



Good practices for the application of modified problem-Based learning models to increase student learning

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Abstract

Technology-based learning is a challenge today. While, student independence needs to be improved through problem-based learning. That, synchronous-based problem-based learning is an alternative solution. The type of this research was quasi-experimental research, with the purpose to determine the effect of the application of Problem based learning synchronously in Tuweb learning on student independence. This research was conducted in FY 2022.2 at UT in Basic Concepts of Science Learning with sample to 25 people. The study was carried out for 2 months. Research instruments was tests and observation sheets. The data obtained were analyzed using statistical tests on the Gain score. It can be concluded that the increase in learning outcomes shows that students are more independent in learning using Problem Based Learning with an average of the three Gain Score values of 0.065, 0.097, 0.15 and obtained results of 0.313%, thus the average increase in learning outcomes in Problem Based Learning-based Tuweb Basic Science Concepts learning is categorized as medium ($0.3 \leq \langle g \rangle < 0.7$). In addition, the application of the Problem Based Learning model has been very good and can increase student engagement

Keywords: Education, problem based learning, synchronous, webinar

Introduction

The rapid development of technology has affected various aspects of life, including the field of education. With the advancement of technology, the education system is no longer limited to the conventional system (Hanifah Salsabila *et al.*, 2020 ^[11]; Yerusalem *et al.*, 2015) ^[27]. One of them is the use of synchronous systems for teaching (Muzaini *et al.*, 2021) ^[16]. The use of synchronous systems for teaching has increased greatly and the potential use of such systems is also expected to continue to grow (Bonk, 2007) ^[8].

Webinar tutorial lectures are one form of synchronous learning settings that are popular today. Webinar is a seminar, presentation, teaching and workshop conducted online, face-to-face *online* delivered through internet media and can be attended by many people who are in different locations, in webinar activities someone can interact directly through images (video) and *text (chat)* (Zakirman & Rahayu, 2022) ^[28]. Webinars strongly support online learning, it allows for real time and synchronous communication between speakers and listeners, covers remotely to reach potential audiences, and makes it possible to archive web-based information for use (Wang & Hsu, 2008) ^[25]. Compared to traditional face-to-face education, the use of online environments is accompanied by certain advantages and disadvantages. Webinars, for example, use video-conferencing technologies that enable direct interaction to occur between participants and their lecturers without the need for them to be in the same physical location; this geographical flexibility and ubiquity are an advantage of webinars. The synchronous setup makes it

possible for participants to communicate directly with their instructors who are able to provide immediate feedback (Ebner & Gegenfurtner, 2019) ^[10].

Synchronous learning is a learning system using the internet network where educators and learners are at one time without pause (Sulistio, 2021) ^[24]. In synchronous learning, it is required between teachers and students to access the internet at the same time. This allows direct interaction between teachers and students online. Synchronous learning is more briefly described as a real class but is virtual (Amadea & Ayuningtyas, 2020) ^[3]. The synchronous learning process includes the process of exchanging information and interacting online between students and educators at the same time (time-bound) through internet conferencing, satellite, video teleconferencing and chat. (Wangi *et al.*, 2022) ^[26].

The advantages of synchronous media educators can communicate directly with learners (ask and answer and discuss), and the activeness or awkwardness of learners can be clearly seen. Meanwhile, the disadvantage of synchronous learning is that this learning requires a smooth internet quota network and is realtime, which means that learners are required to attend on a predetermined schedule, and in this realtime learners are not given a long time when responding to materia (Wangi *et al.*, 2022) ^[26]. Synchronous learning settings generally use media such as video or chat. One application that is widely used in synchronous learning is the Zoom application (Putra & Nisaurasyidah, 2020) ^[19]. Problem Based Learning is a learning model that encourages students to be active by identifying problems,

opinions, and identifying knowledge gaps between individuals. Problem Based Learning also encourages students to be responsible, independent, and active in various types of tasks (Muyassaroh *et al.*, 2022) ^[15]. Problem-based learning is an approach to learning by confronting learners with practical problems or learning that begins with giving problems and has a context with the real world. The problem-based learning model can train students to solve problems with their knowledge. The learning process using problem-based learning can build new knowledge that is more meaningful to students. Problem-based learning is a learning model designed by raising real-life problems that are structured, open, and ambiguous. The issues provided are unclear or unidentified. Learners will be faced with confusing and complex situations. The problem is illustrated at first the discourse is not fully described. Problems are used to stimulate curiosity, analytical skills and problem-solving abilities. Problem Based Learning prepares students to be able to solve problems with appropriate sources. The success of problem-based learning depends on the ability to present realistic problems that will help learners develop problem-solving skills and the ability to become independent (Aninda & Suryadarma, 2018) ^[15].

Synchronous learning is a learning process where teachers and students in realtime communicate in two directions through video conferencing features. Problem-based learning is a learning model that encourages students to be active by identifying problems, opinions, and identifying knowledge gaps between individuals. Problem Based Learning also encourages students to be responsible, independent, and active in various types of tasks (Muyassaroh *et al.*, 2022) ^[15]. The syntax of problem-based learning is divided into 5, namely providing problems to students, organizing students, conducting analytical and discussion, developing and presenting results, analyzing and evaluating the investigation process. Problem Based Learning is a learning strategy by presenting a contextual problem as the first step in learning so that students can collect and integrate new knowledge and focus on student activity in learning activities. The problem-based learning model can improve student learning outcomes, improve problem-solving skills and can foster student motivation to be actively involved in the learning process and actively to discuss in groups (Rahman *et al.*, 2021) ^[20]. Synchronously problem-based learning can be implemented by modifying syntax through the use of learning media.

Research conducted by Pusparingga (2020) shows that the use of problem-based learning in distance learning helps students actively discuss groups. Research related to problem-based learning conducted by Candra (2020) ^[9] also said that student independence in learning using problem-based learning has good to very good categories (Candra *et al.*, 2020) ^[18]. Research conducted by Primandari & Kesumawati shows that the use of online problem-based learning helps achieve CPMK, the main support for success is the existence of practice videos to guide in solving problems, the availability of optimal online learning media (google classroom, zoom) from institutions, and discussions through chat media (Primandari & Kesumawati, 2020) ^[18]. The use of online problem-based learning currently still focuses on solving problems and exposing problems through the media, some students consider it less interesting. In this study, problem-based learning was carried out synchronously via zoom by integrating quizzes and private

discussion rooms, so that it could also develop students' communication skills. Combining several models and media in learning is very possible to complement each other and cover weaknesses in the use of each model or media to create more efficient learning (Muyassaroh *et al.*, 2022) ^[15] (Muyassaroh *et al.*, 2022) ^[15]. Synchronous Problem Based Learning requires a private discussion room and requires quizzes as intermezzos and as a forum for discussion. The development of students' communication skills can be through delivery and discussion of problems found and related to real life, with the problem-based learning model students can be active when communicating if problems are included in learning related to daily life (Nasri & Jamaan, 2022) ^[17]. Thus, the purpose of this study is to determine the effect of the application of Problem Based Learning synchronously in Tuweb learning on student independence.

Method

A type of quasi-experimental research, Quasi experiments are experiments that have treatment, impact measurement, experimental units but do not use random assignments to create comparisons in order to conclude changes caused by treatment (Abraham & Supriyati, 2022) ^[1]. The purpose of this study is to determine the effect of the application of PBL synchronously in Tuweb learning on student independence. This research was conducted in FY 2022.2 at Universitas Terbuka (UT) in Basic Concepts of Science in Elementary Schools. Random sampling amounted to 25 people. The study was carried out for 2 months. Research instruments are divided into two, namely tests and observation sheets. The test is conducted to see students' learning ability and observation to see students' learning independence. The steps taken to obtain a good test instrument are to make a grid of questions that contain the basic competencies to be achieved, learning goals and the level of knowledge tested, arrange the final test test test questions based on the grids that have been made, conduct test questions and then analyze the questions based on the results of the trial so that questions with good categories are obtained. Observation sheets are used in observation activities and student involvement during learning with TUWEB. Furthermore, the data obtained were analyzed using statistical tests on the Gain score

Result and discussion

Result

Problem Based Learning is a learning model that makes contextual problems the main point of learning. Learning using the Problem Based Learning model begins with presenting problems by the teacher. Then students solve problems independently or in small groups, integrate their knowledge to solve problems, to report their work in the form of presentations and writing (Adifta *et al.*, 2022) ^[2]; Huang *et al.*, 2008) ^[12]. Webinars strongly support online learning, it allows for real time and synchronous communication between speakers and listeners, covers remotely to reach potential audiences, and makes it possible to archive web-based information for use (Wang & Hsu, 2008) ^[25]. In this study, problem-based learning was modified in Tuweb's synchronous learning by utilizing Zoom media in the Basic Science Concepts (KDIPA) course.

After students participated in Tuweb-based learning Basic

Science Concepts for 8 meetings, an analysis was carried out on the level of self-engagement and self-regulated learning. A total of 19 students participated in Basic Science Concepts-based Tuweb learning. The involvement of students in Tuweb Basic Science Concepts based on problem-based learning has an average of 81 with a medium

category. Furthermore, student *self-regulated learning* in problem-based learning Tuweb Basic Science Concepts has an average of 60 with a medium category. Improving student learning outcomes in learning Tuweb Basic Science Concepts Problem-based Learning courses at meetings 5, 6 and 7 can be presented in the table below.

Table 1: Analysis of Student Learning Outcomes Improvement of Basic Science Concepts Problem-based Learning Meetings 5, 6 and 7

Meeting to-	Total improvement in learning outcomes	Numbers of respondents	Gain Score (Total HB/n Increase)	N-Gain Score (Average Gain Score obtained/Max Gain Score)
5	125	19	6.57894737	0.06578947
6	185	19	9.736842105	0.097368421
7	285	19	15	0.15

To determine the average increase in learning outcomes, the data of the three Gain Score values were averaged (0.065 + 0.097 + 0.15) and obtained results of 0.313%, thus the average increase in learning outcomes in Tuweb Basic Science Concepts learning based on problem-based learning was categorized as medium ($0.3 \leq <g> 0.7$).

Discussion

Results of evaluation of the implementation of problem-based learning Basic Science Concepts

according to students (analytical skills, argumentation, collaboration, communication, material understanding) After the implementation of problem-based learning in learning Tuweb Basic Science Concepts, students were given questionnaires related to their responses to the implementation of problem-based learning and also related to several 21st Century competencies such as analytical skills, argumentation, collaboration, communication, and material understanding.

The following are the results of these evaluations addressed in Table 2.

Table 2: Evaluation Results Implementation of problem-based learning by students

No	Statement	Evaluation Results by students (%)			
		Strongly Disagree	Disagree	Agree	Strongly Agree
1.	Tuweb with problem based learning model is easy to apply	0	0	57.8	42.1
2.	Tuweb with problem-based learning involves all students in the learning process	0	0	68.4	31.5
3.	Tuweb with problem-based learning can improve collaboration skills between students	0	0	52.6	47.3
4.	Tuweb with problem-based learning can improve students' analytical skills	0	0	68.4	31.5
5.	Tuweb with problem-based learning can train argument skills	0	0	57.8	42.1
6.	Tuwebd with problem based learning can improve students' communication skills	0	0	63.15	36.8
7	Tuweb with problem-based learning can increase students' understanding of the module content	0	0	63.15	36.8

The syntax of problem-based learning is divided into 5, namely providing problems to students, organizing students, conducting analytical and discussion, developing and presenting results, analyzing and evaluating the investigation process (Kurniasih *et al.*, 2021) ^[13] 1) Orientation of students to the problem. This stage is carried out synchronously via zoom. 2) Organizing students to find information (learning), that is, teachers help students to define and organize tasks related to problems. The implementation of this stage begins with the mobilization of students from the main zoom room to the breakout room according to their groups. At each meeting, this stage is carried out synchronously via zoom. The teacher has prepared a zoom breakout room that has been given a description of the name of each group, and arranged for students to enter the room without being invited by the teacher or host. 3) Guidance and investigation of students through independent and group investigation, i.e. teachers encourage students to obtain appropriate information, conduct experiments, and solve problems. With the guidance of the teacher, students already understand the things that need to be done to carry out online discussions. Therefore, the process of developing critical thinking skills at the evaluation stage becomes more optimal. 4)

Development and presentation of discussion results, namely students make reports on the results of investigations as a form of accountability and present them in presentations. 5). The analysis and evaluation stage of the problem-solving process is that the teacher helps students reflect or evaluate the investigation of the problem that has been carried out (Amini *et al.*, 2022) ^[4]. E-Problem-Based Learning allows for group work among students and trains them to accept the opinions of other students in the same group, providing students with a new attitude and spirit of competition, as well as the skills to find solutions to problems they may face. By following these steps, students solve problems using their skills through gathering previously presented information and processing it to reach a solution. (Murniati & Hermawan, 2018) ^[14]

1. 2. Results of evaluation of the implementation of problem based learning Basic Science Concepts according to tutors Tutors were also given questionnaires related to the implementation of problem-based learning in Tuweb KDIPA. Based on the questionnaire, it is known that tutors feel that Tuweb using problem-based learning is easy to implement. Access to tutors who are not fully operating Ms. Teams is an obstacle in the implementation of Tuweb based

on the problem-based learning model. This has the impact felt when organizing students into breakout rooms. Not all students are able to quickly join the breakout room, so they need admin or tutor help themselves in making transfers. In addition to Ms. Teams, quizizz also has a good impact in increasing student involvement in learning. Tutors actively monitor students doing quizizz questions and then ask each student to submit proof of their work in the WA group. In general, according to tutors, the application of the problem-based learning model is very good and can increase student engagement. The tutor's input is in the assessment of student engagement. Previously in the research activities carried out, one indicator of students being involved was to activate the camera. Due to unstable network conditions, the tutor suggested that camera activation be replaced with microtree activation. This remains a reference for students to stay in class and actively respond.

Synchronous learning is a form of learning with direct interaction between students and teachers as well as online. Synchronous learning is divided into two, namely virtual synchronous and direct synchronous. Synchronously directly implement face-to-face learning at the same time; Synchronous virtually applies learning directly but is done face-to-face in the same time but in different places. As for this pandemic, direct synchronous cannot be implemented so that only virtual synchronous can be used (Banila *et al.*, 2021) [6]. The question and answer method during synchronous learning is one way teachers can build an interactive classroom atmosphere. This can be an encouragement for students to be more eager to learn, especially when teachers give appreciation or praise to each student's answer (Wang & Hsu, 2008) [25]. At the time of synchronous learning, the majority of teachers use a direct learning model and use the lecture method. The teacher delivers and explains the material learned through the Google Meet / Zoom / WhatsApp platform directly. This is in line with research (Sukarini, 2020) [23]. Synchronous learning can build student independence and motivation. In synchronous learning, students have free will to be able to determine whether they still have high motivation during learning or doing other activities (Blankson *et al.*, 2015) [7].

1.3. The results of the evaluation of the implementation of problem based learning Basic Science Concepts according to the observations of researchers (student activity, breakout room, SAT, MFI, quisis)

The implementation of problem-based learning is also observed by observers. According to the Observer, there are several notes and inputs in the implementation of future problem-based learning in Tuweb. To make it easier for students to follow the breakout room, it is necessary to provide guidance for accessing and using the breakout room. There are so many students who are constrained in leaving breakout so they must be accompanied by proficient friends. Breakout is the most recommended discussion forum in Tuweb, but its use needs to be accompanied by socialization and guidance. For the use of quizizz, according to observer observations, it needs to be placed at the beginning only. At the beginning, it is useful to focus students' attention on the topic discussed. Quizizz is recommended to have a live score, in order to motivate other students to do their best work in doing Quizizz. In addition to quizizz and Ms. Teams, the g form used also needs to be developed and designed to make it easier for students to answer questions. There are some students who

are constrained when filling out the G-Form so that it interferes with other students' time to continue activities. In the future, other companion applications will be considered, to make it easier for students to fill out electronic worksheets. This is in line with the opinion that problem-based learning can be used to improve student learning outcomes even though it is carried out virtually using the zoom platform (Amini *et al.*, 2022) [4]. Problem Based Learning is able to provide freedom for students in exploring, collecting, and analyzing complete data to solve problems n, serta menganalisis data secara lengkap untuk memecahkan permasalahan (Sastaviana *et al.*, 2022) [21]. In the webinar participants enjoyed the participants' interaction with the instructor, time efficiency for discussion, and the availability of recordings that could be watched again on various occasions (Sugilar, 2020) [22].

Conclusion

Based on data analysis, it can be concluded that the increase in learning outcomes shows that students are more independent in learning using Problem Based Learning with an average of the three Gain Score values of 0.065, 0.097, 0.15 and obtained results of 0.313%, thus the average increase in learning outcomes in Problem Based Learning-based Tuweb Basic Science Concepts learning is categorized as medium ($0.3 \leq \langle g \rangle < 0.7$). In addition, the application of the Problem Based Learning model has been very good and can increase student engagement.

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