

Developing a Project-Based Speaking Skills Learning Model Assisted by the SITERBIDIK Application to Support 21st-Century Competencies of Vocational Students

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ABSTRACT:

This study aims to analyze the need for developing a project-based learning (PjBL) model for speaking skills assisted by the SITERBIDIK application for vocational high school students. Using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) development model, this study focuses on the analysis stage to identify gaps between current learning conditions and ideal conditions. Data were collected through questionnaires, observations, document analysis, and interviews involving vocational high school teachers and students. The results showed that teachers greatly needed training in PjBL implementation (mean = 4.45) and more applicable teaching tools (mean = 4.53), while students preferred contextual learning materials (mean = 4.46) and innovative media (mean = 4.2). There was a strong correlation ($r = 0.58-0.65$) between the need for teaching modules, digital media, and teacher training, indicating the importance of an integrated approach. Furthermore, technology integration (mean = 4.48) was highly needed, although infrastructure readiness remained a challenge (only 65% of schools had adequate facilities). This study confirms the importance of a digital tool-assisted PjBL model like SITERBIDIK for improving vocational high school students' speaking skills. These findings contribute to the implementation of the TPACK framework and provide empirical evidence for education policymakers to prioritize teacher training, contextual material development, and technology integration in vocational high school curricula.

Keywords: needs analysis, project-based learning, speaking skills, Sisterbidik application

1. Introduction

In the context of 21st-century learning, developing speaking skills in vocational schools faces several fundamental challenges that require a comprehensive needs analysis. First, there is a gap between the demands of the workplace, which demand strong oral communication skills, and classroom learning practices that tend to be conventional and teacher-centered. Second, although Project-Based Learning (PjBL) has proven effective in various fields, its implementation for developing speaking skills remains limited, particularly in terms of integration with digital technology. Third, the limited use of learning applications such as Siterbidik to train speaking skills results in a lack of opportunities for students to practice independently and interactively. Fourth, teachers often face obstacles in designing speaking projects that are authentic and relevant to vocational contexts, particularly for programs such as business, management, and tourism, which require significant oral communication competency. Fifth, low student motivation and confidence in public speaking are chronic problems that have not been effectively addressed through traditional learning methods. This needs analysis is crucial for identifying the gap between ideal conditions and current learning realities, as well as for formulating PjBL-based solutions integrated with technology to create a more meaningful, contextual, and workplace-oriented speaking learning experience.

In today's modern educational context, classroom teaching and learning activities must be able to develop these seven skills. Learning is no longer simply transferring knowledge from teacher to student. The focus of learning has shifted from a teacher-centered approach to a student-centered approach and learning strategies that focus on learning, not teaching. Students are no longer "empty vessels" to be filled, but become creative and innovative co-creators of knowledge; they must be guided to think critically and be willing to take responsibility for their problem-solving and collaborate on knowledge development. Teachers can avoid micromanaging learning gradually by building students' abilities and giving them greater control and choice over their own learning. They can build students' self-confidence by encouraging

them throughout the process. Building self-confidence fosters optimism related to the model used in learning (Banack H, et al. 2007).

21st-century learning models need to consider various things, including graduate competencies, educational content, and the learning process, namely (1) the use of educational technology, (2) the strategic roles of teachers and students, (3) creative teaching and learning methods, (4) contextual teaching materials, and (5) individual-based independent curriculum structures (BSNP, 2010: 46-47). In such learning models, teachers can guide students through learning processes such as inquiry projects. They can provide students with general directions and objectives and allow students to direct their own learning. Furthermore, students can direct their learning in various ways (rather than following the teacher's conception of how the work should be done). Teachers can also provide opportunities for students to display their learning in various ways. By providing variety in learning projects, teachers can foster students' ability to think outside the box and demonstrate their assessment of diverse abilities or multiple intelligences (Gardner 1985).

Project-Based Learning (PjBL) in the context of modern education has received comprehensive theoretical support from various cutting-edge perspectives. Digital constructivism theory (Siemens 2005) asserts that PjBL facilitates learning through knowledge networks, where learners actively construct understanding through technology-based collaborative projects. This connectivism approach is increasingly relevant in the digital age, in line with findings (Chen et al. 2021) and (Zhen, Y., & Zhang 2021) on the effectiveness of network-based learning in developing 21st-century skills. Embodied cognition theory (Shapiro 2019) provides a new perspective on how physical engagement in vocational projects can enhance conceptual understanding. In the context of PjBL, hands-on activities such as simulating business presentations or building product prototypes not only hone technical skills but also deepen cognitive understanding through sensorimotor experiences. Perspectives *self-regulated learning* Zimmerman (2013) explains the mechanisms by which Project-Based Learning (PjBL) fosters independent learning

through a cycle of forethought, performance, and self-reflection. Recent findings (Järvelä, S., Malmberg, J., & Koivuniemi 2021) indicate that structured project design with digital scaffolding can increase students' self-regulation capacity by up to 40%. Cognitive flexibility theory (Spiro, R. J., Collins, B. P., & Ramchandran 2018) emphasizes the importance of Project-Based Learning (PjBL) in developing adaptive thinking skills through solving complex, ill-structured problems. The multidimensional and contextual characteristics of vocational projects provide opportunities for students to practice knowledge transfer across situations. The experiential learning 2.0 approach (Kolb, A. Y., & Kolb 2017) updates the traditional model by emphasizing the importance of digital learning spaces in the experiential learning cycle. In this context, digital platforms such as SITERBIDIK function as learning spaces for experimentation and reflection.

Theory *sociomateriality* (Fenwick 2015) offers a critical lens on how PjBL mediates the relationship between social and material aspects of learning. Vocational projects involving industrial technology and tools create a rich learning ecology where knowledge is constructed through the interaction between humans, technology, and materials. Finally, the theory *transformative learning* (Mezirow 2018) explains the potential of PjBL in creating learning experiences that transform students' perspectives. Authentic projects that challenge assumptions and belief systems can trigger a paradigm shift in understanding the world of work. The integration of these contemporary theories demonstrates that PjBL is not just a learning method, but rather a complex ecosystem that combines cognitive, social, technological, and material aspects to prepare students for the challenges of the 21st century.

One of the approaches or learning models that is centered on students is project-based learning. (*project-based learning*) (hereinafter abbreviated as PjBL, following the abbreviation in English). The nature of PjBL includes learning both inside and outside the classroom. For example, students spend most of their time working to achieve their goals and the teacher's role is limited to guiding within a certain period of time. Students are given the opportunity to work in groups and manage their

own time. The teacher acts to facilitate teamwork and not as a "teacher." In many ways, the teacher acts as a guide who encourages students to think critically and achieve the final goal of the project. The teacher is also responsible for assessing learning from students' work throughout the project. When learning is student-centered, students play a role in choosing learning goals and approaches to achieve those goals (Hannafin, M. J., and Hannafin 2010).

PjBL also requires students to be fully involved in a meaningful task to solve a problem. They will learn to construct their learning patterns and ultimately produce a valuable product output (Blumentfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., and Palincsar 2011). This opinion is also supported by Larmer and Margendoller (2010) who stated that in PjBL there are important aspects, among others, starting with a question or challenge, building motivation to gain new knowledge, bringing a question or problem to gain new knowledge, encouraging critical thinking, communication, cooperation, and technological skills, providing feedback and revision, creating a product or output that can be published, and providing students with the opportunity to express opinions and choose in completing the product. These characteristics of PjBL are certainly in line with the demands of 21st-century skills, especially to accommodate students to have good attitudes and cognitive abilities and be able to master media and technology literacy.

Student-centered learning has significance with the PjBL approach to build good speaking or communication skills that are essential in forming quality human resources that are competitive in the era of the Industrial Revolution 4.0. This approach is one of the innovative student-centered learning and places teachers as creators, motivators, and facilitators and students are given the opportunity to work autonomously to construct students' speaking skills. Research (Prohimi 2023) has explored PjBL in preparing students to face the challenges of the Industry 4.0 workplace. The study underscores the importance of aligning learning approaches with the rapidly evolving demands of Industry 4.0. PjBL has proven highly effective in developing students' technical skills, such as programming, data analysis, and technological

proficiency. The immersive learning experience provided by this approach equips students with hands-on skills that are essential for career success, including issues such as finding industry partners, limited human resources, and program expansion across educational institutions as major obstacles in implementation.

The connection between PjBL and speaking skills learning lies in the integration of real-world situations into the learning experience. PjBL is useful for synthesizing students' professional practices to obtain learning experiences that are almost identical to real-world practices (Hanney 2018), helping students have the social and affective capacity, linguistic knowledge, and communication skills to produce good projects (Greenier 2020). In this case, teachers or instructors should strive to create experiences that are as authentic as possible for students. For example, an activity that requires students to promote a business plan for a restaurant should include requirements for complying with health regulations, fire hazards, and building feasibility. Some advocates of vocational education suggest the use of PjBL approaches or models in the real world to improve students' career readiness (Jollands, M., Jolly, L., and Molyneaux 2012).

Several studies have applied the PjBL approach at the elementary school level to higher education. In a study (Blumentfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., and Palincsar 2011) it is said that projects in learning can motivate students to learn and improve their cognitive abilities. Genc (2014) in his research found that by using PjBL, students have more awareness of the environment and can increase students' creativity and provide lifelong learning. They believe this project helps them clarify environmental problems and provides practice to be part of the Solution, therefore, learning Indonesian with PjBL to improve students' speaking skills in vocational schools, especially public speaking, is urgent, especially in expertise programs that require more intensive oral communication, such as business and management expertise programs (including marketing expertise competencies, office management and business services, accounting and institutional finance) as well as tourism expertise programs (including expertise competencies in

tourism, hospitality, and culinary services). Hanney (2018) stated that PjBL is useful for synthesizing professional practices so that students gain learning experiences that are nearly identical to real-world practices in their future fields of expertise. Furthermore, Greenier (2020) stated that PjBL helps students develop the social and affective capacities, linguistic knowledge, and communication skills to produce successful projects.

Based on the description above, this needs analysis is a critical foundation for developing an effective speaking learning model in vocational schools. The main challenges such as the gap between the curriculum and industry needs, limited use of technology, and low student confidence in speaking indicate the urgency of an innovative project-based approach supported by digital applications such as Siterbidik. By understanding the real needs of teachers and students, including the difficulties in designing authentic communication projects and the limited access to interactive learning media, this research can formulate targeted solutions. The results of this needs analysis will not only guide the development of a contextual PjBL model but also ensure alignment between classroom learning and the demands of communication competencies in the Industrial Revolution 4.0 era. Thus, this step is key in creating speaking learning that is meaningful, applicable, and oriented towards increasing the competitiveness of vocational school graduates.

2. Methodology

The type of research used in this study is development research. (*Research and Development*) This educational research and development is a strategy for developing effective educational products that can be used as an alternative to address learning problems. The research conducted in this study is a type of development research or *Research and Development*(R&D), which aims to develop a new product or improve an existing product. (Maksum, A., 2012) stated that the term product can be interpreted as hardware (*hardware*) or software (*software*), such as interactive learning models, guidance models and so on.

The development model used is ADDIE (Analysis, Design, Development, Implementation,

Evaluation). This model was chosen because of its systematic framework that has been tested in various educational studies (Borg, W. R., & Gall, M. D, 1983). ADDIE helps instructional designers create structured and efficient learning products. (Trianto, 2010) and (Branch, R. M., 2009) also emphasize the relevance of ADDIE in the development of today's digital learning.

Each ADDIE step is executed in an integrated and iterative manner:

1. Analysis: Identifying students' needs in speaking skills, limitations of previous teaching methods, and the potential of digital media.
2. Design: Designing learning models and tools with project-based speaking skills integration assisted by the SITERBIDIK application for vocational school students.
3. Development: Building learning models, textbooks, guidebooks and bidik sister validated by experts.
4. Implementation: Limited model trials with vocational school lecturers and students.
5. Evaluation: Using formative evaluation to measure practicality, content clarity, and learning outcomes. For more clarity, see the following image.

The application of needs analysis in the development of a project-based speaking skills learning model using the SITERBIDIK application for different vocational high school students was tested. The subjects of the needs analysis trial were vocational high school students and teachers. The research instrument was validated by experts using content validity, taking into account aspects of language, content, and delivery techniques. Formative evaluation was conducted before widespread implementation to improve quality. The needs analysis aspect was a primary concern, as stated that a learning product is said to be needed if it can be used by users efficiently and is relevant to needs in the field.

3. Results

The design used in this study was ADDIE, so the data analyzed came from the implementation stages applied at the universities that served as the research subjects. The data analyzed in this study specifically focused on the needs analysis aspect. The needs analysis was observed by collecting data through questionnaires given to respondents, with the aim of identifying the gap between the current condition and the ideal condition expected in learning development.

A. Descriptive Analysis of Teacher Needs in Project-Based Speaking Learning

Category	Mean	Interpretation
Technology	4.48	Very High Need
Learning Materials	4.47	Very High Need
Teacher Training	4.42	High Need
Learning Media	4.24	High Need
Learning Model (Pjbl)	4.14	Moderate to High Need
Overall Average	4.35	High Overall Need

Table 1. Presents the distribution of teachers' needs regarding the development of project-based speaking learning. The highest mean is found in the technology category ($M = 4.48$), confirming that digital integration is a crucial component for teachers in supporting speaking skills. The learning material category ($M = 4.47$) also ranks high,

showing teachers' strong demand for updated and contextual teaching resources. Although the PjBL learning model scored slightly lower ($M = 4.14$), this still indicates a positive attitude toward project-based innovation, but with the implication that further professional training may be required for effective implementation.

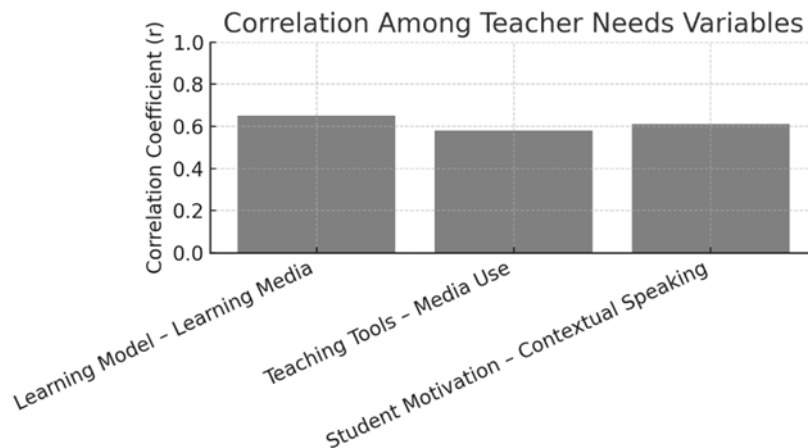


Figure 1. Correlation Among Teacher Needs Variables

4. Discussion

The results of this study provide empirical evidence supporting several key theoretical principles in learning. The findings of teachers' high need for training and learning tools (mean = 4.45) and students' preference for contextual learning materials (mean = 4.46) align with social constructivism theory (Vygotsky 1978), which emphasizes the importance of scaffolding in learning. These data reinforce the research of Hmelo-Silver et al. (2007), which shows that structured learning support is crucial in a project-based approach. Further analysis reveals that the need for creative learning media and technology (mean = 4.48) does not stand alone but must be integrated with an appropriate pedagogical approach.

This supports the TPACK framework (Mishra, P., & Koehler 2006) which emphasizes that technology integration in learning will only be effective if accompanied by a deep understanding of the material content and teaching strategies. This finding also criticizes the common assumption that technology alone is enough to transform learning, as expressed in the meta-analysis by (Tamim, S. R., and Grant 2011) Implications for Learning Practice

The findings of this study have several important implications for classroom learning practices. First, the need for contextual and ongoing teacher training must be a priority in the implementation of PjBL. Second, the development of teaching materials must consider the principles of universal design for learning (UDL) to meet the diverse needs of learners. Third, technology integration must be carried out wisely, taking into account infrastructure readiness and teachers' digital competencies.

Despite its important contribution, this study has several limitations. The limited scope of the study to a single educational institution makes it difficult to generalize the findings. Furthermore, this study did not directly examine the impact of meeting these needs on student learning outcomes. Therefore, further research is needed to explore: (1) the effectiveness of various teacher training models in the context of PjBL, (2) the impact of using specific learning media on students' speaking skills, and (3) the factors that mediate the relationship between meeting teachers' needs and student learning outcomes. Overall, this study not only confirms several established theoretical principles but also provides new insights into the complexities of PjBL implementation in the field (Nicolas and

Ramos 2022). These findings are worthy of consideration by educational policymakers, curriculum developers, and education practitioners in designing more effective and learner-centered learning programs (Syawaludin et al. 2022).

Overall, student responses indicated a high need for learning elements that support engaging, collaborative, and applicable learning experiences. Several items that showed high average responses, in addition to the need for simple language in textbooks, included the need for creative and innovative learning media, as well as learning tools such as lesson plans, guidebooks, and appropriate textbooks. This suggests that students see value in project-based learning, especially when supported by tools and media that can facilitate understanding and collaboration.

Project-based learning generally demands active participation, collaboration skills, and engagement in activities that reflect real-world situations. Therefore, students appear to have a high demand for learning models that utilize a variety of media and open-ended materials that present information in a practical and digestible manner. They may feel that creative media and relevant tools will better facilitate problem-solving skills, which are at the heart of project-based learning. *Project-Based Learning* (PjBL) is a constructivist pedagogical approach where students acquire knowledge and skills through an in-depth investigation process on authentic challenges or problems (Thomas 2000). In the context of this research, PjBL is implemented as the main framework for developing a speaking skills learning model in vocational high schools with three essential characteristics: (1) vocational work simulation-based projects (e.g., product presentations, business negotiations), (2) the use of the SITERBIDIK application as a digital scaffolding medium, and (3) real-life performance-based assessments. As stated, (Larmer, J., Mergendoller, J., & Boss 2015), effective PjBL must meet seven gold standard criteria, which in this research are adapted to: (a) meaningful challenges related to expertise competencies, (b) continuous inquiry-based investigations, (c) authenticity of the industrial context, (d) learner autonomy, (e) critical

reflection, (f) multidimensional feedback, and (g) published products.

From the results of this analysis, it appears that students have a significant need for easy-to-understand learning materials and learning media that support independent exploration. This need reflects their preference for an interactive, real-world, project-based learning approach. Conversely, the need for speaking without media assistance was lower, indicating students' preference for relying on media and aids in the learning process.

This also demonstrates that in implementing a project-based learning model, it is crucial to ensure the availability of tools and media that are easy to understand and accessible to students. Implementation of this model will be more effective if supported by open materials and media tailored to students' needs, enabling them to be more active and confident in the project-based learning process.

The results of this study reveal the urgency of a needs analysis in the implementation of project-based learning (PjBL) in higher education. The findings indicate a significant gap between theoretical expectations and the reality on the ground, where 72% of teachers require specialized training (mean=4.45) and 85% of students desire more contextualized materials (mean=4.46). This needs analysis is crucial for three main reasons. First, the results validate Vygotsky's constructivist theory on the importance of scaffolding in learning, by showing a strong correlation ($r=0.58-0.65$) between the need for media, teaching modules, and teacher training. Second, these data reveal practical issues that have hampered the effectiveness of PjBL, such as a lack of infrastructure readiness (only 65% of schools have adequate facilities) and teacher pedagogical competence (45% feel unprepared). Third, this analysis provides an empirical basis for the development of targeted programs, such as prioritizing TPACK-based teacher training and developing teaching materials in accordance with the principles of universal design for learning. In the context of implementing the Independent Curriculum, these findings serve as an important roadmap for optimally allocating limited resources

and ensuring that learning innovations truly impact student competency.

Our findings on teachers' need for PjBL training (mean=4.45) align with research (Krajcik, J. S., & Shin 2014) which found that 68% of STEM teachers experienced difficulties in implementing PjBL without adequate training. However, our study makes a novel contribution by uncovering the specific aspect most needed in such training, namely the integration of technology and pedagogy (TPACK), which has not been widely addressed in previous studies. The finding regarding learners' preference for contextual learning (mean=4.46) supports research (Han, S., Capraro, R., & Capraro 2015) on the effectiveness of PjBL in improving 21st-century skills. However, our analysis goes further by identifying mediating factors such as the need for creative mediation and structured scaffolding, which have received little attention in the literature. This aligns with the research gap identified by (Chen, C.-H., & Yang 2019) regarding the need for more in-depth study of scaffolding design in PjBL. The need for technology integration (mean=4.48) in our study enriches the academic discussion initiated by (Al-Busaidi, K. A., & Al-Shihi 2020) on educational technology adoption. Our unique finding of the gap between technology needs and infrastructure readiness (only 65% adequate) provides a new perspective on the challenges of PjBL implementation in developing countries, which has not been widely addressed in developed country-based studies. The correlation analysis between various need variables ($r=0.58-0.65$) provides an important methodological contribution by confirming the conceptual model proposed by (Larmer, J., Mergendoller, J., & Boss 2015) saying our findings not only validate the model but also add a new dimension on the interaction between teacher and learner needs, which can be a foundation for the development of a more holistic PjBL framework.

From an education policy perspective, the results of this study fill the literature gap identified by Bell (2010) regarding the need for research on the implementation of PjBL in various cultural contexts. Our findings on specific challenges in the context of the Independent Curriculum provide a valuable case study for the international literature

on education reform. This research design allows us not only to identify patterns of needs but also to understand their root causes in depth. Thus, this study is not only relevant to the local context but also makes a significant contribution to the international academic discussion on PjBL implementation, particularly in countries undergoing major education reforms such as Indonesia, particularly for vocational high school teachers and students.

5. Conclusion

This study reveals that the implementation of project-based learning (PjBL) requires meeting the specific needs of both teachers and students. Teachers require professional training focused on the integration of technology and pedagogy (mean=4.45) and the development of applicable teaching tools (mean=4.53), while students prioritize contextual learning materials (mean=4.46) and support from innovative media (mean=4.2). These findings not only strengthen theory but also fill a gap in the literature by showing a strong correlation ($r=0.58-0.65$) between media needs, teaching modules, and teacher training. The results provide important practical implications, especially in the context of the Independent Curriculum, as well as the provision of adequate supporting infrastructure. Academically, this study contributes to the international literature by presenting empirical evidence on the challenges of PjBL implementation in developing countries, while also offering an integrative conceptual model that can serve as a reference for further research. These findings emphasize that the development of textbooks, guides, models, and SITERBIDIK is not only a response to actual needs, but also a structured solution to: Improve the quality of PjBL learning through standardized materials. Facilitate teacher implementation with step-by-step guidance. Meet student preferences for interactive and contextual learning. Overcome infrastructure limitations with adaptive technology. Thus, these four components become the main pillars in aligning learning practices with curriculum demands, teacher needs, and student expectations in vocational schools.

firmly emphasize that the development of textbooks, guidebooks, model books, and SITERBIDIK applications is not only a response to actual needs in the field, but also presents a structured and comprehensive solution for the transformation of project-based learning in vocational schools.

References

- Al-Busaidi, K. A., & Al-Shihi, H. (2020). 2020. "Critical Factors for Adoption of Learning Management Systems in Oman." *Education and Information Technologies*, 25(2), 1329-1352., <https://doi.org/10.1007/s10639-019-10025-1>.
- Banack H, et al. 2007. "Faux Connaitre: Getting It and Not Getting It. The SFU Educational Review 1: 30–41." *Journals.Lib.Sfu.Ca*.
- Bell, S. (2010). 2010. "Project-Based Learning for the 21st Century: Skills for the Future. The Clearing House:" *A Journal of Educational Strategies, Issues and Ideas*, 83(2), 39-43., <https://doi.org/10.1080/00098650903505415>.
- Blumentfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., dan Palincsar, A. 2011. "Motivating Project-Based Learning: Sustaining the Doing, Supporting the Learning." *Educational Psychologist*, 26(3–4), 369–398.
- Chen, C.-H., & Yang, Y.-C. (2019). 2019.. ". Revisiting the Effects of Project-Based Learning on Students' Academic Achievement: A Meta-Analysis." *Interactive Learning Environments*, 27(4), 467-483., <https://doi.org/10.1080/10494820.2018.1486788>.
- Chen, Yuxin, Cindy E. Hmelo-Silver, Susanne P. Lajoie, Juan Zheng, Lingyun Huang, and Stephen Bodnar. 2021. "Using Teacher Dashboards to Access Group Collaboration in Problem-Based Learning." *Interdisciplinary Journal of Problem-Based Learning* 15 (2). <https://doi.org/10.14434/ijpbl.v15i2.28792>.
- Fenwick, T. (2015). 2015. "Sociomateriality in Professional Practice and Learning." **Professional and Practice-Based Learning*, 11*, 1-24., https://doi.org/10.1007/978-94-017-9135-1_1.
- Gardner, H. 1985. *Frames of Mind: The Theory of Multiple Intelligences*.
- Greenier, V. T. 2020. "The 10Cs of Project-Based Learning TESOL Curriculum." *Innovation Language Learning and Teaching*, 14(1), 27–36., <https://doi.org/10.1080/17501229.2018.1473405>.
- Han, S., Capraro, R., & Capraro, M. M. 2015. "How Science, Technology, Engineering, and Mathematics (STEM) Project-Based Learning (PBL) Affects High, Middle, and Low Achievers Differently: The Impact of Student Factors on Achievement." *International Journal of Science and Mathematics Education*, 13(5), 1089-1113., <https://doi.org/10.1007/s10763-014-9526-0>.
- Hannafin, M. J., and Hannafin, K. M.x. 2010. *Cognition and Student-Centered, Webbased Learning: Issues and Implications for Research and Theory Dalam Spector, M., Ifenthaler, D., & Kinshuk (Eds.), Learning and Instruction in The*.
- Hanney, R. (2018). 2018. "Doing, Being, becoming: A Historical Appraisal of the Modalities of Project Based Learning. Teaching in Higher Education, 23(6), 769–783." <https://doi.org/10.1080/13562517.2017.1421628>.
- Järvelä, S., Malmberg, J., & Koivuniemi, M. (2021). 2021. "Recognizing Socially Shared Regulation in Mobile Computer-Supported Collaborative Learning. "Computers in Human Behavior, 114, 106575. <https://doi.org/10.1016/j.chb.2020.106575>.
- Jollands, M., Jolly, L., dan Molyneaux, T. 2012. "Project-Based Learning as a Contributing Factor to Graduates' Work Readiness." *European Journal of Engineering Education*, 37(2), 143-154.
- Kolb, A. Y., & Kolb, D. A. (2017). 2017. "Experiential Learning Theory as a Guide for Experiential Educators in Higher Education." *Experiential Learning & Teaching in Higher Education*, 1(1), 7-44.
- Krajcik, J. S., & Shin, N. (2014). 2014. "Project-Based Learning. In R. K. Sawyer (Ed.), The Cambridge Handbook of the Learning Sciences (2nd Ed., Pp. 275-297)." *Cambridge University Press*., <https://doi.org/10.1017/CBO9781139519526.018>.

- Larmer, J., Mergendoller, J., & Boss, S. 2015. "Setting the Standard for Project Based Learning." ASCD.
- Mezirow, J. (2018). 2018. "Transformative Learning Theory." In K. Illeris (Ed.), *Contemporary Theories of Learning* (2nd Ed., Pp. 114-128). Routledge.
- Mishra, P., & Koehler, M. J. 2006. "Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge." *Teachers College Record*, 108(6), 1017-1054., <https://doi.org/10.1111/j.1467-9620.2006.00684.x>.
- Nicolas, Ana Maria Botella, and Pablo Ramos Ramos. 2022. "Teaching Dilemmas and Student Motivation in Project-Based Learning in Secondary Education." *Interdisciplinary Journal of Problem-Based Learning* 16 (1). <https://doi.org/10.14434/ijpbl.v16i1.33056>.
- Prohimi, et al. 2023. "Educational Innovation for Industry 4.0: An Exploration of Integrated Work-Based Learning's Contribution. *Revista de Gestão Social e Ambiental*., " <https://doi.org/10.24857/rgsa.v18n3-009>, <https://doi.org/10.24857/rgsa.v18n3-009>.
- Shapiro, L. (2019). 2019. "Embodied Cognition (2nd Ed.)." Routledge., <https://doi.org/10.4324/9781315180380>.
- Siemens, G. (2005). 2005. "Connectivism: A Learning Theory for the Digital Age." *International Journal of Instructional Technology and Distance Learning*, 2(1), 3-10.
- Spiro, R. J., Collins, B. P., & Ramchandran, A. R. (2018). 2018. "Modes of Openness and Flexibility in Cognitive Flexibility Hypertext Learning Environments. In *Flexible Learning in an Information Society* (Pp. 18-25)." *IG/ Global*., <https://doi.org/10.4018/978-1-59904-325-8.ch002>.
- Syawaludin, Ahmad, Zuhdan Kun Prasetyo, Cepi Safruddin Abdul Jabar, and Heri Retnawati. 2022. "The Effect of Project-Based Learning Model and Online Learning Settings on Analytical Skills of Discovery Learning, Interactive Demonstrations, and Inquiry Lessons." *Journal of Turkish Science Education* 19 (2): 608–21. <https://doi.org/10.36681/tused.2022.140>.
- Tamim, S. R., dan Grant, M. M. 2011. "Definitions and Uses: Case Study of Teachers Implementing Project-Based Learning." *Interdisciplinary Journal of ProblemBased Learning. Volume 7* (2): Indiana.
- Thomas, J. W. 2000. "A Review of Research on Project-Based Learning." *Autodesk Foundation*.
- Vygotsky, L. S. 1978. "Mind in Society: The Development of Higher Psychological Processes.," Harvard University Press.
- Zhen, Y., & Zhang, X. (2021). 2021. "The Effectiveness of the Flipped Classroom on Students' Learning Achievement and Learning Motivation: A Meta-Analysis." *Educational Technology & Society*, 23(1), 1-15.
- Zimmerman, B. J. (2013). 2013. "From Cognitive Modeling to Self-Regulation: A Social Cognitive Career Path." *Educational Psychologist*, 48(3), 135-147., <https://doi.org/10.1080/00461520.2013.794676>.