COMBATTING GHOSTING IN SYNCHRONOUS ONLINE LEARNING: EFFICACY OF PROJECT-BASED LEARNING ON BIOLOGY STUDENTS' ACHIEVEMENT, CREATIVE THINKING SKILLS, AND ENGAGEMENT

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ABSTRACT

The phenomenon of ghosting in synchronous online learning, which indicates student disengagement, negatively affects student achievement. This study aims to assess the effectiveness of the Project-Based Learning (PjBL) model in improving student academic achievement, creative thinking skills, and engagement in synchronous online learning environments. A mixed-method, pre-experimental design with a one-group pretest-posttest approach was employed. The participants were enrolled in an Environmental Education course delivered through synchronous online tutorials (webinars). The PjBL model was implemented in six stages: posing essential questions, designing project plans, scheduling tasks, monitoring project activities and progress, assessing outcomes, and evaluating the learning experience. Data were analyzed using descriptive statistics. The results revealed that the PjBL model improved student learning outcomes at a low level, significantly enhanced creative thinking skills, and greatly increased student engagement. The study concludes that the PjBL model is a promising pedagogical approach for enhancing synchronous online learning experiences and fostering student cognitive development.

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Keywords: achievement; creative thinking skills; engagement; online learning; project-based learning

INTRODUCTION

Digitalization of education is a domino effect from the realization of the Super Smart Society era, better known as Society 5.0. Digitalization encouraged the development of digital education infrastructure and new models for organizing educational work, for example, changing access to information and mobile communication with teachers, services, tools, and digital teaching material (Godin & Terekhova, 2021). Digital learning and technologies have changed the scope of education and initiated learning development with various online learning strategies (Timotheou et al., 2023; Cevikbas & Greefrath, 2023). Daniel (2020) revealing the continued effect of digitalization in education is the transformation of teaching across education levels to move online, or we currently refer to it as online learning (Daniel, 2020; Chang & Gomes, 2022)

Online learning has become a trend in education, especially in higher education settings, since it adds leisure and spasticity to students' lives (Mubarak et al., 2020; Rosli et al., 2022; Apandi et al., 2023) because online learning is mostly suitable for experienced students with a high degree of independence and high locus of control. Studies have shown that students who self-regulate

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and have strong internal motivation are more successful in online learning environments. They can manage their time effectively, stay motivated without direct supervision, and have the skills to use technology efficiently (Ogbodoakum et al., 2022). Online learning is interpreted as lifelong learning, which reflects the importance of continuous engagement that allows students to develop professionally throughout their lives (Jin et al., 2023)learners often face challenges in properly applying SRL in online learning environments. Recent developments in artificial intelligence (AI. Online learning provides convenient benefits because it offers flexibility and accessibility, allowing anyone to acquire new knowledge and skills anytime and anywhere (Wart et al., 2020).

Online learning became the new educational model (Zuo et al., 2021; Checa-morales et al., 2022), especially during the pandemic that hit the world around 2020. Online learning is a process where the teacher and the learner are in different physical areas. It is carried out with technology support (Moore et al., 2011) like using the internet and several other vital technologies in expanding material in the furtherance of educational basics (Fry, 2001) to provide knowledge, abilities, and skills to students (Tan & Mohd , 2017). Online learning offers teachers and students various benefits (Ramazanoglu et al., 2022). Online learning allows students to learn collaboratively with teachers and classmates (Katz, 2000), with no boundaries to learn (Hill et al., 1998). It also offers leisure and flexibility (Poole, 2000).

There are two types of online learning: synchronous and asynchronous. Online learning that is carried out well worldwide, including in Indonesia, has limitations, and new problems arise. One problem that arises from synchronous online learning is the phenomenon of 'ghosting' in online learning. Ghosting is a term that refers to the passivity of students in the online learning process (Kismiati et al., 2022). The phenomenon of ghosting is also equated with learning disengagement or off-task activity. Even Ralston (2021) conventionally categorizes ghosting as cheating. According to him, ghosting is explained as the unethical practice of having someone other than the student registered in the course take the student's exams, complete their assignments, and write their essays, has become a standard method of cheating in today's online higher education learning environment (Ralston, 2021). Ghosting can also be interpreted as the physical absence of students in synchronous online classes while administratively present. Ghosting, or student disengagement in learning, has a rushing impact on students. Student disengagement is closely related to lack of attendance, grades, general well-being, and school success. A survey by Rahayu et al. (2023) proves that there is a phenomenon of ghosting in synchronous online learning that occurs in 20,343 students at a remote university in Indonesia. Thus, it is appropriate for this phenomenon to be highlighted to the world that strategies are needed to reduce and overcome the phenomenon of ghosting in synchronous online learning.

Smith & Thompson (2022), and Jones & Martin (2023) investigated the influence of ghosting in synchronous online learning that causes low learning outcomes, including low student creativity. Therefore, it is necessary to research learning models that can improve all three components simultaneously: learning outcomes, creativity, and engagement in synchronous online learning. Creative thinking is one of the skills expected by students to realize the era of Super Smart Society, or Society 5.0. Creative thinking is defined as the ability of the thinking process to generate new or unique ideas to solve problems (Batlolona et al., 2019; Ernawati et al., 2023; Nahar, 2023). A creative thinking skill is a divergent thinking ability (Almeida et al., 2008) consisting of four basic components: originality, fluency, flexibility, and elaboration (Guilford, 2016; Jackson et al., 2012). Fluency is the ability to quickly produce new solutions to new problems (Lucchiari, 2019) or generate many ideas, alternatives, or uses when responding to a specific stimulus and the ease with which one generates them (Aldossari, 2021). An example of fluency involves recalling concepts, experiences, information, or previously learned. Fluency has sub-aspects such as intellectual fluency, verbal fluency, fluency of forms, and fluency of meanings. Fluency becomes important because it helps students move quickly and smoothly from long-term memory to ideas. It helps face and think creatively, solve problems efficiently, and make decisions. Flexibility is defined as the number of categories of design and uniqueness (Ku, 2015). Flexibility is the ability to simultaneously intend different points of view on an issue (Sa'idah et al., 2021; Hidayati et al., 2023). Then, originality is the ability to answer problems or respond to situations using language, methods, or non-routine and relevant ideas (Ibrahim et al., 2024) to provide various ways to solve problems (Atmojo & Sajidan, 2020). Another aspect of creative thinking skills is elaboration. Elaboration is defined as the ability to solve issues (creative solutions) or respond to situations in detail (Trisnayanti et al., 2020; Ibrahim et al.,

2024), involves adding depth and enriching ideas (Fajri et al., 2023). Creative thinking is a skill managed by memory in the form of ideas included in a quality product (Ritter & Mostert, 2017; Ozgen & Erdem, 2023). It considers problems from different perspectives, makes self-regulation, and finds many ways to see a situation (Sheu & Chen, 2014)

Project-Based Learning (PjBL) is a strategy to improve various competencies for students, such as problem-solving and creative thinking skills, academic achievement, and self-regulated learning, and it also presents the ability to see issues from a better perspective) (Azizah & Widjajanti, 2019; Mursid et al., 2022). Project-based learning (PjBL) will encourage students to practice through steps: making learning plans, designing their learning, implementing the bodies of knowledge, and evaluating their projects (Nilsook et al., 2021; Kongkhen & Chatwattana, 2023). Furthermore, students are asked to generate and present the products from the results of the investigation. The PjBL model also features a deeper insight into learning, flexibility in communication, supportive relationships, learning motivation, and more positive attitudes (Zubaidah et al., 2017). Several syntax PjBL models can be applied. The PjBL syntax model by The George Lucas Educational Foundation (2005) includes steps such as starting with the essential question, designing a plan for the project, creating a schedule, monitoring the students and the progress of the project, assessing the outcome, and evaluating the experience (Nurohman, 2015). The PjBL syntax requires students to make products that can answer essential problems or questions. Making products is the highest level of bloom cognitive skills (Khoiri et al., 2023) and actual execution of creative thinking (Wahyudi et al., 2021). PjBL leverages creative thinking to enhance students' motivation, collaboration, and connection. By fostering engagement, PjBL provides a robust solution to ghosting in synchronous online learning. It ensures students stay connected and committed throughout the learning process.

Research in education, especially digitalization and new teaching methods, is crucial due to changes in the Super Smart Society era. Digitalization has transformed how education works, with online learning becoming widespread, especially in universities. However, this rise in synchronous online learning has led to issues like 'ghosting,' where students cheat, disengage, have less creativity, and have less achievement. Tackling these problems requires immediate research to find solutions and improve synchronous online

learning quality. Additionally, it is vital to study how to nurture creative thinking skills to enhance students' achievement and engagement using innovative methods like Project-Based Learning (PjBL) to prepare students for success in the digital age and the goals of the Super Smart Society era.

Therefore, this study aims to investigate the efficacy of the Project-Based Learning (PjBL) model in enhancing students' achievement, creativity, and engagement in synchronous online environments.

METHODS

This research is a pre-experimental type with a one-group pretest-post-experimental design. The research method applied in this study is a mixed method that combines quantitative and qualitative research to obtain a more comprehensive understanding of the research problem (Clark, 2017). The sample of this research was 60 biology education students in UT regional offices of Purwokerto who enrolled in environmental education courses delivered through synchronous online tutorials (webinars). The research sample was obtained based on a random sampling technique.

In this design, researchers compare the pretest and posttest scores after treatment. This study used the same test items for pretest and posttest. The treatment given to the research sample was the application of a project-based learning model (PjBL) consisting of 6 learning syntaxes: start with the essential questions, design a plan for the project, create a schedule, monitor the students and the progress of the project, assess the outcome, and evaluate the experience (Research & Prepared, 2016).

The instruments used in the data collection are tests, student worksheets, questionnaires, observation sheets, interview forms, and student products. The test measured students' comprehensive level before and after treatment or applying the PjBL model. The student worksheet contains the guidance and tasks that students must do according to the PjBL syntaxes.

Creative thinking skills were assessed using questionnaires completed by students and observers. The observed aspects included fluency, originality, flexibility, and elaboration, measured using a Likert scale. Observers also observe the learning process when creative thinking skill is built. Observers also evaluated the quality of each student group's product. The products created by students in the PjBL model were assessed using a Likert scale based on creativity, the

popularity of the published product (as indicated by the number of likes and views), and relevance (as indicated by the appropriateness of the product). These assessments were conducted two weeks after the end of the learning sessions. A student engagement questionnaire was used to measure their engagement. The student engagement instrument was modified from Helme and Clarke (1973) (Rahayu et al., 2021). The assessment form of student products was used to assess students' products of the project. Students used this questionnaire at the end of the lesson.

The observers observed the synchronous interactions when online learning occurs in general classes and when students discuss with their groups in breakout rooms. Besides, the observers also observe the interactions in small groups through WhatsApp. Therefore, each student's progress in achievement can be observed regularly.

In this study, a researcher acted as the tutor in webinars who implemented the PjBL model. Other researchers acted as observers in the online learning of the course. Data collection was also conducted through interviews using an interview form to find out their opinions regarding the implementation of PjBL online.

The data were analyzed using the Normalized Gain score test (N-Gain score test) to analyze students' outcomes as a form of student learning achievement. The N-gain score test is carried out by calculating the difference between the pretest score (test before the application of the PjBL model and the posttest score (test after the application of the PjBL model) (Hake, 1999). N-

Gain Score is classified into the high categories $(G > 0,7)$, medium categories $(0,3 \leq g \geq 0,7)$, and low categories $(G < 0,3)$ (Hake, 1998, Oktavia et al., 2019).

Students' creative thinking skills and student products of PjBL were analyzed by dividing the total scores of creative thinking skills or student products by the number of samples. The total scores are calculated by adding each student's score. The total scores are classified into four categories. 81-100% range is categorized as very high, 61-80% as a high category, 41-60% as a moderate category, 21-40% as a low category, and bad category with a range of 0-20% (Riduwan, 2012).

RESULTS AND DISCUSSION

Physical absence (ghosting) during the synchronous online learning process in social higher education needs to be minimized so that student engagement in learning becomes better, student creativity is higher, and learning outcomes are better.

The application of the project-based learning (PjBL) model is expected to minimize ghosting in online learning by increasing student engagement and is even expected to initiate the development of creative thinking skills.

Improving students' achievement is one indicator of the success of a learning process. At the beginning of learning, a pretest is carried out to determine the initial engagement of students, and a posttest after applying the PjBL model. The pretest, posttest, and N gain scores obtained are shown in Table 1.

Table 1. Descriptive Analysis of Students' Achievement in Online Learning with the PjBL Model

Learning Outcome	Score	
	Pretest	Posttest
Average	50.94	64.13
Max score	66	80
Min score	33	52
N Gain	0.268	
Category	low	

The impact of implementing PjBL on students' achievement can be observed through the comparison of pretest and posttest scores, as well as the calculation of N gain scores.

Although the improvement was at a low level, learning outcomes also showed an increase as measured by the N-gain obtained from the pretest scores also from t test. The results of inferential statistical analysis using the t-test showed a

significance value of 0.0008, which is less than $\alpha = 0.05$. This indicated that there was a significant difference between the pretest and posttest scores of students' learning outcomes after the implementation of the Project-Based Learning (PjBL) model. This meant that the implementation of the PjBL model had a positive and significant effect on improving students' learning outcomes. The increase in posttest scores suggests that stu-

dents were able to better understand and apply the learning materials after engaging in project-based activities, compared to their initial knowledge as measured in the pretest.

Implementing the PjBL model in this study has enhanced students' low-level achievement. Project-based learning (PjBL) has positively influenced students' achievement (Chen & Yang, 2019; Guo, 2020). In PjBL, students immerse themselves in practical projects encouraging active learning and problem-solving abilities. These initiatives prompt students to tackle real-world problems, fostering a more profound grasp of the subject matter. Through active engagement in project-based tasks, students enrich their academic knowledge and cultivate critical thinking, engagement, and collaboration skills, all vital for success in contemporary professional environments. PjBL represents a practical educational approach that transcends traditional classroom methods, equipping students to navigate future challenges and seize opportunities (Reid et al., 2020).

Therefore, implementing PjBL significantly positively affects students' achievement, leading to improved understanding, skill development, and preparedness for the future. Implementing PjBL positively affects student content knowledge and the development of skills such as collaboration, critical thinking, and problem-solving (Almulla, 2020).

By implementing PjBL effectively, students can improve their understanding of content.. By implementing PjBL effectively, students' achievements are significantly enhanced as they gain a deeper understanding of the subject matter and develop essential skills for success in the 21st century (Nugroho et al., 2019). Overall, the implementation of PjBL has been found to have a positive effect on students' achievement.

The Society 5.0 era was a reform of the industry revolution 4.0 era. Several things must be considered, one of which is the development of knowledge to improve the quality of human resources through improving education quality. Education is required to improve to accomplish the Society 5.0 era, and students must think critically and creatively, collaborate, and communicate well (Ishikawa & Hara, 2023; Tanaka & Fujimoto, 2023). Creative thinking ability was evaluated through self-assessment by the students and also by observers/tutors. The same instrument was used to measure fluency, flexibility, originality, and elaboration. Figure 1 presents the result of an analysis of students' creative thinking skills in the Environmental Education course through the implementation of the PjBL model based on student assessment results. The analysis of students' self-assessment of their creative thinking skills showed that the average creative thinking skills in the class were 73.86 or categorized as high. Similarly, it is known that all aspects of creative thinking are categorized high, with a fluency score of 76.04, flexibility score of 74, originality score of 70.42, and elaboration score of 75.
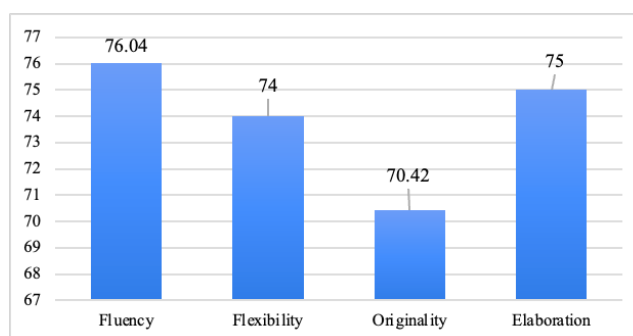
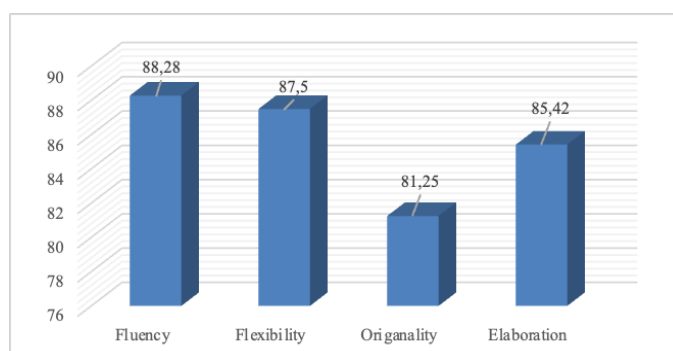Average Classroom Creative Thinking Skills= 73.86
Figure 1. Self-Assessment of the Students' Creative Thinking Skills after the Implementation of Project-based Learning Model

Thus, according to students' self-assessments, the lowest aspect of creative thinking is originality, and the highest aspect is fluency. The results of the student self-assessment analysis of creative thinking skills are slightly different from the observers' assessment. The observers' assessment of students' creative thinking skills is shown in Figure 2. The average creative thinking skills in the class was 88.61, which is very high. It is higher than student self-assessment. When viewed from the aspects of creative thinking, it is shown that all aspects of creative thinking measured were categorized very high with a fluency score of 88.28, flexibility score of 87.5, originali-

ty score of 81.25, and elaboration score of 85.42. The assessment of each aspect of students' creative thinking skills based on observers is higher than that of student self-assessment. However, the assessment of the highest and lowest aspects is the same. The highest score is the fluency aspect, and the lowest is the originality aspect.

Average Classroom Creative Thinking Skills=88.61

Figure 2. Observers' Assessment of the Students' Creative Thinking Skills after the Implementation of Project-based Learning Model

These results show that PjBL can improve creative thinking skills (Bell, 2018; Gao & Zhang, 2022). The fluency aspect has the highest value, presumably because fluency refers to the ability to quickly generate many ideas or solutions. This process prioritizes quantity over quality. Because initial ideas do not need deep attention, students can quickly generate many ideas without thinking too much about their uniqueness or innovation (Williams & Kim, 2021). According to Silver & Cai (1996) and Sasmita et al. (2021), fluency is the easiest aspect to achieve because this aspect relates to the ability of students to propose problems that have various solutions. For example, in the topic studied about environmental pollution, the students can analyze the causes of environmental pollution such as community activities that throw garbage carelessly (throwing garbage in rivers, throwing garbage on the road, and others), disposal of industrial waste in rivers, the use of environmentally environmental unfriendly fuel, the use of plastic bags, illegal logging, and many others.

The originality aspect is the lowest aspect since finding new ideas that are unique, interesting, and innovative is not easy (Johnson & Taylor, 2021). In addition to assessing creative thinking skills using a questionnaire, the observer also observed the development process of creative thinking skills based on students' actions and expressions during the learning process.

Based on the interviews, the originality aspect is challenging to obtain because 1) they are not only students but also they are teachers, so they have much work at school; 2) they must accomplish their thesis as final stage students; 3) they get difficulty to find a suitable time for dis-cussing or working together with other member group projects since they live in a different region. Therefore, the students adopt and modify existing projects. According to student self-assessment, the elaboration aspect (75) was slightly higher than the flexibility aspect (74), but based on the observation results, the elaboration aspect (85.42) was slightly lower than the flexibility aspect (87.5) (Figures 1 and 2). These results align with Torrance (1974) and Zhang and Li (2021), who stated that there was no significant difference between creative thinking skills, elaboration aspects, and flexibility.

Elaboration is the ability to detail answers correctly and appropriately (Guilford, 1967), shown when students fill out the student worksheets containing all the syntax of the PjBL model on online learning. They have answered the problem correctly and appropriately from various points of view. Another aspect is the flexibility aspect. Flexibility in thinking means the skill to see problems from different perspectives and consider various types of solutions (Preiss, 2022). This is shown when a group of students discuss essential problems that will be solved by designing a project on online learning forums.

The product of creative thinking skills in synchronous online learning is video. This video was recently published on YouTube. After 2 weeks from publication, this video was assessed from 3 aspects: creativity, popularity of the published product (judging from the number of likes and viewers), and relevance (the suitability of the product). The observers assess the products of students' creative thinking skills. It is shown in Figure 3.
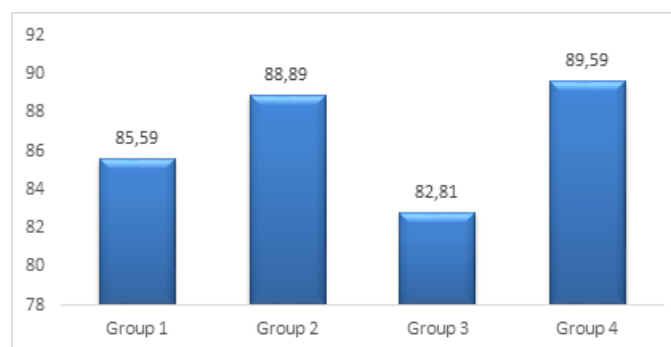
Figure 3. Project-based Learning Products

Based on Figure 3, there are four groups in synchronous online classes. Based on the observation, the PjBL product of each group in the class is very good. The PjBL products of Groups 1 and 4 are considered the most superior. The PjBL products can be seen in Table 2.

Table 2. Students' Project-based Learning Products

Group	Product Title	Description	Link
1	Conversion of forests into plantations and settlements	This video contains knowledge related to the problem of converting forests into plantations and settlements. At the end of the video, it shows that there are efforts that can be made so that the function of the forest as an animal habitat can be well-preserved	https://www.youtube.com/watch?v=4_noxPw-GVV8
2	Extinction of flora in *Rafflesia arnoldii* and pitcher sacs.	This video educates viewers about two rare floras in Indonesia: *Rafflesia arnoldii* flowers and pitcher bags. This video shows efforts to preserve rare flora in Indonesia through in-situ and ex-situ conservation.	https://www.youtube.com/watch?v=1jhNB3tnWMQ
3	Water Pollution	This video shows the phenomenon of water pollution in the river caused by factory waste disposal and garbage disposal. The end of the video shows several efforts to turn waste into more valuable items.	https://www.youtube.com/watch?v=rPhmRbNUJ88
4	Soil Pollution	This video shows the phenomenon of soil pollution caused by the accumulation of garbage that is thrown carelessly by humans. The end of this video shows an effort to preserve the soil by utilizing waste garbage to make useful products through the 3R, Reduce, Reuse, and Recycle principles.	https://www.youtube.com/watch?v=4JV1CYqwF4g

Based on the explanation above, it could be concluded that the Project-Based Learning (PjBL) model improved students' learning outcomes at a low level but successfully enhanced their creative thinking skills to a good level. This occurred because PjBL placed greater emphasis on the process rather than directly on content mastery (Yu, 2024). Students were able to focus on their projects without necessarily having a deep understanding of theoretical concepts. This was consistent with the findings of Zhang (2023), Purbosari (2023), and Rahardjanto (2019), which showed that the implementation of PjBL could enhance students' creativity, although it did not significantly increase academic achievement.

The key to reducing ghosting in learning is increasing student engagement in synchronous online learning. The following is the result of data analysis in the form of student engagement scores (generally) from the research sample after implementing the PjBL model in synchronous online learning of the Environmental Education Course.

Table 3. Descriptive Analysis of Student Engagement In Online Learning With The Pjbl Model

Student engagement	Score
Total Score of Student Engagement	1463
Total ideal score	1728
Overall student engagement (%)	84,66
Category	Very high

Table 3 indicates that student engagement in the PjBL model is very high. This means that PjBL actively involves students in synchronous online learning. Every syntax in PjBL has encouraged each student to play an active role in the learning process so that the phenomenon of ghosting in synchronous online learning can be overcome. This is in line with the result of other research that PjBL can increase student engagement in the learning process (Dumford & Miller, 2018; Legget & Harrington, 2021; Sukackė et al., 2022). Furthermore, implementing PjBL in synchronous online courses promotes higher student engagement levels than traditional lecture-based approaches (Maulina et al., 2022; Al-Bahadli et al., 2023; Uyen et al., 2023). The use of PjBL in synchronous online courses has been found to impact student engagement positively. This positive impact on student engagement can be attributed to the collaborative and interactive nature of PjBL, which encourages active participation and fosters a sense of ownership and autonomy among students (Chen & Yang, 2021; Uyen et al., 2023). The percentage of engagement of each student can be seen in Figure 4.
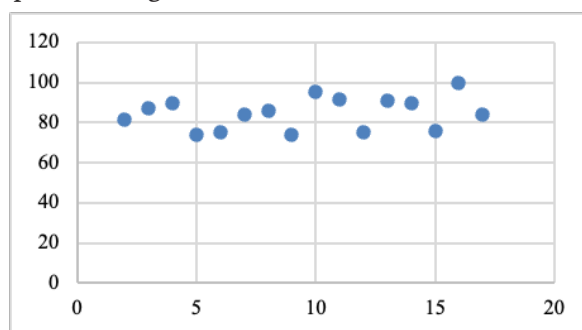

Figure 4. Student Engagement Rate in Each Research Sample

Figure 4 shows that the lowest student engagement rate is 80%, and the highest is 100%. This proves that using the PjBL model can encourage student engagement in synchronous online learning. Implementing the PjBL model in synchronous online courses positively impacts student engagement, as it allows for active participation and collaboration, fostering a sense of ownership and autonomy among students.

However, although PjBL could indeed enhance student engagement in synchronous online courses, it was important to consider the potential weaknesses of this approach Some critics argue that PjBL can be time-consuming and may not effectively cover all the necessary course material. (Juandi et al., 2021; Maulina et al., 2022; Uyen et al., 2023). This was also conveyed by the respondents, stating that: (1) there were obstacles in implementing the PjBL model during synchronous online tutorials, such as limited time due to most respondents already working as teachers; (2) the respondents' distant domiciles made offline or in-person meetings difficult to conduct; and (3) unstable internet connections during online sessions.

Additionally, in synchronous online courses, students may face challenges in collaborating effectively on projects due to limitations in communication and coordination. This can lead to unequal distribution of workload and unequal participation, which may result in disengagement for certain students. Therefore, it was essential to have strong intrinsic motivation among students or adequate digital infrastructure to support effective communication among them.In addition, the students revealed that in PjBL model learning, they were initiated to complete a project that required them to seek to complete it actively. Thus, students experience first-hand experience, which demands that learning is not limited to mere knowledge.

CONCLUSION

Students' engagement in synchronous online learning needs to be built and maintained so that the phenomenon of ghosting does not occur. This research proves that applying the PjBL model in synchronous online learning can increase student engagement in learning and creative thinking skills in the very high category. In addition, applying the online synchronous learning model can improve student learning outcomes even in the low category. It concludes that the PjBL model is a promising pedagogical approach for enhancing synchronous online learning experiences and fostering student cognitive development. Based on the results of this study, it is recommended that future research develop an operational guideline for the implementation of Project-Based Learning (PjBL) in synchronous online tutorials, covering aspects such as project duration, technology utilization, and the role of the tutor.

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