



## RESEARCH ARTICLE

**Digital Project Based Blended Learning Model (DPBBL) and Learning Motivation towards Problem Solving Student**Dydik Kurniawan<sup>1\*</sup>, Siti Masitoh<sup>2</sup>, Bachtiar Sjaiful Bachri<sup>3</sup>, Warman<sup>4</sup>, Usfandi Haryaka<sup>5</sup>, Tri wahyuningsih<sup>6</sup><sup>1,2,3</sup> State University of Surabaya, Surabaya, Indonesia<sup>4,5,6</sup> Mulawarman University, Samarinda, Indonesia**ARTICLE INFO****ABSTRACT**

Received: Oct 27, 2024

Accepted: Dec 18, 2024

**Keywords**

Digital Model  
 Project Based Blended  
 Learning (DPBBL)  
 Conventional Methods  
 Problem Solving Learning  
 Motivation

The purpose of this research is to determine the results of testing the Digital Project Based Blended Learning (DPBBL) model versus conventional methods and learning motivation for student problem solving. This experimental research was carried out using a 2x2 factorial design. The subjects in this research were undergraduate students in the Guidance and Counseling Studies Program, which consisted of four classes with 133 students. The subjects that were the focus of the experiment were taken classically randomly, namely four ABCD classes. This research hypothesis was tested using multiple linear regression statistical tests. The calculation results show that: Based on the research the following results can be drawn. (1) There is a difference in problem solving between learning with the Digital Project Based Blended Learning (DPBBL) Model and conventional methods, with the average class score showing that students who received learning treatment with the Digital Project Based Blended Learning (DPBBL) Model obtained higher problem solving compared to conventional methods. (2) There is a significant (significant) difference in the average score of students' problem-solving learning outcomes between those who have high learning motivation and low learning motivation. It was found that the problem-solving application of the science learning process for students with higher learning motivation was higher than for students with low learning motivation. (3) there is an interaction between the Digital Project Based Blended Learning (DPBBL) Model and students' learning motivation towards problem solving. It is possible that there are several internal factors that influence students' problem-solving learning outcomes. Based on the results of this research, it was concluded that using the Digital Project Based Blended Learning (DPBBL) Model, conventional methods, and Learning Motivation can improve the problem-solving learning outcomes of Guidance and Counseling students.

**\*Corresponding Author:**

dydik.22010@mhs.unesa.ac.id

**INTRODUCTION**

In the Guidance and Counseling Media Development course, students often face challenges that hinder the development of their problem solving. One of the main issues is the prevalence of passive learning approaches, where conventional methods dominate teaching styles. This passive learning prevents students from actively asking, analyzing and critically engaging with lecture material, which is important for honing their problem-solving skills (Herawati et al., 2023; Putra Manuaba et al., 2020; Ye et al., 2020).

To address these issues, a shift toward active learning strategies, real-world case studies, and structured collaborative projects is critical to equip students with the problem solving necessary for a successful career in media mentoring and development. Problem solving can be defined as a self-oriented cognitive-behavioral process used to identify or find effective solutions to specific problems in everyday life (Kua et al., 2022; Widiana et al., 2023; Zahroh et al., 2022). Problem solving refers to

the process of finding solutions to challenges or obstacles that arise in various contexts (Gestira et al., 2021; Purwaningsih et al., 2020; Rozandy & Koten, 2021). Problem solving often requires critical thinking, creativity, and the ability to evaluate different options (Anggraini et al., 2022; Nasyrullah et al., 2023; Shodikin et al., 2022). Problem solving often requires critical thinking, creativity, and the ability to evaluate different options. This is a valuable skill in many areas of life, including academics, work, and relationships (S. Liu & Liu, 2020; Nur & Atmaca, 2020).

Based on the opinions above, it can be concluded that problem solving is a cognitive-behavioral process used to identify and find effective solutions to specific challenges in various contexts. This skill requires critical thinking, creativity, and the ability to evaluate different alternatives. Problem solving is valuable in both professional and personal life because it allows individuals to overcome obstacles and make the right decisions.

Project assignments are one way to improve the learning experience of students or learners. With project assignments, students will try to find references as best they can and as best as possible. A good assignment is one that makes students or students active from a cognitive, affective and psychomotor perspective. It is hoped that the activation of these three aspects will lead to more meaningful learning outcomes. Project-based learning is an educational approach that focuses on creative thinking, problem solving, and interaction between students and peers to create and use new knowledge (Budiarti et al., 2023; Isro et al., 2021; Purwaningsih et al., 2020).

The 21st century is an era of very rapid development of technology and information. Today's students or learners are humans who were born and raised by sophisticated technology. This condition of students can be called Native Digital Students. Teaching or education on campus should aim at teaching that is oriented towards current developments and digital technology so that the graduates achieved are in line with the demands of the times and can compete with other graduates in more developed countries. According to (G. Liu et al., 2023; Reichert-Schlax et al., 2023; Vanbecelaere et al., 2020), the use of digital technology in learning provides learning conditions with opportunities to create a rich learning environment for students, rich in information and learning resources, and can be inserted with various multimedia-based learning elements. The results of this project assignment vary depending on the student's creativity, one example is slow motion video. Assignments in the form of digital-based projects are deemed appropriate to overcome the above problems, gaps or expectations. Blended learning is an approach that combines traditional face-to-face instruction with online learning activities (Anggraini et al., 2022; Risdianto et al., 2023; Suana, Wati, et al., 2023).

In a blended learning environment, students engage in a mix of direct interactions with lecturers and peers, as well as virtual activities via digital platforms (Hevi et al., 2023; Lin et al., 2017; Soyooof et al., 2023). The aim of blended learning is to utilize the benefits of traditional and online methods, offering a more flexible and personalized learning experience (Anggraini et al., 2022; Gestira et al., 2021; Suana, Wati, et al., 2023). So far, the lecture process has been carried out offline and conventionally, but in 2020, when the Covid -19 pandemic occurred, the DPBL model requires learning using a blended learning approach because it can create a dynamic and student-centered environment that encourages involvement, collaboration, critical thinking, and application of knowledge in the real world (Mursid et al., 2022; Risdianto et al., 2023; Suana, Andra, et al., 2023). It aligns with the needs of 21st century students and helps prepare them for success in an ever-evolving world.

Media created is an alternative in the learning process/providing guidance and counseling services because students will not only get material from one source, but material from various sources selected through the student needs analysis stage. (Huang et al., 2023). The position of the media is of course very important, because the media functions as an intermediary, it will be able to cover the shortcomings of the teacher's delivery in learning (Golinelli et al., 2020). Therefore, educators are expected to be able to select media appropriately, develop digital media, and apply digital media in the process of both learning/providing guidance and counseling services. In the Guidance and Counseling service process there are interaction activities between educators and students in an educational environment, as well as reciprocal communication that takes place in educational situations can make it easier to achieve learning goals. Therefore, educators are required to be educators who can bridge interests and facilitate needs. This education is through real efforts that can be applied in educating students (Cellini et al., 2020). One of the real efforts implemented by

educators in the process of providing guidance and counseling services is to utilize media in the process of providing guidance and counseling services. The use of media in Guidance and Counseling Services can provide a stimulus to increase students' interest in learning (Mansur & Rafiudin, 2020).

From the explanation of the solution provided, it can be concluded that through the use of the Digital Project Based Blended Learning (DPBBL) model, this can be a solution to help overcome the problem of the lack of competence of Guidance and Counseling students in creating digital-based Guidance and Counseling media through critical thinking, collaboration and problem solving. Based on the explanation of the discussion above, the researcher plans to carry out research entitled developing the Digital Project Based Blended Learning (DPBBL) model to improve students' critical thinking, collaboration and problem solving in Guidance and Counseling media development courses.

## **RESEARCH METHODS**

The basis for the research development model entitled "Development of a Digital Project Based Blended Learning (DPBBL) Model to Improve Student Critical Thinking, Collaborative, and Problem Solving in Guidance and Counseling Media Development Courses" is based on the Dick and Carey Model (2015). Digital Project Based Learning Model: Project Based Learning (PjBL) is a learning approach where students are actively involved in real-world projects and challenges. DPBL indicates that this approach is implemented using digital tools and resources. Students work on projects that require them to investigate, research, collaborate, and ultimately create a product or solution. This method can improve Critical Thinking, Collaborative, and Problem-Solving abilities.

### **1. Research subject**

Digital Project Based Blended Learning (DPBBL) learning model that was developed. The subjects of the research trials were undergraduate students from the UNMUL Guidance and Counseling Study Program who were taking the Guidance and Counseling Media Development course with a total of around 83 students who were divided into two parallel classes, namely class A and class B which were heterogeneous, so that they were in accordance with the implementation of the learning model, which will be developed in the Study Program.

### **2. Data type**

In the research entitled " Digital Project Based Blended Learning Model (DPBBL) and learning motivation towards Problem Solving", expert opinion shows that several types of research data can be used to support the development and evaluation of Digital Project Based Blended Learning (DPBBL). The following types of research data may be relevant: (a) Quantitative Data: Quantitative data refers to numerical data that can be analyzed statistically. In the context of the Digital Project Based Blended Learning model (DPBBL), quantitative data can be collected through various instruments such as surveys, questionnaires, or pre and post tests. Quantitative data as a data source for determining prototype needs. Learning model designs are taken from students, teacher observations, expert trial results, small group and large group trials, and (b) Qualitative Data: Qualitative data provides detailed and non-numerical information about experiences, perceptions, and behavior of participants. In research on the Digital Project Based Blended Learning model (DPBBL), qualitative data can be collected through methods from the results of field observation analysis in the form of RPS, lecture modules, exam questions and student assignment documentation, etc.

### **3. Data collection instruments**

Based on the steps of the Digital Project Based Blended Learning (DPBBL) model, an instrument was designed that will test the feasibility, practicality and effectiveness of the Digital Project Based Blended Learning (DPBBL) model. The research instrument created was an instrument consisting of a data collection instrument and an instrument for student learning outcomes on problem solving skills. The data collection instrument consists of (1) validation sheet, (2) observation sheet to see student implementation and activities, (3) student response questionnaire to learning components. For an instrument for evaluating problem solving skills. To provide guidance on the things that will be used in the instrument format, first determine the components, aspects and indicators in the instrument.

#### 4. Data collection techniques

To obtain data that supports research and development, researchers used several data collection methods/techniques, namely through (1) validation, (2) interviews, (3) document analysis, (4) questionnaires, (5) observation, and (6) documentation

#### 5. Data analysis techniques

Data analysis with quantitative correlation uses multiple linear regression analysis techniques, so several prerequisite tests must be carried out, namely the Normality test, homogeneity test, while to test the hypothesis using SPSS series 25 for Windows software. Before carrying out the multiple linear regression test, prerequisite tests are first carried out, namely the Normality test and homogeneity test as conditions for research to be carried out.

### RESEARCH RESULT

To prove the research hypothesis, two-way analysis of variance was used with the help of SPSS Version 25.0 for Windows software. Statistical analysis can be seen in the following table:

**Table 1: Descriptive test results**

| Descriptive Statistics              |                     |         |                |     |
|-------------------------------------|---------------------|---------|----------------|-----|
| Dependent Variable: PROBLEM SOLVING |                     |         |                |     |
| METHOD                              | Learning Motivation | Mean    | Std. Deviation | N   |
| DPBBL                               | HIGH                | 76.4035 | 4.30473        | 57  |
|                                     | LOW                 | 80.0000 | .00000         | 9   |
|                                     | Total               | 76.8939 | 4.18469        | 66  |
| Conventional Method                 | HIGH                | 61.2203 | 2.08499        | 59  |
|                                     | LOW                 | 51.8750 | 2.64237        | 8   |
|                                     | Total               | 60.1045 | 3.72597        | 67  |
| Total                               | HIGH                | 68.6810 | 8.32659        | 116 |
|                                     | LOW                 | 66.7647 | 14.57536       | 17  |
|                                     | Total               | 68.4361 | 9.30408        | 133 |

Statistical data from SPSS 25 calculation results between learning methods, learning motivation, and problem solving with a total of 120 students obtained the following results: (1) problem solving on the Digital Project Based Blended Learning (DPBBL) Model obtained an average (mean) of 76.8939 and a standard deviation of 4.18469. Meanwhile, the conventional method obtained an average (mean) of 60.1045 and a standard deviation of 3.72597, (2) High learning motivation in the Digital Project Based Blended Learning (DPBBL) Model obtained N: 57 and low learning motivation obtained N : 9. Meanwhile, high learning motivation in conventional methods was obtained by N.59 and low learning motivation was obtained by N: 8, and (3) Total results of learning problem solving in Guidance and Counseling subjects which had high learning motivation were obtained by N: 116 and low learning motivation was obtained by N. :17.

**Table 2: Data analysis results**

| Tests of Between-Subjects Effects   |                         |     |             |           |      |
|-------------------------------------|-------------------------|-----|-------------|-----------|------|
| Dependent Variable: PROBLEM SOLVING |                         |     |             |           |      |
| Source                              | Type III Sum of Squares | df  | Mean Square | F         | Sig. |
| Corrected Model                     | 10087.977 <sup>a</sup>  | 3   | 3362.659    | 324.026   | .000 |
| Intercept                           | 268398.087              | 1   | 268398.087  | 25862.837 | .000 |
| METHOD                              | 6931.149                | 1   | 6931.149    | 667.885   | .000 |
| Learning_Motivation                 | 122.131                 | 1   | 122.131     | 11.769    | .001 |
| METHOD * Learning_Motivation        | 618.952                 | 1   | 618.952     | 59.642    | .000 |
| Error                               | 1338.730                | 129 | 10.378      |           |      |
| Total                               | 634332.000              | 133 |             |           |      |
| Corrected Total                     | 11426.707               | 132 |             |           |      |

a. R Squared = .883 (Adjusted R Squared = .880)

(Source: SPSS Output)

### Hypothesis testing 1

Based on the results of data analysis using two-way ANOVA, a p value of 0.000 ( $p$  value  $< 0.05$ ) was obtained, which means that  $H_0$  was rejected and  $H_1$  was accepted, meaning that there was a significant difference in problem solving between groups of students who learned to apply the Digital Project Based Blended Learning Model (DPBBL) with groups of students who apply conventional methods. Thus, it can be said that the application of the Digital Project Based Blended Learning (DPBBL) Model has a better influence than conventional methods on problem solving.

### Hypothesis testing 2

Based on the results of data analysis, a p value of 0.001 ( $p$  value  $< 0.05$ ) was obtained so that  $H_0$  was rejected and  $H_1$  was accepted, which means there is a significant difference in problem solving between the group of students with high learning motivation and the group of students with low learning motivation. Therefore, it can be said that high learning motivation has a better influence than low learning motivation on problem solving.

### Hypothesis testing 3

From the results of the two-way ANOVA, the p value = 0.000 ( $p$  value  $< 0.05$ ) so that  $H_0$  is rejected and  $H_1$  is accepted, which means there is a significant interaction between the application of the Digital Project Based Blended Learning (DPBBL) Model. and conventional methods and learning motivation with problem solving.

A significant result is that there is an interaction between the application of the Digital Project Based Blended Learning (DPBBL) Model and conventional methods and learning motivation for problem solving are also strengthened by Figure 1, as follows:

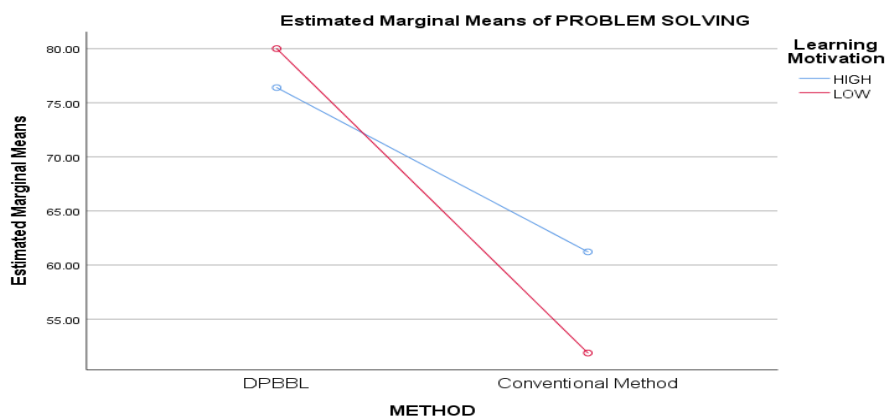


Figure 1: Interaction results

Figure 1 shows that there is a converging line or intersection of problem-solving data between low and high learning motivation in the control group (conventional method) and the Digital Project Based Blended Learning (DPBBL) model experiment.

## DISCUSSION

Based on the research report, data presentation, and data analysis regarding the influence of the Digital Project Based Blended Learning (DPBBL) Model with conventional methods and Learning Motivation on problem solving in class (DPBBL) and the conventional method depart from the same initial conditions, namely after carrying out a Normality test and a homogeneity test showing that the two samples are normally distributed and there is no difference in variance. Furthermore, the research can be analyzed and interpreted as follows.

#### a. Problem solving between groups of students applying the digital project based blended learning (DPBBL) Model and conventional methods.

From the research results, it was found that the average problem-solving score for students who were treated with the Digital Project Based Blended Learning (DPBBL) model was 76.8939, while students who were treated with conventional methods had an average score of 60.1045. Apart from that, based on hypothesis testing, there is a significant difference in

problem solving between the group of students who apply the Digital Project Based Blended Learning (DPBBL) model and the group of students who apply conventional methods with a p value of 0.000 (p value < 0.05). Thus, it can be said that the application of the Digital Project Based Blended Learning (DPBBL) model has a better influence than conventional methods on student problem solving.

From the research results above, it can be concluded that learning with the Digital Project Based Blended Learning (DPBBL) model is better than conventional learning methods (I Made Teguh et al., 2023; Pantiwati et al., 2023; Telaumbanua, 2022). Because in learning students are required to be more active and creative. In learning, students are required to try to seek knowledge and solve problems from various existing sources. According to Bruner's theory, the search for knowledge by humans will provide the best results and produce meaningful knowledge (Fahlevi & Jabnabillah, 2023; Nihilouw et al., 2022; Rees et al., 2023). Meanwhile, conventional methods tend to be boring because in the learning process students only listen to explanations from the teacher (lectures) and continue working on questions given by the teacher (Hardiyanto et al., 2018; Oktaviani et al., 2018; Siswondo & Agustina, 2021).

**b. There is a significant difference in problem solving between groups of students with high motivation and groups of students with low motivation**

Judging from learning motivation, based on the results of hypothesis testing, it was found that there was a significant difference in problem solving between groups of students with high learning motivation and groups of students with low learning motivation. This is indicated by a p value of 0.001 (p value < 0.05). Therefore, students who have high learning motivation have better learning achievements than students who have low learning motivation.

As for distributing the learning motivation questionnaire, there are question items that have the highest scores. There are also several extreme question items (which have the lowest total questionnaire scores), namely question items number 13 and number 14 on the indicator of quickly getting bored with routine tasks. Based on this, some students' learning motivation is said to be good enough and must be maintained, for example in terms of being diligent in facing assignments, being tenacious in facing learning difficulties, showing interest in various problems, being able to defend his opinions and not easily giving up what he believes in (Djamaan et al. al., 2021; Khoerunisa & Amirudin, 2020; Mardani et al., 2021).

However, there are several student learning motivations that need to be improved so that students have better learning motivation, such as students should be happier doing their assignments independently, students should be happier doing routine tasks, students should study material more often repeatedly. -repeat, and enjoy doing creative activities that can support their learning activities (Febriandar, 2018; Fitriati et al., 2021; Wulansari & Manoy, 2021).

**c. There is significant interaction between groups of students who apply the Digital Project Based Blended Learning (DPBBL) Model with conventional methods and student motivation towards problem solving.**

The results of the third hypothesis test are that there is a significant interaction between the application of the Digital Project Based Blended Learning (DPBBL) model and learning motivation and problem solving. This is shown by the p value 0.000 (p value < 0.05). This shows that there is a learning interaction and learning motivation towards problem solving.

Research on the Digital Project Based Blended Learning (DPBBL) learning model carried out by researchers in problem solving learning in Guidance and Counseling subjects revealed that there was an influence of the Digital Project Based Blended Learning (DPBBL) Model on students' learning motivation in Guidance and Counseling subjects in accordance with problems expressed in the background. From this problem, teachers must have the ability to manage learning, one of which is by using the Digital Project Based Blended Learning (DPBBL) Model.

The results of the researcher's observations in the learning process using the Digital Project Based Blended Learning (DPBBL) model went well and as expected. In this research, by using the Digital Project Based Blended Learning (DPBBL) model, it can be seen that in the classroom students increase their attention in learning.

Learning using the Digital Project Based Blended Learning (DPBBL) model makes students more active in finding solutions to problems given by the teacher (Asundi et al., 2022; Fahlevi, 2022; Fitriana & Ikawati, 2023). Students also learn about the use of Guidance and Counseling subjects in everyday life and learn about the uses of Guidance and Counseling subjects for the future. This makes students happy and motivated in learning (Agustina et al., 2022; Daud Mahande et al., 2022; Mielikäinen et al., 2023). This makes it easier for students to understand the material because they work on the questions in their own way plus the questions given are related to students' daily lives. Students who previously thought that Guidance and Counseling subjects were subjects that were difficult to understand and did not exist in everyday life, now when students learn using the Digital Project Based Blended Learning (DPBBL) Model, students more easily understand the material and know the use of Guidance subjects. and Counseling in everyday life (Ulya et al., 2022; Adriadi et al., 2022; Thongkoo et al., 2023). The existence of the Digital Project Based Blended Learning (DPBBL) model motivates students to be more active in learning (Edmawita, 2023; Purwanti et al., 2022; VARBarao et al., 2022). As stated by (Ariani et al., 2023; Hudayana et al., 2022; Knoblauch, 2022) that motivation is defined as the driving force within a person to carry out certain activities in order to achieve certain goals. So overall or generally it can be concluded that the application of the Digital Project Based Blended Learning (DPBBL) model is learning that can stimulate students' problem solving. Apart from that, another supporting factor that encourages the achievement of maximum learning outcomes is the learning motivation factor because with the application of any learning, if learning motivation is not followed, then the achievement of student learning outcomes will be less than optimal (Nasrah, 2020; Sahroni et al., 2021).

## CONCLUSION

Based on the research, the following conclusions can be drawn. (1) There is a difference in problem solving between learning using the Digital Project Based Blended Learning (DPBBL) Model and conventional methods, with the average class score showing that students who received learning treatment using the Digital Project Based Blended Learning (DPBBL) Model obtained higher problem solving compared to conventional methods. (2) There is a significant (significant) difference in the average score of students' problem-solving learning outcomes between those who have high learning motivation and low learning motivation. It was found that the problem-solving application of the science learning process for students with higher learning motivation was higher than for students with low learning motivation. (3) there is an interaction between the Digital Project Based Blended Learning (DPBBL) Model and students' learning motivation towards problem solving. It is possible that there are several internal factors that influence students' problem-solving learning outcomes

## REFERENCES

- 'Ulya, R., Kartono, K., & Mariani, S. (2022). Creative thinking ability and student learning motivation with project based blended learning model for students of class XI. *Mathematics Didactic: Journal of Mathematics Education*, 8 (2). <https://doi.org/10.33654/math.v8i2.1843>
- Adriadi, A., Asra, R., Ihsan, M., & Rayani, N. (2022). BLENDED LEARNING BASED ON PROJECT BASED LEARNING TO IMPROVE STUDENTS' CRITICAL THINKING ABILITY IN PLANT MORPHOLOGY COURSES, BIOLOGY PROGRAM, FACULTY OF SCIENCE AND TECHNOLOGY. *Bio-Lectura: Journal of Biology Education*, 9 (2). <https://doi.org/10.31849/bl.v9i2.11502>
- Agustina, W., Degeng, INS, Praherdhiono, H., & Lestarc, SR (2022). The Effect of Blended Project-Based Learning for Enhancing Students' Scientific Literacy Skills: An Experimental Study in University. *Pegem Egitim ve Ogretim Dergisi*, 13 (1). <https://doi.org/10.47750/pegegog.13.01.24>
- Anggraini, N., Arifin, Z., Amizera, S., & Destiansari, E. (2022). Application of Blended Project Based Learning to Improve Students' Problem Solving Skills in Soil Ecology Courses. *EDUCATIVE:*

- JOURNAL OF EDUCATIONAL SCIENCE, 4 (3). <https://doi.org/10.31004/edukatif.v4i3.2768>
- Ariani, D., Hidayat, A., & Girikalho, AS (2023). The Implementation of Project Based Learning in Blended Learning System to Improve English Speaking Skill of Polytechnic Students. *ENGLISH FRANCA : Academic Journal of English Language and Education*, 7 (1). <https://doi.org/10.29240/ef.v7i1.6284>
- Asundi, M., Kandakatla, R., Talageri, V., & Vijayalakshmi, M. (2022). STUDENTS PERSPECTIVES ON CHALLENGES IN BLENDED PROJECT-BASED LEARNING (PBL) COURSE IMPLEMENTED IN FIRST-YEAR UNDERGRADUATE ENGINEERING. *EDULEARN22 Proceedings*, 1. <https://doi.org/10.21125/edulearn.2022.1231>
- Budiarti, RS, Harlis, & Siburian, J. (2023). Development Of STEM-Based PjBL E-Student Worksheet to Foster Character Building. *Journal of Science Education Research*, 9 (11). <https://doi.org/10.29303/jppipa.v9i11.6169>
- Cellini, N., Canale, N., Mioni, G., & Costa, S. (2020). Changes in sleep patterns, sense of time and digital media use during COVID-19 lockdown in Italy. *Journal of Sleep Research*, 29 (4), 1–5. <https://doi.org/10.1111/jsr.13074>
- Daud Mahande, R., Asma Darmawan, F., & Daud Malago, J. (2022). Metacognitive Assessment Model for Student Project-Based Learning through the Blended Learning Practice MOOCs. In *MOOC (Massive Open Online Courses)*. <https://doi.org/10.5772/intechopen.98996>
- Djamaan, A., Aslang, A., Jafar, M., Rachman, S., & Nur Fauziah, G. (2021). THE INFLUENCE OF MOTIVATION, INTEREST IN INDEPENDENT LEARNING ON LEARNING OUTCOMES OF MAKASSAR NAILING SCIENCE POLYTECHNIC cadets (CASE STUDY OF UTS AND UAS IMPLEMENTATION). *VENUS*, 5 (9). <https://doi.org/10.48192/vns.v5i9.410>
- Edmawita. (2023). The Influence of the Project-Based Blended Learning Method on the Motivation and Science Learning Outcomes of Class V Students at Sd Negeri 13 Muaro, Sijunjung Regency. *Scientific Journal of Basic Education*, 8 (1).
- Fahlevi, M.R. (2022). Study of Project Based Blended Learning as a Post-Pandemic Learning Model and Form of Implementation of the Independent Curriculum. *Sustainable Journal of Educational Quality Studies*, 5 (2). <https://doi.org/10.32923/kjmp.v5i2.2714>
- Fahlevi, MR, & Jabnabillah, F. (2023). Project-Based Blended Learning (PjB2L) in Statistics Learning in Higher Education. *Tadris Journal of Mathematics*, 6 (1). <https://doi.org/10.21274/jtm.2023.6.1.15-32>
- Febriandar, EI (2018). THE INFLUENCE OF TEACHER CREATIVITY IN APPLYING ICE BREAKING AND LEARNING MOTIVATION ON PRIMARY SCHOOL STUDENT LEARNING OUTCOMES. *Brilliant: A Research And Conceptual Journal*, 3 (4). <https://doi.org/10.28926/brilliant.v3i4.253>
- Fitriana, N., & Ikawati, A. (2023). Increasing Electrochemical Cognitive Abilities with Blended Learning Digital Literacy Project Based Learning model. *ChemEdu*, 4 (3). <https://doi.org/10.35580/chemedu.v4i3.56263>
- Fitriati, I., Purnamasari, R., Fitriarningsih, N., & Irawati, I. (2021). Implementation of Digital Game Based Learning Using the Educandy Application for Evaluation and Learning Motivation of Bima Students. *2021 Research and Community Service Proceedings*.
- Gestira, M., Abdurrahman, & Viyanti. (2021). PjBL-Based Blended Learning Implementation on Energy Topic to Improve the Problem-Solving Skill. *Impulse: Journal of Research and Innovation in Physics Education*, 1 (1). <https://doi.org/10.14421/impulse.2021.11-04>
- Golinelli, D., Boetto, E., Carullo, G., Nuzzolese, A.G., Landini, M.P., & Fantini, M.P. (2020). Adoption of digital technologies in health care during the COVID-19 pandemic: Systematic review of early scientific literature. *Journal of Medical Internet Research*, 22 (11). <https://doi.org/10.2196/22280>
- Hardiyanto, H., Susilawati, S., & Harjono, A. (2018). The Influence of Problem-Based and Expository Learning Models with Science Process Skills on the Physics Learning Outcomes of Class VIII MTsN 1 Mataram Students in the 2014/2015 Academic Year. *Journal of Physics and Technology Education*. <https://doi.org/10.29303/jpft.v1i4.267>
- Herawati, I., Widodo, S., Herpratiwi, H., & Nurwahidin, M. (2023). Development of Steam Innovation Learning Against Conventional Methods of Teachers in Islamic Boarding Schools. *JETISH: Journal of Educational Technology Information Social Sciences and Health*, 2 (2). <https://doi.org/10.57235/jetish.v2i2.636>
- Hevi, S.S., Agbenorxevi, C.D., Malcalm, E., Owusu, N.O., Nkrumah, G., & Osei, C. (2023). Digital learning space experience and learner continuous use in institutions of higher learning: a moderated-



- mediation model. *Journal of Research in Innovative Teaching and Learning*.  
<https://doi.org/10.1108/JRIT-04-2023-0045>
- Huang, W., London, J. S., & Perry, L. A. (2023). Project-Based Learning Promotes Students' Perceived Relevance in an Engineering Statistics Course: A Comparison of Learning in Synchronous and Online Learning Environments. *Project-Based Learning Promotes Students' Perceived Relevance in an Engineering*. 0 (0), 1–18. <https://doi.org/10.1080/26939169.2022.2128119>
- Hudayana, K., Mujahid, I., & Alif, A. (2022). PROJECT-BASED BLENDED LEARNING MANAGEMENT TOWARDS INCREASING COOPERATION IN LIMITED FACE-TO-FACE MEETINGS AT SMPJ HASANUDDIN DAU MALANG. *VOX EDUCATION: Scientific Journal of Educational Sciences*, 13 (2).
- I Made Tegeh, Ketut Agustini, & Sulastri, IA (2023). Collaborative Project Based Blended Learning on Resilience and Student Learning Outcomes. *Journal of Educational Technology*, 7 (4).  
<https://doi.org/10.23887/jet.v7i4.60417>
- Isro, AL, Anggraito, YU, Bintari, SH, & Semarang, UN (2021). Description of students' critical thinking skills in integrated PJBL STEM learning environmental change material. *Journal of Innovative Science Education*, 10 (37).
- Khoerunisa, T., & Amirudin, A. (2020). The Effect of Ice Breaking on Students' Learning Motivation in Science Subjects in Class III of the Nurusshiddiq Kedawung Cirebon Islamic Integrated Elementary School. *EduBase : Journal of Basic Education*, 1 (1).  
<https://doi.org/10.47453/edubase.v1i1.47>
- Knoblauch, C. (2022). Combining and Balancing Project-Based and Blended Learning in Education. *International Journal of Advanced Corporate Learning (IJAC)*, 15 (1).  
<https://doi.org/10.3991/ijac.v15i1.27135>
- Kua, MY, Dolo, FX, & Suparmi, NW (2022). Development of Virtual Blended Learning Based on Edmodo with Problem-Solving for Basic Physics. *Indonesian Journal of Physics Education*, 18 (1). <https://doi.org/10.15294/jpfi.v18i1.26825>
- Lin, M.H., Chen, H.C., & Liu, K.S. (2017). A study of the effects of digital learning on learning motivation and learning outcomes. *Eurasian Journal of Mathematics, Science and Technology Education*, 13 (7). <https://doi.org/10.12973/eurasia.2017.00744a>
- Liu, G., Ma, C., Bao, J., & Liu, Z. (2023). Toward a model of informal digital learning of English and intercultural competence: a large-scale structural equation modeling approach. *Computer Assisted Language Learning*. <https://doi.org/10.1080/09588221.2023.2191652>
- Liu, S., & Liu, M. (2020). Computers in Human Behavior The impact of learner metacognition and goal orientation on problem-solving in a serious game environment. *Computers in Human Behavior*, 102 (April 2019), 151–165. <https://doi.org/10.1016/j.chb.2019.08.021>
- Mardani, NK, Atmadja, NB, &... (2021). The Influence of the Problem Based Learning (Pbl) Learning Model on Motivation and Social Science Learning Outcomes. *Journal of Social Sciences Education...*
- Mielikäinen, M., Viippola, E., & Tepsa, T. (2023). Experiences of a project-based blended learning approach in a community of inquiry from information and communication technology engineering students at Lapland university of applied sciences in Finland. *E-Learning and Digital Media*. <https://doi.org/10.1177/20427530231164053>
- Mursid, R., Saragih, AH, & Hartono, R. (2022). The Effect of the Blended Project-based Learning Model and Creative Thinking Ability on Engineering Students' Learning Outcomes. *International Journal of Education in Mathematics, Science and Technology*, 10 (1).  
<https://doi.org/10.46328/ijemst.2244>
- Nasrah, AM (2020). Analysis of Student Motivation and Online Learning Outcomes During the Covid-19 Pandemic. *Elementary Education Research*, 3 (2).
- Nasyrullah, M., Rif'at, M., & Sudiansyah, S. (2023). STEM-PjBL Model Learning to Improve Problem Solving Skills of Mining Geology Vocational School Students. *JiIP - Scientific Journal of Educational Sciences*, 6 (12). <https://doi.org/10.54371/jiip.v6i12.3418>
- Ninilouw, R., Salamor, L., & Hatala, R. (2022). Improving Social Skills through Project Based Blended Learning Model at SMAN 3 Ambon. *IJRAEL: International Journal of Religious Education and Law*, 1 (1). <https://doi.org/10.57235/ijrael.v1i1.38>
- Nur, H., & Atmaca, M. (2020). The anxiety levels, quality of sleep and life and problem-solving skills in healthcare workers employed in COVID-19 services. 80, 131–136.  
<https://doi.org/10.1016/j.jocn.2020.07.073>

- Oktaviani, DG, Harjono, A., & Gunada, IW (2018). Class X Students' Mastery of Business and Energy Concepts Using the Expository Learning Model Assisted by Organizers. *Journal of Physics and Technology Education*. <https://doi.org/10.29303/jpft.v4i2.821>
- Pantiwati, Y., Kusniarti, T., Permana, FH, Nurrohman, E., & Sari, TNI (2023). The Effects of the Blended Project-Based Literacy that Integrates School Literacy Movement Strengthening Character Education Learning Model on Metacognitive Skills, Critical Thinking, and Opinion Expression. *European Journal of Educational Research*, 12 (1). <https://doi.org/10.12973/eu-jer.12.1.145>
- Purwaningsih, E., Sari, SP, Sari, AM, & Suryadi, A. (2020). The effect of stem-pjbl and discovery learning on improving students' problem-solving skills of the impulse and momentum topic. *Indonesian Journal of Science Education*, 9 (4). <https://doi.org/10.15294/jpii.v9i4.26432>
- Purwanti, A., Hujjatusnaini\*, N., Septiana, N., Amin, AM, & Jasiah, J. (2022). Analysis of Students' Critical Thinking Skills Through the Integrated Blended-Project Based Learning Model of 21st Century Skills Based on Students' Skill Level. *Journal of Science & Science Learning*, 6 (3). <https://doi.org/10.24815/jipi.v6i3.25705>
- Putra Manuaba, IBA, Dewi, NGAPLS, Prabawa, IPY, Bhargah, A., Darmayani, S., & Wu, C.-C. (2020). Simulation-based learning compared with conventional methods in procedural skills. *Indonesian Journal of Biomedical Science*, 14 (2). <https://doi.org/10.15562/ijbs.v14i2.268>
- Rees, C., Allen, H., Whitehouse, M., Cheeptham, N. (Ann), Harrison, M., DeVries, E., Sjokvist, G., & Miller, C. (2023). Curiosity-Driven, Inquiry-Based Science Projects Bridge Face-to-Face and Online Learning Formats During COVID-19: A Teacher's Community of Inquiry. *The Canadian Journal of Action Research*, 23 (3). <https://doi.org/10.33524/cjar.v23i3.657>
- Reichert-Schlx, J., Zlatkin-Troitschanskaia, O., Frank, K., Brückner, S., Schneider, M., & Müller, A. (2023). Development and Evaluation of Digital Learning Tools Promoting Applicable Knowledge in Economics and German Teacher Education. *Educational Sciences*, 13 (5). <https://doi.org/10.3390/educsci13050481>
- Risdianto, E., Medriati, R., Parwito, P., & Setiawan, I. (2023). Requirements Analysis of the Development of Project Based Learning (PjBl)-based Blended Learning Model Assisted by MOOC. *AL-ISHLAH: Journal of Education*, 15 (2). <https://doi.org/10.35445/alishlah.v15i2.2839>
- Rozandy, M.P., & Koten, Y.P. (2021). SCRATCH AS PROBLEM SOLVING COMPUTATIONAL THINKING IN A PROTOTYPE CURRICULUM. *IN CREATE Journal*, 8.
- Sahroni, O., Nuryuniarti, R., Pratiwi, AS, & Nurkamilah, M. (2021). STUDENT MOTIVATION IN PPKN SUBJECTS DURING ONLINE LEARNING IN PRIMARY SCHOOLS. *Pendas Cakrawala Journal*, 7 (1). <https://doi.org/10.31949/jcp.v7i1.2362>
- Shodikin, A., Sumarno, WK, & Nurkumala, SE (2022). Student Metacognition in Mathematics Problem Solving on Set Materials Student Metacognition in Solving Mathematics Problems on Set Materials. *JOURNAL OF MATHEMATICS AND MATHEMATICS EDUCATION*, 7 (2).
- Siswondo, R., & Agustina, L. (2021). Application of Expository Learning Strategies to Achieve Mathematics Learning Goals. *Association: Student Scientific Journal...*, 1 (80).
- Soyoof, A., Reynolds, B.L., Vazquez-Calvo, B., & McLay, K. (2023). Informal digital learning of English (IDLE): a scoping review of what has been done and a look towards what is to come. In *Computer Assisted Language Learning* (Vol. 36, Issue 4). <https://doi.org/10.1080/09588221.2021.1936562>
- Suana, W., Andra, D., Permadi, D., & Putri, NMAA (2023). A Systematic Review of Project-Based Blended Learning as an Innovative Teaching Model. [https://doi.org/10.2991/978-2-38476-060-2\\_14](https://doi.org/10.2991/978-2-38476-060-2_14)
- Suana, W., Wati, S., District, IW, Sagala, MK, & Rinaldi, D. (2023). The Effect of Project-Based Blended Learning Model on Students' Creative Thinking Skills in Global Warming Topic. *Scientific Journal of Physics Education*, 7 (3), 424. <https://doi.org/10.20527/jipf.v7i3.9380>
- Telaumbanua, S. (2022). The Effect of Project Based Blended Learning Towards Negotiation Text Writing Ability Moderated by Learning Motivation. *AL-ISHLAH: Journal of Education*, 14 (2). <https://doi.org/10.35445/alishlah.v14i2.1159>
- Thongkoo, K., Daungcharone, K., & Thanyaphongphat, J. (2023). Blended learning-driven interdisciplinary project-based approach: Gender differences in learning achievement and perceptions of university students. 8th International Conference on Digital Arts, Media and Technology and 6th ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering, ECTI DAMT and NCON 2023.

<https://doi.org/10.1109/ECTIDAMTNCON57770.2023.10139599>

- VARBarao, RCoata, JShibli, M. Bertolini, & JGSSouza. (2022). DEVELOPMENT OF A LEARNING MODEL BASED ON BLENDED LEARNING INTEGRATED WITH PROJECT BASED LEARNING IN LEARNING PAPER WRITING IN CLASS XI AT SMA NEGERI 4 PALEMBANG. *Braz Dent J*, 33 (1).
- Vanbecelaere, S., Van den Berghe, K., Cornillie, F., Sasanguie, D., Reynvoet, B., & Depaepe, F. (2020). The effectiveness of adaptive versus non-adaptive learning with digital educational games. *Journal of Computer Assisted Learning*, 36 (4). <https://doi.org/10.1111/jcal.12416>
- Widiana, LVW, Prayitno, BA, & Sugiharto, B. (2023). Augmented reality based on problem solving framework to scientific explanation ability: Validity and practicality. *Proceedings of ...*
- Wulansari, NH, & Manoy, JT (2021). The Influence of Students' Motivation and Interest in Learning on Mathematics Learning Achievement During Study at Home. *JOURNAL OF MATHEMATICS AND SCIENCE EDUCATION RESEARCH*, 4 (2). <https://doi.org/10.26740/jppms.v4n2.p72-81>
- Ye, Y., Ye, Y., Xiong, Y., Xiong, Y., Zhou, Q., Zhou, Q., Wu, J., Wu, J., Li, X., Xiao, X., Xiao, X., & Xiao, X. (2020). Comparison of Machine Learning Methods and Conventional Logistic Regressions for Predicting Gestational Diabetes Using Routine Clinical Data: A Retrospective Cohort Study. *Journal of Diabetes Research*, 2020. <https://doi.org/10.1155/2020/4168340>
- Zahroh, SH, Fauzi, A., & Nikat, RF (2022). STUDENTS' CONCEPTUAL UNDERSTANDING USING SSCS PROBLEM-SOLVING ACCOMPANYED WITH CPS ON NEWTON'S LAW MATERIAL. *Journal of Physics Innovation and Learning*, 9 (1). <https://doi.org/10.36706/jipf.v9i1.16653>