e-ISSN: 2715-4203, p-SSN: 2715-419X
DOI: https://doi.org/10.31933/dijdbm.v4i3
Received: 15 February 2023, Revised: 12 March 2023, Publish: 29 April 2023

Factors Influencing Critical Thinking: Problem Base Learning, Discovery Learning, and Project Base Learning

Bambang Bagus H[1, 2], Bambang Suprianto[3], Arie Wardhono[4], Cris Kuntadi[5]
[1)]Universitas Negeri Surabaya, Email: bambang.19014@mhs.unesa.ac.id
[2)]Politeknik Penerbangan Surabaya, Email: b.bagus@poltekbangsby.ac.id
[3)]Universitas Negeri Surabaya, Email: bambangsuprianto@unesa.ac.id
[4)]Universitas Negeri Surabaya, Email: ariewardhono@unesa.ac.id
[5)]Universitas Bhayangkara Jakarta Raya, Email: cris.kuntadi@dsn.ubharajaya.ac.id

*Corresponding author: Bambang Bagus H

Abstract: This paper aims to determine the improvement of critical thinking. The development of critical thinking skills can be done through the intervention of learning models. In a study or scientific publication, previous or pertinent research is crucial. The theory and phenomena of linkages or influences between variables are strengthened by prior research or pertinent research in this regard. This article examines learning paradigms such as problem-based learning, discovery learning, and project-based learning as well as other elements that affect critical thinking. Building a hypothesis of influence between variables for use in future studies is the goal of this article. The result of this literature review article is 1) problem base learning affects critical thinking; 2) discovery learning affects critical thinking; and 3) project base learning affects critical thinking.

Keywords: Critical Thinking Skill, Problem-Based Learning, Discovery Learning, and Project-Based Learning

INTRODUCTION

The goal of education in the twenty-first century is to improve students' cognitive abilities to be capable of resolving issues that surround them. Real-world intelligence is not simply knowledge; it also includes the ability to solve problems in a meaningful, pertinent, and contextual way (Dwyer et al., 2014). Contextual student learning can train critical thinking, master technology, cooperation, and collaboration is indispensable in solving problems. The goals to be achieved by students are very diverse, for example, thinking skills, social skills, psychomotor skills, and process skills. The objective is that education can equip pupils to master these talents so they can become successful adults in the 21st century, which requires a variety of skills that a person must master. The four pillars of life—learning to know, learning to do, learning to be, and learning to live together—remain relevant in the 21st century and require important abilities. Each of the four guiding principles identifies a

particular set of abilities that should be strengthened throughout learning activities, including critical thinking, problem-solving, metacognition, communication, cooperation, creativity, innovation, information literacy, and a host of other abilities(Dwyer et al., 2014). The objective is that education can equip pupils to master these talents so they can become successful adults in the 21st century, which requires a variety of skills that a person must master. The four pillars of life learning to know, learning to do, learning to be, and learning to live together remain relevant in the 21st century and require important abilities. Each of the four guiding principles identifies a particular set of abilities that should be strengthened throughout learning activities, including critical thinking, problem-solving, metacognition, communication, cooperation, creativity, innovation, information literacy, and a host of other abilities. Different 21st-century talents must be taught explicitly. In a nutshell, the core tenet of 21st-century learning is that it should be socially integrated, collaborative, student-centered, and contextual. For the children of the country to have a better future, teachers' roles in implementing 21st-century learning are crucial(Zubaidah, 2016).

The following seven (7) abilities are highlighted in Wagner's (Zubaidah, 2016) and Harvard University's Change Leadership Group's identification of the competencies and coping mechanisms needed for students to navigate life, the workplace, and citizenship in the twenty-first century. (1) the capacity for critical thought and problem-solving, (2) the capacity for teamwork and leadership, (3) the capacity for agility and adaptability, (4) the capacity for initiative and entrepreneurship, (5) the capacity for effective verbal and written communication, (6) the capacity for information access and analysis, and (7) the capacity for curiosity and imagination.

Researchers are interested in doing this research by bringing up the subject of critical thinking abilities because of the context of the aforementioned concerns. To support the hypothesis being investigated, to understand the link or influence between variables, and to develop hypotheses, pertinent publications are required. According to a review of the literature on the subject of education, this article explores how problem-based learning, discovery learning, and project-based learning affect critical thinking.

The issues that will be presented can be formed to create hypotheses for more research based on the background, including:

1. Does the problem of base learning affect critical thinking?
2. Does discovery learning affect critical thinking?
3. Does project base learning affect critical thinking?

LITERATURE REVIEW

Critical thinking Skill

To think according to Plato is to speak silently. "To think is to lay down the relationship between the parts of our knowledge". In the Big Indonesian Dictionary (KBBI) thinking means using reason to consider and decide something. The thought process is three steps, namely: the formation of understanding, the formation of opinions, and the drawing of conclusions. The ability to think critically is a very essential ability for life, work, and functioning effectively in all other aspects of life. Critical thinking ability is the ability to think that is initiated and processed by the left brain. Critical thinking is one of the higher-order thinking processes that can be used in the formation of student conceptual systems. According to Ennis, quoted by Alec, critical thinking is sensible and reflective thinking that focuses on deciding what to believe or do. In reasoning, critical thinking skills are needed or in other words, critical thinking skills are part of the reasoning(Dwyer et al., 2014)(Fisher, 2009; Sumadi, 2011)

Critical thinking is thinking well and pondering or studying the thought processes of others. saying that schools should teach children the right way of thinking. Then he defined

critical thinking, namely: "Active, persistent, and careful consideration of any belief or form of knowledge received is viewed from various angles of reasons that support and conclude it(Hendra, 2013).

According to "Critical thinking is skilled and active interpretation and evaluation of observations and communication, information and argument". Critical thinking is a skilled and active interpretation and evaluation of observation and communication, information, and argument. argues that critical thinking is the ability to make rational decisions about what should be believed, not to be believed. According to John Dewey, critical thinking is an active consideration continuously and carefully about a belief or form of knowledge that is taken for granted by including supportive reasons and rational conclusions. Critical thinking is one part of higher-order thinking skills or abilities. states that "critical thinking in terms of cognitive skills in interpretation, analysis, evaluation, inference, explanation, and self-regulation". Critical thinking is the term interpreting, analyzing, evaluating, inference, explaining, and self-regulation (McGregor, 2007) (Linh et al., 2019) (Zamroni & M. Mahfudz, 2009)(Facione, 2015; Sitohang, 2019)

Problem Base Learning

problem-based teaching is a learning approach where students work on authentic problems to compile their knowledge, develop higher levels of inquiry and skills, developing independence and self-confidence(Fadilla et al., 2021). Arends further stated that the essence of Problem-Based Learning is the authentic and meaningful extension of various problematic situations to students that can serve as a springboard for investigation and investigation. (Fadilla et al., 2021) said that the Problem-Based Learning model is a form of learning that emphasizes learning experiences so that students can reconstruct their knowledge through the presentation of real problems so that they can learn independently. The advantages of implementing PBM include training in thinking skills and problem-solving skills, imitating the role of adults in dealing with real situations, and practicing independent learning.

Problem-based learning according (Mulyanto et al., 2018) Problem-Based Learning (PBL) is a student-centered method that makes problems the starting point of the learning process. Correspondingly, (Fadilla et al., 2021)states that problem-based learning is a learning that allows students to conduct research, integrate theory and practice, and apply knowledge and skills to develop a solution to problem-solving. Meanwhile, Finkle and Torp (Osman & Kaur, 2014) state that Problem-Based Learning as a curriculum development and learning system that simultaneously develops both solving strategies and a knowledge base of disciplines and skills by placing students as active role holders to solve ill-structured problems. (Osman & Kaur, 2014) argues that in problem-based learning, real problems become a learning context for students, to learn what is already known, and what is not yet known so that this helps students develop higher-order thinking skills

The characteristic of problem-based learning is that the teacher is a facilitator, using explicit processes to facilitate learning, using real problems, learning in small groups, and new information obtained through self-study (Masek & Yamin, 2011) In line with that Hassan et al in (Maulidiya & Nurlaelah, 2019) state the characteristic of PBL is a matter of not testing skills but developing skills and the problem used is a problem close to the student.

In general, the problem-based learning process begins with learning in groups that make the problem the initial stimulus. Each group will identify information relevant to the problem. Then formulate a hypothesis. The process of making hypotheses is also controlled by the teacher, next the group decides what information is needed, conducts further investigations to collect data related to the problem, each group member shares information from the results of the investigation carried out and the last thing is that each group presents the results of the investigation that has been carried out (Osman & Kaur, 2014) With such a

learning process, students will be able to form knowledge in themselves it will also help improve students' critical thinking skills.

Discovery Learning

The cultivation of a concept will be more effective through discovery activities than with the teacher delivering the material orally. According to (Sukartiningsih & Jacky, 2019) discovery learning is an activity of finding truth through one's own experience, the discovery activity can aim to find a concept and solve problems. The application of the discovery learning model has a relationship with engagement in students. The implication of the discovery learning model for students according to (Sukartiningsih & Jacky, 2019) is that there is an increase in students' intellectual power so that they show new hope for success and students will learn to organize and deal with problems and try to find solutions to problems on their own. The thing that needs to be considered by teachers in the application of the discovery learning model is the existence of various advantages and disadvantages. So, it must be aligned with the characteristics of the student. There are several advantages and disadvantages of the discovery learning model described (Wahyudi et al., 2019).

The Discovery Learning model is a learning model that demands student activity in learning by finding and investigating the solution to a problem, so that the results obtained will last a long time in memory (Wahyudi et al., 2019).

The theory of discovery learning was first pioneered by Bruner, namely in the learning process of students investigating, controlling objects, asking questions, and direct analysis. The basis of hypothesis thinking is that students effectively recognize the idea if the idea is obtained through a learning process that begins with researching and discovering. Discovery learning is an educational model where a person seeks and finds knowledge by himself. In the teaching framework, educators deliver illustrative material that is not directly to the core however, students are allowed to search using critical thinking approach methods(Putri et al., 2020). discovery is part of an instructive practice that incorporates teaching techniques that advance dynamic learning, located in the process, guiding oneself, discovering oneself and dexterously

Project Base Learning

Project Based Learning is a learning method that uses projects as a learning medium and is considered in line with government regulations. Students are required to explore, assess, interpret, synthesize, and information to produce various forms of learning outcomes. Educators only act as facilitators.

A project-based learning approach focuses on the fundamental ideas and principles of a topic, involves students in meaningful problem-solving and other tasks give them the freedom to design their learning, and ends with the creation of useful and realistic student work products. The PjBL model emphasizes learning activities that are relatively lengthy, holistic, interdisciplinary, student-centered, and integrated with real-world practices and issues, in contrast to traditional learning models, which are typically characterized by short-duration, isolated classroom practices, and teacher-centered learning activities (Wang, 2022)

Project-based learning focuses on active learning where students extrapolate authentic questions or assignments, develop plans, reflect on evaluating solutions, and generate multiple representations of ideas. Blumenfeld places Project Based Learning learning as a comprehensive instructional approach that can motivate children to think about what they are doing, not just focus on getting it (Smith, 2015).

Project-based learning is a learning model that involves a project in the learning process. Projects undertaken by learners can be individual or group projects and are carried

out within a certain period collaboratively, producing a product, the results of which will then be displayed or presented (Smith, 2015).

Table 1. Relevant Research

No	Author	Previous Research Results	Similarities to this article	Differences with this article
1	(Amin et al., 2020)	Compared to conventional models, the PBL model has a greater impact on critical thinking ability and environmental attitude. Students' critical thinking abilities are encouraged to develop an environmental mindset through the use of problem-based learning models in environmental problem-solving activities.	Problem-based learning affects critical thinking skills	-
2	(Mulyanto et al., 2018)	(1) There are significant differences in math learning outcomes between students who use the Problem-Based Learning model and those who use the conventional model. (2) Mathematical learning outcomes differ significantly between students with high and low critical thinking skills.	Problem-based learning affects critical thinking skills	-
3	(Choi et al., 2014)	Despite positive trends, the learning outcomes of PBL were not significantly different from a traditional lecture in this small underpowered study. Larger studies are needed to investigate the effects of PBL on critical student abilities.	Testing the influence of problem-based learning on critical thinking skills	Problem-based learning does not have a significant effect on critical thinking skills
4	(Putri et al., 2020)	Discovery learning has been shown to improve students' mathematical critical thinking skills in the medium category, with an average N-gain of 0.53.	Discovery learning affects critical thinking skills	-
5	(Martaida et al., 2017)	Students who use the discovery learning model have better critical thinking abilities than students who use traditional learning. Students who use the discovery learning model have higher cognitive abilities than students who use traditional learning methods.	Discovery learning affects creative thinking skills	Discovery learning affects cognitive ability
6	(Wahyudi et al., 2019)	According to the results of a paired sampled test, there were significant improvements in the students' mean scores in the post-test compared to their pre-test. The significant gains indicated that discovery-based speaking assessments were effective in improving students' speaking ability, critical thinking, and creativity.	Discovery learning affects critical thinking skills	Discovery learning affects learning goals, speaking skills, and creativity
7	(Maknuunah et al., 2021)	Project-based learning methods combined with a design thinking approach provide students with a holistic and detailed learning method for achieving learning objectives. Then, because project-based learning methods work, it is expected to improve students' critical thinking skills.	Project-based learning affects critical thinking skills	-

8	(Alawi & Soh, 2019)	When used effectively by teachers in STEM education, the PjBL method can improve students' critical thinking skills. Finally, the PjBL method can effectively improve students' critical thinking skills, which is one of the most important aspects of STEM education.	Project-based learning affects critical thinking skills	-
9	(Issa & Khataibeh, 2021)	The findings show that 1) project-based learning and problem-based learning affect students' creativity and critical thinking; 2) project-based learning and problem-based learning have different effects on student creativity; and 3) (3) project-based learning and problem-based learning have no impact on students' critical thinking.	Project-based learning and problem-based learning affect critical thinking skills	Project-based learning and problem-based learning affect student creativity
10	(Korkmaz & Karakuş, 2009)	When compared to the traditional learning model, the blended learning model contributed more to students' critical dispositions and levels; and there was a positive correlation between student attitudes toward geography course and their critical thinking dispositions and levels.	-	The blended learning model affects critical thinking skills and student attitude
11	(Prayogi et al., 2018)	The study's findings demonstrated that the CIBL model is feasible due to its validity, practicability, and effectiveness. This means that the CIBL model was successful in promoting PTP's CT ability.	-	Critical Inquiry-Based Learning can affect critical thinking skill ability
12	(Dehghanzadeh & Jafaraghaee, 2018)	This study demonstrates how flipped classrooms improve nursing students' critical thinking abilities. Future research should look into the effects of flipped classrooms on other aspects of nursing education.	-	Flip Class Room can affect critical thinking ability

RESEARCH METHODS

This scientific study was written using qualitative methodologies and a literature review (library research). examines theories and connections or influences between variables found in books and journals from both online and print sources, including Mendeley, Scholar Google, and other internet sources.

A literature review should be used consistently with methodological presumptions in qualitative research. This means that it must be applied deductively to avoid influencing the researcher's questions. The exploratory nature of qualitative research is one of its primary justifications (Hasyim & Ali, 2022).

RESULT AND DISCUSSION

The discussion of this literature review article in the focus on learning models based on theoretical studies and pertinent prior research.:

1. The Influence of Problem Base Learning on Critical Thinking

Critical thinking is affected by problem-based learning, Students that participate more actively in class learning using the PBL paradigm have high critical thinking skills. The problems with their immediate environment can be resolved when the pupils address them in their groups. It is a result of the students' diligent efforts to find solutions. Through group discussions, the PBL paradigm helps students to learn how to solve problems. It is evident in the group's stages of research and investigation. When people attempt to solve problems collectively, they can practice and exchange ideas. (Amin et al., 2020) If the elements or indications of critical thinking are affected by the problem-based learning process (problem-oriented, organized-oriented, investigation guide as an individual or group, attainment development, and presentation) (formulate the problem, give the argumentation, perform deduction, perform evaluation and determine and implement), (Amin et al., 2020).

The impact of the PBL model on other factors, such as spatial reasoning capacity, learning outcomes, students' social sensitivity to the environment, motivation, etc., has to be investigated in more detail. The context of qualitative, quantitative, or development research can all be used to make recommendations for additional studies.

Recommendations for candidates, including lecturers and teachers, to adopt the PBL model, particularly in problem-solving, as this model can boost students' critical thinking abilities and environmental attitudes when solving environmental problems. The researcher also suggests collaborating with blended learning or e-learning when using the PBL model in the teaching and learning process because the investigation and attainments development stage takes a lot of time.

Problem-based learning affects critical thinking, this is in line with research conducted by : (Masek & Yamin, 2011),(Maulidiya & Nurlaelah, 2019) and (Fadilla et al., 2021).

2. The Effect of Discovery Learning on Critical Thinking

Discovery learning affects critical thinking, whereas syntax discovery learning (the stimulation stage, the problem stateman stage, the data collection stage, the data processing stage, the verification stage, and the generalization stage) affects the dimensions or indicators of critical thinking (formulate the problem, give the argumentation, perform deduction, perform evaluation and determine and implement (Amin et al., 2020).

To increase critical thinking, the learning process becomes more lively because two-way communication is established, and students' Active participation makes learning more meaningful and powerful. Giving longer time at the data processing stage so that students are free to express ideas during discussions, and giving longer time at the verification stage so that all groups can present the results of the discussion and present the results of the experiment. This positively impacts student learning outcomes, which increase as the learning process increases

the following suggestions are put forward: (1) teachers are expected to use media that are appropriate to learning materials so that learning objectives are achieved, and learning is more meaningful for students. (2) researchers who wish to carry out this research are advised to use pop-up book media with different learning model settings also For other researchers who will research critical thinking skills develop instruments that go through validity and reliability tests. In the future, innovation will be created from a collaboration between media and learning models (Fahmi et al., 2019).

discovery learning affects critical thinking, this is in line with research conducted by: (Fahmi et al., 2019),(Minan et al., 2021), and (Sukartiningsih & Jacky, 2019).

3. The effect of project-based learning on critical thinking

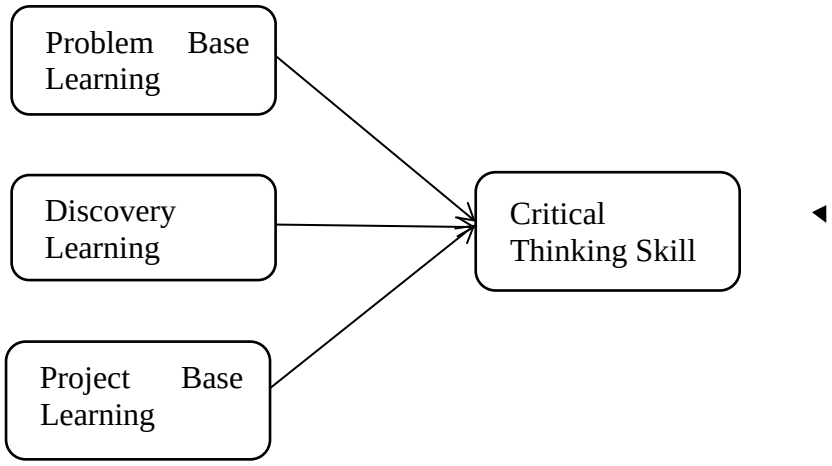
Project base learning affects critical thinking, whereas syntax problem base learning 1) introduction and team planning of the project; 2) the initial research phase in terms of gathering information; 3) creation, development, initial evaluation of presentation, and prototype artifacts; 4) second research phase; 5) Final Presentation Development; and 6) publication of product or artifacts (Dimmitt, 2017) affects the dimensions or indicators of critical thinking (formulate the problem, give the argumentation, perform deduction, perform evaluation and determine and implement), (Amin et al., 2020)). To improve critical thinking by paying attention to project base learning, educators must continue to strive to stimulate students to improve critical thinking skills with various relevant learning models (Yerimadesi et al., 2019). project-based learning should be sought to be developed in the form of outcome seminars and training activities that accommodate students to practice.

Base Learning projects affect critical thinking, if the problem of base learning is perceived well by students, this will be able to improve the quality of critical thinking, (Wang, 2022). Individuals who act creatively when presenting their ideas are intimately tied to active learning activities. Individual creativity can lead to actions like coming up with original ideas and attitudes that determine their learning strategies (fluency). Additionally, creative kids typically have intricate interests and are adaptable while solving problems (Munandar, 2016).

Project base learning affects critical thinking, this is in line with research conducted by: (Lestari & Ilhami, 2022),(Mutakinati et al., 2018), and (Dimmitt, 2017).

Conceptual Framework

In considering this article, keep the following in mind: the problem formulation, theoretical studies, pertinent prior research, and explanation of the influence between variables.



Picture 1. Conceptual Framework

Based on the *conceptual framework* image above, problem-based learning, discovery learning, and project-based learning affect critical thinking. Apart from these three variables that affect critical thinking, many other variables affect it including:

a) Blended learning model: (Korkmaz & Karakuş, 2009),(Jou et al., 2016), (Alotaibi, 2013), and (Hasanah & Nasir Malik, 2020).
b) Critical Inquiry-Based Learning: (Prayogi et al., 2018),(Prayogi et al., 2018), and (Wale & Bishaw, 2020).

c) Flip Class Room: (Dehghanzadeh & Jafaraghaee, 2018), (Kurnianto & Haryani, 2020) and (Nugraheni et al., 2022).
d) Digital storytelling: (Dewi et al., 2019),(Yang & Wu, 2012), and (Chen & Chuang, 2021).
e) Numbered Head Together: (Leasa et al., 2020), (Wanah et al., 2021), and (Rizky Ichwani & Novita, 2016).

CONCLUSION AND SUGGESTIONS

Conclusion

Based on theory, hypotheses for more research might be developed based on pertinent articles and debates:

1. Problem-based learning affects critical thinking.
2. Discovery learning affects critical thinking.
3. Project-based learning affects critical thinking.

Suggestion

Based on the aforementioned conclusions, it is suggested in this article that numerous other factors affect critical thinking in addition to the issues with base learning, discovery learning, and project-based learning. As a result, additional research is still required to identify these other factors. in addition to the variable ones examined in this article. Other factors include blended learning models, critical inquiry-based learning, flip classrooms, digital storytelling, and numbered head together.

REFERENCES

Alawi, N. H., & Soh, T. M. T. (2019). The Effect of Project-Based Learning (PjBL) on Critical Thinking Skills Form Four Students on Dynamic Ecosystem Topic "Vector! Oh! Vector!" *Creative Education*, *10*(12), 3107–3117. https://doi.org/10.4236/ce.2019.1012235

Alotaibi, K. N. R. (2013). The Effect of Blended Learning on Developing Critical Thinking Skills. *Education Journal*, *2*(4), 176. https://doi.org/10.11648/j.edu.20130204.21

Amin, S., Utaya, S., Bachri, S., Sumarmi, & Susilo, S. (2020). Effect of problem-based learning on critical thinking skills and environmental attitude. *Journal for the Education of Gifted Young Scientists*, *8*(2), 743–755. https://doi.org/10.17478/jegys.650344

Chen, H., & Chuang, Y. (2021). The effects of digital storytelling games on high school students' critical thinking skills. *Journal of Computer Assisted Learning*, *37*(1), 265–274. https://doi.org/10.1111/jcal.12487

Choi, E., Lindquist, R., & Song, Y. (2014). Effects of problem-based learning vs. traditional lecture on Korean nursing students' critical thinking, problem-solving, and self-directed learning. *Nurse Education Today*, *34*(1), 52–56. https://doi.org/10.1016/j.nedt.2013.02.012

Dehghanzadeh, S., & Jafaraghaee, F. (2018). Comparing the effects of traditional lecture and flipped classroom on nursing students' critical thinking disposition: A quasi-experimental study. *Nurse Education Today*, *71*, 151–156. https://doi.org/10.1016/j.nedt.2018.09.027

Dewi, N. R., Magfiroh, L., Nurkhalisa, S., & Dwijayanti, I. (2019). The development of contextual-based science digital storytelling teaching materials to improve students' critical thinking on classification themes. *Journal of Turkish Science Education*, *16*(3), 364–378. https://doi.org/10.12973/tused.10288a

Dimmitt, N. (2017). THE POWER OF PROJECT-BASED LEARNING: EXPERIENTIAL EDUCATION TO DEVELOP CRITICAL THINKING SKILLS FOR UNIVERSITY STUDENTS. *CBU International Conference Proceedings*, *5*, 575–579. https://doi.org/10.12955/cbup.v5.988

Dwyer, C. P., Hogan, M. J., & Stewart, I. (2014). An integrated critical thinking framework for the 21st century. *Thinking Skills and Creativity*, *12*, 43–52. https://doi.org/10.1016/j.tsc.2013.12.004

Facione, P. (2015). Critical Thinking: What It Is and Why It Counts. *Insight Assessment*. https://www.researchgate.net/publication/251303244

Fadilla, N., Nurlaela, L., Rijanto, T., Ariyanto, S. R., Rahmah, L., & Huda, S. (2021). Effect of problem-based learning on critical thinking skills. *Journal of Physics: Conference Series*, *1810*(1). https://doi.org/10.1088/1742-6596/1810/1/012060

Fahmi, Setiadi, I., & Elmawati, D. (2019). DISCOVERY LEARNING METHOD FOR TRAINING CRITICAL THINKING SKILLS OF STUDENTS. *European Journal of Education Studies*, *6*(3), 342–351. https://doi.org/10.5281/zenodo.3345924

Fisher, A. (2009). *Berpikir kritis sebuah pengantar*. (4th ed.). Erlangga.

Hasanah, H., & Nasir Malik, M. (2020). Blended learning in improving students' critical thinking and communication skills at University. *Cypriot Journal of Educational Sciences*, *15*(5), 1295–1306. https://doi.org/10.18844/CJES.V15I5.5168

Hasyim, U., & Ali, H. (2022). REUSE INTENTION MODELS THROUGH CUSTOMER SATISFACTION DURING THE COVID-19 PANDEMIC: CASHBACK PROMOTION AND E-SERVICE QUALITY CASE STUDY: OVO ELECTRONIC MONEY IN JAKARTA. *Dinasti International Journal of Digital Business Management*, *3*(3), 440–450. https://doi.org/10.31933/dijdbm.v3i3

Hendra, S. (2013). *Strategi jitu mencapai kesuksesan belajar*. Elex Media Komputinda.

Issa, H. B., & Khataibeh, A. (2021). The Effect of Using Project-Based Learning on Improving the Critical Thinking among Upper Basic Students from Teachers' Perspectives. *Pegem Journal of Education and Instruction*, *11*(2), 52–57. https://doi.org/10.14527/pegegog.2021.00

Jou, M., Lin, Y. T., & Wu, D. W. (2016). Effect of a blended learning environment on student critical thinking and knowledge transformation. *Interactive Learning Environments*, *24*(6), 1131–1147. https://doi.org/10.1080/10494820.2014.961485

Korkmaz, Ö., & Karakuş, U. (2009). THE IMPACT OF BLENDED LEARNING MODEL ON STUDENT ATTITUDES TOWARDS GEOGRAPHY COURSE AND THEIR CRITICAL THINKING DISPOSITIONS AND LEVELS. In *The Turkish Online Journal of Educational Technology-TOJET* (Vol. 8, Issue 4).

Kurnianto, B., & Haryani, S. (2020). Critical Thinking Skills and Learning Outcomes by Improving Motivation in the Model of Flipped Classroom Article Info. *Journal of Primary Education*, *9*(3), 282–291. https://doi.org/10.15294/jpe.v9i3.27783

Leasa, M., Corebima, A. D., & Batlolona, J. R. (2020). The effect of learning styles on the critical thinking skills in natural science learning of elementary school students. *Elementary Education Online*, *19*(4), 2086–2097. https://doi.org/10.17051/ilkonline.2020.763449

Lestari, I., & Ilhami, A. (2022). PENERAPAN MODEL PROJECT BASED LEARNING UNTUK MENINGKATKAN KETERAMPILAN BERPIKIR KREATIF SISWA SMP: SYSTEMATIC REVIEW. *LENSA (Lentera Sains): Jurnal Pendidikan IPA*, *12*(2), 135–144. https://doi.org/10.24929/lensa.v12i2.238

Linh, N. Q., Duc, N. M., & Yuenyong, C. (2019). Developing critical thinking of students through STEM educational orientation program in Vietnam. *Journal of Physics:*

Conference Series, *1340*(1), 012025. https://doi.org/10.1088/1742-6596/1340/1/012025

Maknuunah, luil, Kuswandi, D., & Soepriyanto, Y. (2021). Project-Based Learning Integrated with Design Thinking Approach to Improve Students' Critical Thinking Skills. *International Conference on Information Technology and Education*, 150–155.

Martaida, T., Bukit, N., Eva, ;, & Ginting, M. (2017). The Effect of Discovery Learning Model on Student's Critical Thinking and Cognitive Ability in Junior High School. *IOSR Journal of Research & Method in Education*, *7*(6), 1–08. https://doi.org/10.9790/7388-0706010108

Masek, A., & Yamin, S. (2011). The Effect of Problem-Based Learning on Critical Thinking Ability: A Theoretical and Empirical Review. *International Review of Social Sciences and Humanities*, *2*(1), 215–221. www.irssh.com

Maulidiya, M., & Nurlaelah, E. (2019). The effect of problem-based learning on critical thinking ability in mathematics education. *Journal of Physics: Conference Series*, *1157*(4). https://doi.org/10.1088/1742-6596/1157/4/042063

McGregor, Debra. (2007). *Developing thinking ; developing learning : a guide to thinking skills in education*. McGraw-Hill.

Minan, M., Saputro*, S., Budi, S., & Suranto, S. (2021). Student's Critical Thinking Skills Through Discovery Learning Model Using E-Learning on Environmental Change Subject Matter. *European Journal of Educational Research*, *10*(3), 1123–1135. https://doi.org/10.12973/eu-jer.10.3.1123

Mulyanto, H., Gunarhadi, & Indriayu, M. (2018). The Effect of Problem-Based Learning Model on Student Mathematics Learning Outcomes Viewed from Critical Thinking Skills. *International Journal of Educational Research Review*, 37–45. www.ijere.com

Munandar, U. (2016). *Pengembangan Kreatifitas Anak Berbakat*. Rineka cipta.

Mutakinati, L., Anwari, I., & Yoshisuke, K. (2018). Analysis of students' critical thinking skills in middle school through stem education project-based learning. *Jurnal Pendidikan IPA Indonesia*, *7*(1), 54–65. https://doi.org/10.15294/jpii.v7i1.10495

Nugraheni, B. I., Surjono, H. D., & Aji, G. P. (2022). How can flipped classrooms develop critical thinking skills? A literature review. *International Journal of Information and Education Technology*, *12*(1), 82–90. https://doi.org/10.18178/ijiet.2022.12.1.1590

Osman, K., & Kaur, S. J. (2014). Evaluating biology achievement scores in an ICT-integrated PBL environment. *Eurasia Journal of Mathematics, Science and Technology Education*, *10*(3), 185–194. https://doi.org/10.12973/eurasia.2014.1076a

Prayogi, S., Yuanita, L., & Wasis, L. (2018). Critical inquiry-based learning: A model of learning to promote critical thinking among prospective teachers of physic. *Journal of Turkish Science Education*, *15*(1), 43–56. https://doi.org/10.12973/tused.10220a

Putri, A., Roza, Y., & Maimunah, M. (2020). Development of Learning Tools with the Discovery Learning Model to Improve the Critical Thinking Ability of Mathematics. *Journal of Educational Sciences*, *4*(1), 83. https://doi.org/10.31258/jes.4.1.p.83-92

Rizky Ichwani, A., & Novita, D. (2016). IMPLEMENTATION OF NUMBERED HEADS TOGETHER (NHT) COOPERATIVE LEARNING MODEL IN CHEMICAL BONDING TOPIC TO REHEARSE THE STUDENT'S CRITICAL THINKING SKILLS IN GRADE X SMAN 1 DRIYOREJO. *UNESA Journal of Chemical Education*, *5*(2), 232–238.

Sitohang, K. (2019). *Berpikir Kritis: Kecakapan Hidup di Era Digital*. PT. Kanisius.

Smith, S. (2015). (Re)counting meaningful learning experiences: Using student-created reflective videos to make invisible learning visible during PjBL experiences. *Interdisciplinary Journal of Problem-Based Learning*, *10*(1). https://doi.org/10.7771/1541-5015.1541

Sukartiningsih, S., & Jacky, M. (2019). What is Discovery Learning Can Grow Critical Thinking Skills? *The Indonesian Journal of Social Studies*, *2*(2), 87–94. https://journal.unesa.ac.id/index.php/jpips/index

Sumadi, S. (2011). *Psikologi kepribadian*.

Wahyudi, R., Rukmini, D., Anggani, D., & Bharati, L. (2019). Developing Discovery Learning-Based Assessment Module to Stimulate Critical Thinking and Creativity in Students' Speaking Performance. *English Education Journal*, *9*(2), 172–180. http://journal.unnes.ac.id/sju/index.php/eej

Wale, B. D., & Bishaw, K. S. (2020). Effects of using inquiry-based learning on EFL students' critical thinking skills. *Asian-Pacific Journal of Second and Foreign Language Education*, *5*(1). https://doi.org/10.1186/s40862-020-00090-2

Wanah, H. N., Zubaidah, S., Susanto, H., & Astriani, M. (2021). Using Remap-NHT to enhance students' critical thinking skills in biology. *AIP Conference Proceedings*, *2330*. https://doi.org/10.1063/5.0043289

Wang, S. (2022). Critical Thinking Development Through Project-Based Learning. *Journal of Language Teaching and Research*, *13*(5), 1007–1013. https://doi.org/10.17507/jltr.1305.13

Yang, Y. T. C., & Wu, W. C. I. (2012). Digital storytelling for enhancing student academic achievement, and critical thinking.; Learning motivation: A year-long experimental study. *Computers and Education*, *59*(2), 339–352. https://doi.org/10.1016/j.compedu.2011.12.012

Yerimadesi, Y., Bayharti, B., Azizah, A., Lufri, L., Andromeda, A., & Guspatni, G. (2019). Effectiveness of acid-base modules based on guided discovery learning for increasing critical thinking skills and learning outcomes of a senior high school student. *Journal of Physics: Conference Series*, *1185*(1). https://doi.org/10.1088/1742-6596/1185/1/012151

Zamroni, Z., & M. Mahfudz. (2009). *Panduan teknis pembelajaran yang mengembangkan critical thinking*. Depdiknas.

Zubaidah, S. (2016). KETERAMPILANABAD KE-21: KETERAMPILAN YANG DIAJARKAN MELALUI PEMBELAJARAN. *Program Studi Pendidikan Biologi STKIP Persada Khatulistiwa Sintang Kalimantan Barat*, 1–17. https://www.researchgate.net/publication/318013627