your own learning.

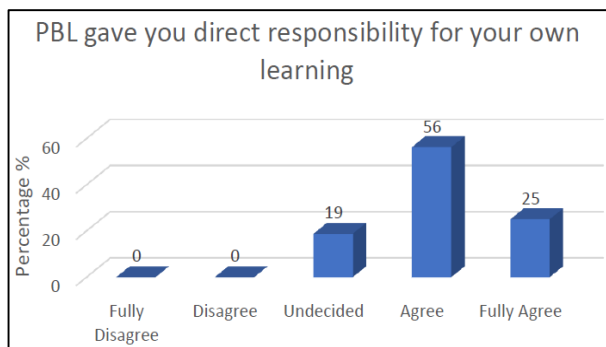
Q2: Having participated in PBL session, my confident and ability to undertake a real problem in ventilation and indoor air quality

Q3: The PBL sessions have helped my understanding of the theoretical ventilation and indoor air quality

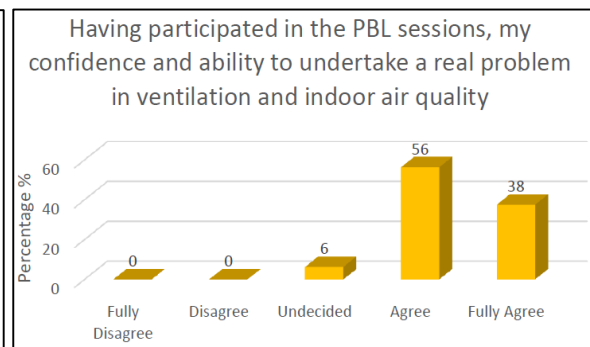
Q4: The PBL sessions have helped my ability to work in groups

Q5: The PBL sessions should be kept as part of this course

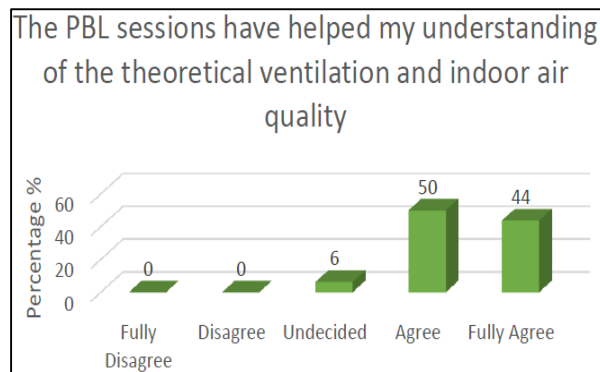
Figure 2 shows the students' perception towards PBL gave the direct responsibility for own leaning. The majority of students agreed the PBL direct respond to their own learning with 56% followed by 25% fully agreed and 19% undecided. Student required to find the information from internet, book and journal to understand the chapter. This in line with the student-centered learning through autonomous and self-directed study, students have more control over their learning and accountability for their own learning process [11]. Most crucially, new knowledge can be gained for solving problem and cross-disciplinary challenges that are typical of professional practice [12]. Figure 3 shows the students' perception on confident and ability to undertake real problem ventilation and indoor air quality. The majority of students agreed the PBL provides on confident and ability a real problem with 56% followed by 38% fully agreed and 6% undecided. The problem given focuses on real-life issues and challenges in order to assist them grasp real-life situations [13]. students may aid in the development of learners' curiosity and lifelong learning habits by providing them with deeper views on case scenarios.



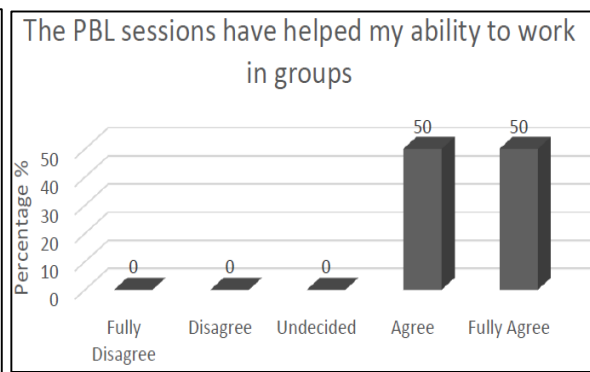
**Figure 2: Students' Perception in PBL gave the direct responsibility for own learning**



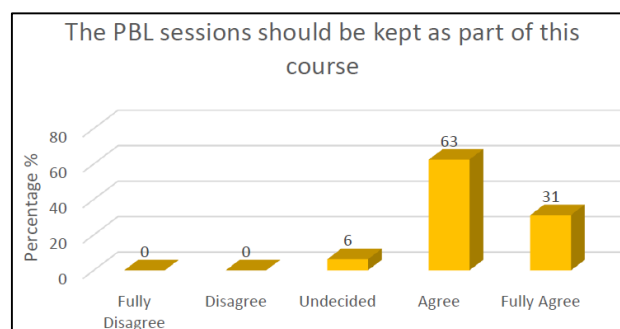
**Figure 3: Students' perception on my confident and ability to undertake a real problem in ventilation and indoor air quality**



**Figure 4: Students' perception on understanding theoretical ventilation and indoor air quality**



**Figure 5: Students' perception on ability to work in group**



**Figure 6: Students' perception on PBL session should be kept as part of course**

Figure 3 shows the students' perception on confident and ability to undertake real problem ventilation and indoor air quality. The majority of students agreed the PBL provides on confident and ability a real problem with 56% followed by 38% fully agreed and 6% undecided. The problem given focuses on real-life issues and challenges in order to assist them grasp real-life situations [13]. students may aid in the development of learners' curiosity and lifelong learning habits by providing them with deeper views on case scenarios. Figure 4 shows the students' perception on understanding of the theoretical ventilation and indoor air quality. The majority of students agreed the PBL helped on understanding of the theoretical with 50% followed by 44% fully agreed and 6% undecided. PBL approach enables pupils to actively process information, impacting content mastery and eventual academic accomplishment. This strategy is meant to assist students in resolving concerns or problems presented by a range of learning resources [14]. Figure 5 illustrates the students' perception on helping students' ability to work in group. 50% students agree and fully agree the PBL activity assist them to work in group. PBL activity emphasizes collaboration activities, strong communication among group members, studying topics and seeking for knowledge to address issues or challenges. Aside from that, students are responsible for their own learning and must share responsibility among group members to guarantee that the problem is handled. PBL also helps students manage their study time properly since they must finish the assigned work within a certain period [15]. Figure 6 shows the students' perception on PBL session to be kept in the HVAC course. The majority of students agreed the PBL activity can be kept in the HVAC course with 63% followed by 31% fully agreed and 6% undecided. This positive perception provides the PBL activity can be used in future with the variable of activities and cover all chapter in the HVAC course.

#### 4. Conclusion

In summary, based on students' perceptions, it is fairly stated that PBL is a good activity to be implemented for HVAC course as PBL emphasises student-centered learning and is focused on real-life issues or problems. The activities and techniques used in this method should be wide, but the evaluation must be based on precise criteria that determine the level of learners' capacity to apply information at the higher level. This study indicates that the PBL promote the students direct responsible for their own learning, teamwork, professionalism, and effective communication among them. It is recommended to determine the quality of teaching-learning process and assessment system for PBL in future studies.

#### Acknowledgement

The authors would also like to thank to Universiti Tun Hussein Onn Malaysia and Setapak Vocational College for their support.

#### References

- [1] Elaine H.J. Yew and Karen Goh. Problem-Based Learning: An Overview of its Process and Impact on Learning. *Health Profession Education* 2 2016: 75-79
- [2] D M Aswan, L Lufri and R Sumarmin. Influence of Problem Based Learning on Critical Thinking Skills and Competence Class VIII SMPN 1 Gunuang Omeh, 2016/2017. *IOP Conf. Series: Material Science and Engineering* 335 2018.
- [3] W Wahyu, Kurnia and R S Syaadah. Implementation of problem-based learning (PBL) approach to improve studen's academic achievement and creativity on the topic of electrolyte and non electrolyle solutions at vocational school. *IOP Conf Series: Journal of Physics: Conf Series* 1013 2018.

- [4] Paryanto, F Hidayat and C T Harjanto. Implementation of problem based learning to improve student learning achievement in turning machining lesson. *Journal of Physics: Conference series* 1446 2020.
- [5] Bagus Shandy Narmaditya, Dwi Wulandari and Siti Rosnita Binti Sakarja, Does Problem-Based Learning Improve Critical Thinking Skill. *Cakrawala Pendidikan Edisi Oktober 2018, TH.XXXVII, NO.3.*
- [6] Marhamah and Baiq Miftahul Jannah. The Influence of Problem Based Learning Model Using Lesson Study Pattern on Creative Thinking Ability of Students. *Journal of Physics: Conference Series* 1539 2020.
- [7] Osman, M. H. Ready or Not: Students with Self-Directed Learning? *Journal of Engineering Science and Technology* 10 2016: 84-90.
- [8] Ansari, M. T., Rahman, S. A., Badgajar, V. B., Sami, F., & Abdullah, M. S. (2015). Problem Based Learning (PBL): A Novel and Effective Tool of Teaching and Learning. *Indian. Journal of Pharmaceutical Education and Research* 49 2015: 258-265.
- [9] Abdul Kadir, Z., Abdullah, N. H., & Mohd Salleh, B. A Study of Students' Perceptions Of The Pbl Environment And Learning Motivation In The Effective Communication Class Among Undergraduates Of Faculty Of Technology Management, Business And Entrepreneurship, Universiti Tun Hussein Onn Malaysia (UTHM). *Journal of Techno-Social*, 5(1) 2013.
- [10] Lutfun Nahar, Raneem Osama Salem, Ayesha Nuzhat, Lamia Alakrash and Sabiq Anjum Dipro. Medical Students' Perception and Satisfaction with Under-Graduate Medical Hybrid Problem-Based Learning Curriculum in a Saudi Medical School. *International Journal of Education Vol 6 No 3* 2014.
- [11] Valsa Chanthampadathil Augusthy. A comparative study of the learning aoutcomes and students's satisfaction from problem-based learning and lecture based learning in obstetrics and gynaecology. *Ineternational Journal of Reproduction, Contraception, Obsterics and Gynecology* 2016: 1368-1374.
- [12] Allen, D. E., Donham, R. S., & Bernhardt, S. A. (2011). Problem-Based Learning. *New Directions for Teaching and Learning* 2011: 21-29. [2] L. Stein, "Random patterns," in *Computers and You*, J. S. Brake, Ed. New York: Wiley, 1994, pp. 55-70 (Example for a chapter in a book).
- [13] Asyari, M., Al Muhdhar, M. H. I., Susilo, H., & Ibrohim, I. (2016). Improving Critical Thinking Skills through the Integration of Problem Based Learning and Group Investigation. *International Journal for Lesson and Learning Studies* 5 2016: 36-44.
- [14] Grant, M. M. Learning, Beliefs, and Products: Students' Perspectives with Project-Based Learning. *Interdisciplinary Journal of Problem-Based Learning* 5 2011: 37-69.
- [15] Mohamad Ikran Zakaria, Siti Mistima Maat and Fariza Khalid. A Systematic Review of Problem Based Learning in Education. *Creative Education* 10 2019: 2671-2688.