

Project-Based Learning (PjBL) Practice in Technical and Vocational Education and Training (TVET) in Indonesia and Malaysia: A Comparative Study

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Abstract. This qualitative-comparative study examined the use of Project-Based Learning (PjBL) in Technical and Vocational Education and Training (TVET) institutions in Indonesia and Malaysia. It observed the use of PjBL as a student-centered learning method to bridge the gap between academic knowledge and practical skills required for the changing needs of the job market. Empirical research in Indonesia demonstrates that PjBL improves students' collaboration, communication, and interpersonal abilities. The implementation of PjBL in Politeknik Negeri Padang (PNP) Indonesia follows a structured approach categorized into small, medium, and large-scale projects, integrating various subjects and fostering interdisciplinary collaboration among students. Similarly, in Malaysia, PjBL supports efforts to restructure TVET to satisfy industrial demands, particularly at institutions such as Kolej Komuniti Selayang (KKSJ) and Politeknik Sultan Idris Shah (PSIS). The Malaysian model stresses regular review and weekly assessment of student projects, with the goal of improving students' critical thinking, problem-solving, and innovative skills. However, there are significant variances in the evaluation time and the duration of project application between Indonesia and Malaysia. Overall, the comparative analysis offers insight on the changing pedagogical approaches in TVET schools in Indonesia and Malaysia, highlighting the importance of PjBL in preparing students to face the recent globalized workforce.

Keywords: comparative analysis, globalized workforce, PjBL, TVET

Introduction

The characteristics of vocational education is not merely focused on professional accomplishment or skill training, but the integration of the two. Essentially, with the evolving of technology where the market demands raised, the needs of the industries on high skilled abilities and professional quality of the vocational education' graduates also increase (Chiwen & Qin, 2018; Guo et al., 2020; Hidayah et al., 2021). Therefore, the curriculum goal, setting and standards, and the flexibility of the lecturers using applicable teaching methods and techniques in Technical and Vocational Education and Training (TVET) should accommodate the needs in producing the ready-to-work work forces to fulfil the competitive market demands. It is in accordance with the Presidential Regulation No. 68 of 2022 concerning revitalization of vocational education and training in Indonesia (Revitalization of Vocational Education and Training, 2022) which highlights that all vocational educations should apply the link and match, and dual system training for their students to develop knowledge and improve their skills to be competent in the workplace. The regulation states that vocational institutions' graduates should have competitive values which are being productive, innovative, and well-trained (Hidayah et al., 2021; Syahril et al., 2018). To implement the Presidential Regulation aforementioned, Project-Based Learning (PjBL) is considered as an appropriate learning model to be included in the curriculum of TVET institutions in Indonesia.

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Likewise, numerous empirical research in South East Asia (ASEAN) (e.g., Guo et al., 2020; Jalinus et al., 2017; Liu, 2018; Syahril et al., 2018; Tongsakul et al., 2011) stated that PjBL is developed for TVET institutions since the learning method allows students to establish their project collaboratively by undergoing some processes. During the whole process, mostly for a longer time up to one semester, teachers and/ or instructors would supervise them so that they can create consequential and practical project. Hence, it is a deep learning for the students as they can work together with their peers or groups in elaborating and identifying various problems, and coming out with high-complexity solutions while accomplishing their project. At the same time, the PjBL learning method can also train students for life-long learning and to be responsible in their learning by setting goals and exploring themselves to obtain a good result (Megayanti et al., 2020; Tongsakul et al., 2011). PjBL is a student-centred learning method, a transferable theory into practice through experiences and reflections (Jalinus et al., 2017; Liu, 2018; Vargas et al., 2018), where the students are encouraged to create a project based on the surrounding phenomena through inventions and innovations (Nilsook et al., 2021). In other words, it is the process where the students are more involved and engaged in their learnings based on authentic real-world tasks initialized from practical issues and terminated with the production of a design and/ or product through varied tasks. The artifact creation conducted one of which through solving the authentic problem is considered as the most essential part in PjBL and becomes the characteristics of PjBL (Guo et al., 2020).

For a number of years, the learning approach in TVET has shifted from teacher-centered to student-centered. It is because the latter is not effective in producing students who can develop practical application of acquired knowledge. There are no expected teaching effects concerning on the students' high-level thinking on real-life projects. Thus, there are changes made in performing the learning process in vocational institutions, to name a few, reforming education act in Thailand particularly for Thai vocational education institutes (Nilsook et al., 2021; Tongsakul et al., 2011), implementing the analysis made on the barriers faced by TVET teachers in China to provide the students with hands-on knowledge (Liu, 2018), and improving the professional education of the students as the skilled workers in regard of the study's result (Nilsook et al., 2021; Vargas et al., 2018).

Concisely, some vocational institutions in Indonesia have applied the PjBL in their curriculum and recommended teachers using this learning approach in their classes (Ahmad et al., 2023; Hidayah et al., 2021; Jalinus et al., 2017; Syahril et al., 2018). Syahril et al. (2018) in their study involving Diploma III Mechanical Engineering students, Universitas Negeri Padang found the significance impact of implementing PjBL collaboratively. Their study's results showed that by applying the collaborative PjBL, the students apprehended the arrangements profoundly in creating a product based on the technical skills they learned. Hence, the project proposals evaluated in the study demonstrated the improvement of the students' collaborative, communication, and interpersonal skills which were the essential competencies needed in the working life. Accordingly, Jalinus et al. (2017) also reported the essential improvement made by the students of two Community College in West Sumatra: Community College Tanah Datar and Community College Pesisir Selatan. Community College is part of vocational institutions, which provides one or two years of study focusing on particular needs in accordance with local wisdom of the area. The students in these two vocational institutions are found to be more productive and competence after implementing the seven steps of PjBL within their learning process.

For the past few years, Department of English, Politeknik Negeri Padang has been collaborating with two TVET institutions in Malaysia: Kolej Komuniti Selayang (KKS) and Politeknik Sultan Idris Shah (PSIS), Selangor. One of them is a collaboration in improving the teaching and learning methods in each institution. Hence, the aim of this study was to examine the differences of PjBL implementation between the institutions of the two countries since both

are included in ASEAN countries. Therefore, the research question sought to be answered by this study were:

1. What are the learning methods implemented in Kolej Komuniti Selayang and PSIS?
2. How are the academic activities, which are in line with the PjBL, conducted by each institution?

Methodology

This qualitative study used comparative research design to identify the similarities and differences of PjBL implementation in two TVET institutions in Malaysia: Kolej Komuniti Selayang (KKSJ), and Politeknik Sultan Idris Shah (PSIS), Selangor, Malaysia. This study was conducted by applying the bibliographic research by examining published articles published concerning TVET, PjBL, and Educational System in Indonesia and Malaysia. Hence, a focused comparison was applied as the technique to describe the occurrences of PjBL in the two institutions, while at the same time gathering emerging insights regarding the application (Coccia & Benati, 2018).

KKSJ and PSIS are vocational institutions under the Ministry of Higher Education, Directorate of Polytechnics and Community College, Malaysia. Beside producing workforce for industries with the diploma level, KKSJ also opens full-time certificate for short courses (e.g. six weeks) generally of a self-improvement. For the short courses, mostly the length of the courses' period was varied based on the needs of the people who applied and their desired courses.

Likewise, PSIS is also under the Ministry of Higher Education, Directorate of Polytechnics and Community College, Malaysia. It currently has seven departments ranging from engineering to social science, and also has Center of Environmental Technology (CENTA), and Corporate, Industrial Services and Employability Center (CISEC). Concerning the CISEC, PSIS has been establishing several collaborations with industries such as with Puncak Niaga (*Kolaborasi Politeknik Sultan Idris Shah & Korporat Tingkatkan Kebolehpasaran Mahasiswa*, 2023) as one of the ways to increase graduates' employability.

Findings and Discussion

Project-Based Learning at TVET in Indonesia

The focus of attention of Project-Based Learning (PjBL) implementation at TVET in Indonesia of this study is in Politeknik Negeri Padang (PNP). PjBL conducted in PNP is the implementation of the Decree of Ministry of Education and Culture, Number 3/M/2021 concerning Key performances Indicator of Higher Education Institutions and Higher Education Service Institutions under Ministry of Education and Culture. Therefore, the PNP Director Regulation on the Guidance for the Implementation of PjBL and Case Method was established in December, 2022 (Tim Kurikulum, 2022) as the follow up of the Ministry' Decree, so that lecturers can comprehend about the two learning methods in their teaching-learning process. To answer the challenges in the globalisation era which is associated with the global market, PNP ought to put the transformation of its education system as its main consideration. PjBL has been recognized worldwide as an effective learning method in preparing the students to develop their hard and soft skills; collaborative skills and time-management (Ahmad et al., 2023; Almulla, 2020; Handoyono et al., 2020; Virtue & Hinnant-Crawford, 2019) through authentic and disciplinary subject learning (Ahmad et al., 2023; Guo et al., 2020; Hidayah et al., 2021; Jalinus et al., 2017; Syahril et al., 2018), carried out as a practicum prerequisite (Hidayah et al., 2021) to be completed over sustained period. (Hidayah et al., 2021; Liu, 2018; Tongsakul et al., 2011; Vargas et al., 2018)

In general, the implementation of PjBL in PNP is categorized into three level in accordance with the project' size and the graduates' profile and profession. Those levels are 1) PjBL in small-scale project; 2) PjBL in medium-scale project; and 3) PjBL in large-scale project. PjBL in small scale project is set for the students for the similar batch within a study program, with the maximum length of one semester for the implementation. PjBL in medium-scale project is set for students derived from a few different batches and diverse study programs, with a maximum length of one semester for the implementation. Likewise, PjBL in large-scale project is also set for the students from varied batches and study programs, however, it is different in the length of its implementation which is a maximum of four semesters (Tim Kurikulum, 2022).

The categorization implemented by PNP is in accordance with Liu (2018)'s study that points out that PjBL would be practical for the students and the industries when the projects are long-term program without any strict time limits, even though he only set the project for the maximum one year or two semesters. He is also in agreement with PNP PjBL classification concerning the multidisciplinary majors in a project. He argues that the more background involves in a project, the more the students learn and improve their self-organization and responsibility in completing the project. Undoubtedly, the students can increase their collaborative skills in a team, where at the same time encouraging their higher-order thinking to strengthen their ability to transfer what they have learned in real-world situations. It can contribute to efficiency and efficacy of the learning process because students can learn from a distinct perspective on a specific topic through their team to obtain intended result (Almulla, 2020; Virtue & Hinnant-Crawford, 2019). Through sharing knowledge, students and their lecturers can share the exploration process so that the students can evolve from "expert learner" to "expert" (Almulla, 2020, p. 2). Even though Hidayah et al. (2021) in their findings reported that one of the advantages of implementing PjBL in vocational and higher education is the underachieved learning outcomes, Virtue et al. (2019) and Almulla (2020) argue that the PjBL offers students a highly engaging experience during the process of learning. The emphasize made by the teachers on the characteristics and instructions on how to conduct the PjBL by providing comments, suggestions and evaluations on the students' project can stimulate students' motivation to do their tasks and achieve the targeted outcomes (Handoyono et al., 2020; Hung, 2011; Virtue & Hinnant-Crawford, 2019).

In regard to the curriculum, the implementation of PjBL in PNP accommodates several subjects offered to the students to one particular semester (ongoing semester). All subjects within certain semester whether even or odd semester are involved in the PjBL process. Therefore, each department in PNP should work together with the study programs under the department to design and organize the curriculum so that each subject offered in one certain semester is integrated from one to another. The departments and related study programs are also responsible to organize the availability of infrastructures for the implementation of PjBL (Tim Kurikulum, 2022). To make the learning process becomes systematic and effective, PjBL techniques from interdisciplinary aspects need to be equated (Virtue & Hinnant-Crawford, 2019) leading to the reform in curriculum (Tongsakul et al., 2011). The lecturers should place themselves as the mentor when setting up, carrying out, and/or reviewing the PjBL (Almulla, 2020; Jalinus et al., 2017; Tongsakul et al., 2011) which oblige them to comprehend the stages and the expected outcomes of each stage in performing PjBL prior to assign the tasks to the students (Megayanti et al., 2020; Tongsakul et al., 2011). Therefore, student-centred learning is considered the most improved method for PjBL, as in this type of method the students are expected to challenge themselves to determine learning in order to gain experience, concentrate more on technical skills and practical knowledge (Ahmad et al., 2023; Almulla, 2020; Jalinus et al., 2017; Tongsakul et al., 2011).

In the implementation of PjBL in PNP, seven steps PjBL model established by Jalinus have been validated and assessed by Aiken, with a significant coefficient (0.796) (Jalinus et al., 2017). As highlighted by Jalinus et al. (Jalinus et al., 2017), the seven steps are fallen into three major categories, which are 1) skill competency debriefing (three stages), 2) project work (three stages), and 3) evolution (1 stage). The first category consists of the formulation of the expected learning outcome, understanding the concept of teaching material, and skills training. The second category consists of designing the project team, marking the project proposal, and executing the tasks of the project. Whereas for the third category consists of presentation of the project report.

In practice, PNP employs six steps for the PjBL implementation to the students in the institution. The first step is elaborating the ideas for the project starting with the essential questions in line with the real world' problem occurring in the industries. This step needs depth investigation by the students, which can be done through library research or direct observation. The second step is designing a plan for the project based on the obtained idea. The students along with the lecturers of the related subjects involved in the project discuss a thorough analysis and plan of the projects such as the infrastructure and equipment needed. In a dialogic interaction, they exchange and modify the concepts. The third step is the time for the students within their group to create a time schedule for their project considering the expected outcomes for each stage of the project and the implementation place whether it can be done in or outside the classroom. The fourth step is the project' monitoring carried out by each subject's lecturer. The monitoring is done in order to ensure the students have performed all the plans in the time schedule to obtain the targeted outcome per stage. The fifth is assessing the outcome using the indicators that have been set by department and study program, as the stakeholders from the institution, and conducted by the lecturers. Besides assessing the product, and the process taken for the project, the lecturers also assess the performance of each student within a group. The sixth is evaluating the experience. For this step, the students should present their project in the form of report, and then lecturers would provide comments and feedback of the project made (Tim Kurikulum, 2022).

It has been proven that through PjBL method, students can exhibit their comprehension of the theoretical concepts they have learned on campus and apply them in a practical learning process for a specific actual-life situation collaboratively and create a product with a target market in view. (Almulla, 2020; Handoyono et al., 2020; Jalinus et al., 2017; Sarwandi et al., 2019; Vargas et al., 2018). Despite the steps generated by PNP as mentioned above, Sarwandi et al. (2019) in their study concerning the implementation of PjBL on the students of Project Management Department at Universitas Negeri Padang, included questionnaire in the process right after elaborating ideas. Here, the questionnaire is aimed to validate the material and media experts. Besides that, they also conduct a test for the product produced during the report presentation of the students in order to determine the effectiveness of the product. Furthermore, Hung (2011), and Vargas et al. (2018) also in the agreement of the effectiveness of PjBL for TVET students following the steps taken by PNP. They oppose the debate concerning the ineffectiveness of PjBL to be used as learning method in terms of the low learning outcomes achieved. They argue that in the implementation of PjBl, what should be taken as the measurement of its effectiveness is not merely the learning outcomes, but the relevant and meaningful experiences the students gained during the process. Having a well-prepared instructional intervention in regard to theoretical conception and proper implementation illuminate the students to the desired end results and strengthens their engagement with learning. A well-organized execution of a project that can be monitored and assessed in every production stage can be the evaluation ground for the improvement of PjBL learning method in the future.

Project-Based Learning at TVET in Malaysia

Regarding the implementation of PjBL at TVET institutions in Malaysia, it is concentrated in KKSJ and PSIS were included as the models. It is in line with the eleventh plan (2016-2020) on the strategic plan of transforming TVET to meet industry demand issued by Director General Economic Planning Unit highlighting the needs of the industries in the Industrial Era (IR) 4.0 and how TVET institutions can produce high-quality graduates by revising the curriculum to more engaging the students to authentic real-world problem (*Eleventh Malaysia Plan 2016-2020. Transforming Technical and Vocational Education and Training to Meet Industry Demand*, 2015; Yunus, 2023)

In practice, the implementation of PjBL in Malaysia' TVET institutions particularly in Kolej Komuniti Selayang (KKSJ) and Politeknik Sultan Idris Shah (PSIS), Selangor is similar to what has been done in PNP. Both of the institutions adopted the PjBL implementation from PjBL module conducted for the first time by Polytechnic Kota Bharu in 2009 and have been setting the standard for community colleges and polytechnics in Malaysia (Abdul Rahman et al., 2009; Che Isa & Azid, 2021; Sadrina et al., 2018). It is a student-driven learning method (Ahmad et al., 2023; Almulla, 2020; Mustapha et al., 2020; Tongsakul et al., 2011) that encourages a collaborative approach among the students, where the outcomes of the learning process are developing a challenging real-world project. The project itself is in congruence with the model highlighted in PjBL guidance; engages learning and technical experiences; involves authentic project; integrates concept and knowledge (Handoyono et al., 2020; Jalinus et al., 2017; Mustapha et al., 2020; Vargas et al., 2018). Hung (2011), Almulla (2020), Tongsakul et al. (2011) stated that in the determination to produce a project initiated from the real-life problem, a group of individuals may challenge themselves to collaborate with their peers in the matter of sharing and reflecting on the intended knowledge in order to achieve the common goal leading to improving their self-directed learning (autonomous).

In the PjBL module that they use, the students are also encouraged to produce innovative products or projects in a field of specialization, so that at the time they graduate they can be a skilled worker and specialized in that particular area. In teamwork, they should divide the responsibility of each member and the activities that should be taken as a group. During the process of carrying out the PjBL module, the students in the two institutions; KKSJ and PSIS, are asked to design a project consisting of several tasks in a group throughout a certain length of time. The problem found by the students becomes the topic of the project, whereas the task is the sub-division of the problem, and assessed weekly. Here, the PjBL module guide is used by the supervisor or lecturers to supervise and evaluate the students' works task by task. Each task is designed to be accomplished by the students weekly, and the lecturers would evaluate the progress, so that the students can make improvement for the next stage of their work in accordance with the evaluation (Abdul Rahman et al., 2009).

Hence, the weekly evaluation is in contrast with what was pointed out by Vargas et al. (2018) in their empirical study establishing a PjBL on a suburban Technical and Vocational School (TVS) in Cuba. The interdisciplinary work on developing an agriculture system in Cuba employing the six steps of PjBL were consistent with the steps carried out by PNP (Tim Kurikulum, 2022) where the evaluation of the students' project occurred on the sixth step. The assessment in this step is performed for the whole process and is not limited only to the end result, such as self-assessment, peer assessment and group assessment. In their study, Vargas et al. (2018) differentiate the assessment for the written report and for the presentation with particular indicator for the rubrics. Likewise, Liu (2018) says that the three assessments performed by the students thereof can reinforce them to be more critical and provoke them to make improvement on their project.

There have been many advantages gained by the students upon experiencing the PjBL in the two institutions. The characteristics and instructions of PjBL provoke them to become

creative and inventive which are considered crucial in PjBL method. Hence, at the same time reinforce active engagement with the learning process, such as discussion and hands-on practice in line with the empirical study of Mustapha et al. (2020), Che Isa and Azid (2021), and Mohd. Yusof et al. (2015) in other TVET institutions in Malaysia. It can be said that a deeper understanding of applicable knowledge of the project can improve the students' performance, such as critical and higher levels of thinking skills and reach the targeted outcomes. Even though the focus of the attention of the PjBL is the end process, the students are not feeling under pressure, and always enthusiastic and excited to acquire the skills in producing the product designed (Abdul Rahman et al., 2009; Che Isa & Azid, 2021; Mustapha et al., 2020). The improved performance of the students indicates the higher self-confident the students have. They become clear, thoughtful, and respectful in expressing their ideas and responding to other opinions and perspectives during the team discussion without losing their self-esteem. As pointed out by Almulla (2020) and Tongsakul et al. (2011), inevitably both teachers and students gain positive impacts from PjBL with regard to their personal development, professional learning, resolving challenging issues, and managing emotional anxiety.

The Differences between the Practice of PjBL in Indonesia and in Malaysia

The differences of the PjBL practices between the TVET institutions in Indonesia and in Malaysia are in the form of the period for the project evaluation, and the executing time. First, in terms of assessment, there is a slight difference between the implementation of PjBL in Indonesia and in Malaysia. In Indonesia, the assessment is performed after the fifth cycle of PjBL when the students in their group collaboratively work on the project based on the framework and concept of the project that they have planned previously (Jalinus et al., 2017; Megayanti et al., 2020; Syahril et al., 2018). On the other hand, the assessment made for the students' project of PjBL practice in Malaysia is conducted regularly on each task contained in the project-producing development (Abdul Rahman et al., 2009; Sadrina et al., 2018). The TVET institutions in Malaysia consider that evaluation should be performed on weekly basis in order to obtain effective supervising. Second is in terms of the executing time. There is no specific time for the implementation of PjBL practices in the higher vocational in Indonesia. Indeed, the learning method can be done in every semester involving several related subjects with the project chosen. However, mostly the practice of PjBL is conducted within one semester or six months, starting from the third semester when the students have gained adequate knowledge in theory and practice, so that they can develop the knowledge throughout the PjBL process. Meanwhile, the higher vocational institutions in Malaysia establish the PjBL practice for the students' senior project (Mustapha et al., 2020) after they have completed their six months on-the-job training in industries (Abdul Rahman et al., 2009).

Conclusion

Despite the moderate discrepancy between the implementation of PjBL in TVET institutions in Indonesia and in Malaysia, the compelling part is that the students can benefit from the PjBL as the benchmark of professional works prior to entering their career life. PjBL is beneficial for both teachers and students, and through PjBL practices, it can be seen that the students can accelerate their personal development (e.g., interpersonal communication, and their professional development (e.g., academic skills). More research regarding further use of multi-media-oriented should be conducted to evaluate the effectiveness of PjBL in compliant with the emerging growth of technology within 21st century.

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References

- Abdul Rahman, M. B. H., Mat Daud, K. A., Jusoff, K., & Abd Ghani, N. A. (2009). Project Based Learning (PjBL) Practices at Politeknik Kota Bharu, Malaysia. *International Education Studies*, 2(4), 140–148. <https://doi.org/10.5539/ies.v2n4p140>
- Ahmad, S. T., Watrinhos, R., Samala, A. D., Muskhir, M., & Dogara, G. (2023). Project-based learning in vocational education: A bibliometric approach. *I.J. Modern Education and Computer Science*, 4, 43–56. <https://doi.org/10.5815/ijmecs.2023.04.04>
- Almulla, M. A. (2020). The Effectiveness of the Project-Based Learning (PBL) Approach as a Way to Engage Students in Learning. *SAGE Open*, 1–15. <https://doi.org/10.1177/2158244020938>
- Che Isa, Z., & Azid, N. (2021). Embracing TVET education: The effectiveness of project based learning on secondary school students' achievement. *International Journal of Evaluation and Research in Education*, 10(3), 1072–1079. <https://doi.org/10.11591/ijere.v10i3.21392>
- Chiwen, W., & Qin, W. (2018). Reflection and construction of Higher Vocational Curriculum based on professional quality education. *Advances in Social Science, Education and Humanities Research (ASSEHR)*, 133–137.
- Coccia, M., & Benati, I. (2018). Comparative Studies. In A. Farazmand (Ed.), *Global Encyclopedia of Public Administration, Public Policy, and Governance* (pp. 1–7). Springer, Cham. https://doi.org/10.1007/978-3-319-31816-5_1197-1
- Eleventh Malaysia Plan 2016-2020. *Transforming technical and vocational education and training to meet industry demand*. (2015). <http://www.epu.gov.my>
- Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of project-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, 102. <https://doi.org/10.1016/j.ijer.2020.101586>
- Handoyono, N. A., Suparmin, S., Samidjo, S., Johan, A. B., & Suyitno, S. (2020). Project-based learning model with real object in vocational school learning. *International Conference on Vocational Education of Mechanical and Automotive Technology (ICoVEMAT)*. <https://doi.org/10.1088/1742-6596/1700/1/012045>
- Hidayah, N., Arum, A. P., & Apriyansa, A. (2021). Project-Based Learning (PjBL): Advantages, disadvantages, and solutions to vocational education (in pandemic era). *Proceedings of the 3rd International Conference on Law, Social Sciences, and Education, ICLSSE 2021*, 1–8. <https://doi.org/10.4108/eai.9-9-2021.2313669>
- Hung, W. (2011). Theory to reality: a few issues in implementing problem-based learning. *Education Tech Research Dev*, 59, 529–552. <https://doi.org/10.1007/s11423-011-9198-1>
- Jalinus, N., Nabawi, R. A., & Mardin, A. (2017). The seven steps of Project Based Learning model to enhance productive competences of vocational students. *1st International Conference on Technology and Vocational Teachers (ICTVT 2017)*, 251–256.
- Kolaborasi Politeknik Sultan Idris Shah & korporat tingkatan kebolehpasaran mahasiswa. (2023). <https://www.puncakniaga.com>
- Liu, H. (2018). Barriers of Project-Based Learning in teaching and learning of Chinese Technical and Vocational Education and Training (TVET): A review. *TVET@ASIA*, 12(1–14). www.tvet-online.asia
- Megayanti, T., Busono, R. T., & Maknun, J. (2020). Project-based learning efficacy in

- vocational education: A Literature review. *IOP Conference Series: Materials Science and Engineering*. <https://doi.org/10.1088/1757-899X/830/4/042075>
- Mohd Yusof, M. N., Ismail, N. S., Musta'amal, A. H., & R, A. (2015). Impementation of Project-Based Learning (PjBL) at a Malaysian polytechnic – A preliminary study. *2nd International Conference on Education and Social Sciences*, 548–554.
- Mustapha, R., Sadrina, S., Mat Nashir, I., Azman, M. N. A., & Hasnan, K. A. (2020). Assessing the implementation of the Project-Based Learning (PJBL) in the Department of Mechanical Engineering at a Malaysian polytechnic. *Journal of Technical Education and Training*, 12(1), 100–118. <https://doi.org/10.30880/jtet.2020.12.01.011>
- Nilsook, P., Chatwattana, P., & Seechaliao, T. (2021). The Project-Based Learning management process for vocational and technical education. *Higher Education Studies*, 11(2). <https://doi.org/10.5539/hes.v11n2p20>
- Revitalization of Vocational Education and Training, (2022).
- Sadrina, S., Mustapha, R., & Ichsan, M. (2018). The evaluation of Project-Based Learning in Malaysia: Propose a new framework for polytechnics system. *Jurnal Pendidikan Vokasi*, 8(2), 143–150. <https://doi.org/10.21831/jpv.v8i2.19100>
- Sarwandi, S., Giatman, M., Sukardi, S., & Irfan, D. (2019). Developing mobile-based project-based learning module for project management courses in vocational education. *Jurnal Pendidikan Vokasi*, 9(2), 207–216. <http://dx.doi.org/10.21831/jpv.v9i2.25947>
- Syahril, S., Jalinus, N., Nabawi, R. A., & Arbi, Y. (2018). The create skills of vocational students to design a product: Comparison Project Based Learning versus cooperative learning-Project Based Learning. *5th UPI International Conference on Technical and Vocational Education and Training*, 316–320.
- Tim Kurikulum, P. N. P. (2022). *Panduan penerapan pembelajaran berbasis proyek (Project Based Learning) dan pembelajaran pemecahan kasus (Case Method) pada Politeknik Negeri Padang*.
- Tongsakul, A., Jitgarun, K., & Chaokumnerd, W. (2011). Empowering students through Project- Based Learning: Perceptions of instructors and students in vocational education institutes in Thailand. *Journal of College Teaching & Learning*, 8(12), 19–34.
- Vargas, N. V., Ortiz, J. L. A., & Ceballo, V. M. A. (2018). Project Based Learning in the technical and vocational education and training. *International Journal of Environmental & Science Education*, 13(9), 767–776.
- Virtue, E. E., & Hinnant-Crawford, B. N. (2019). “We’re doing things that are meaningful”: Student perspectives of Project-based Learning across the disciplines. *Interdisciplinary Journal of Problem Based Learning*, 13(2), 9–27. <https://doi.org/10.7771/1541-5015.1809>
- Yunos, S. (2023). *Strategic planning to transform Malaysian TVET students into future ready professionals*. www.tvet-online.asia