Project based learning design “gadget play duration survey” for junior high school students

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Project Based Learning Design "Gadget Play Duration Survey" for Junior High School Students

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Abstract. This study aims to produce a learning trajectory in project-based statistical learning using blended learning that helps students in the learning process during the pandemic. The research method used is design research, which is a research method that aims to develop local instruction theory through collaboration between researchers and teachers to improve the quality of learning. At the preparing for the experiment stage, the researcher reviewed the literature on project-based learning models, blended learning, the materials used, the PMRI approach, the LSLC system, and design research and analysed the objectives to be achieved such as learning objectives; determine the initial conditions of the study; discuss HLT to be developed, prepare pre-test, project activity sheet, post-test, and lesson plans; and determine the characteristics of the class and the role of the teacher. At the design experiment stage, there the teaching experiment to see the quality of the HLT which will become a learning trajectory. At the retrospective analysis stage, the data that has been obtained is to determine whether it supports or does not match the conjecture that has been designed. The subjects in this study were students of class VIII.7 SMP Negeri 17 Palembang. The results showed that a series of activities in project-based blended learning with the LSLC and PMRI systems could assist students in solving problems related to data presentation and central tendency materials.

Keywords: Blended Learning · Lesson Study Learning Community · Project Based learning · PMRI

1 Introduction

The main reasons for introducing statistics into the curriculum are that statistics are needed in many disciplines and occupations and for students to experience the usefulness of mathematics [1–3]. Statistics is a science consisting of theories and methods that study how to plan, collect, analyse, interpret, draw conclusions and present and determine decisions within certain risk limits based on existing strategies [4].

Based on the results of the study, there are still problems in the central tendency material, including: (1) Students have difficulty distinguishing between the amount of data and the amount of data to find the average. (2) Students have difficulty in determining

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the data that will be used to determine the average value of a group of data. (3) Students forget to sort the data. Whereas students should sort the data first to determine the median. (4) Students are often stuck with a lot of the same data so that students write down all the existing data when determining the mode. (5) students are still wrong in using the existing formulas [5, 6].

Some difficulties in data presentation materials include students having difficulty presenting data in tables completely and not understanding the concept of bar charts [7], students having difficulty understanding facts and procedures in data presentation material [8].

One solution in statistics learning that can facilitate students to understand the concepts and uses of statistics is the PMRI approach [9]. The PMRI approach starts from situations that have been experienced by students, then emphasizes process skills, discussions, collaborations, arguments with classmates so that students can find themselves and can solve problems either individually or in groups [10].

Blended learning is a combination of on-net and off-net learning. The aim of blended learning is to create a more flexible, efficient, and effective learning and teaching experience by designing each of the best learning models [11].1Collaborative learning can be facilitated by the lesson study for learning community (LSLC) learning system [12]. The application of LSLC in learning which consists of collaboration between colleagues to design, experiment, observe and reflect then redesign learning will be able to improve the quality of learning [13].

From these problems, it is necessary to design a project-based statistical learning material that can be used in pandemic learning using the Lesson Study system and the PMR approach.

2 Method

This study uses the design research method, which is a research method that aims to develop local instruction theory through collaboration between researchers and teachers to improve the quality of learning [14, 15].

The study involved eighth grade students of SMP Negeri 17 Palembang who were in their respective homes due to the new normal period. The school that is the place of research is a school that is included in the Lesson Study community and can use zoom during learning.

In the learning design there are three stages, namely preparing for the experiment, the design experiment, and the retrospective analysis which is carried out repeatedly. The repetition, which is also called the cyclic cycle, is carried out until a new theory is found which is the result of a revision of the learning theory being tried.

The things that are done in the preliminary design stage are: (1) reviewing the literature on project-based learning models, the materials used, the PMRI approach, the Lesson Study system, and design research as well as analysing the objectives to be achieved such as learning objectives; (2) determine and determine the initial conditions of the study; (3) discussing the hypothetical learning trajectory that will be developed, compiling pre-tests, project activity sheets, post-tests, scoring rubrics, answer predictions, and lesson plans; and (4) determine the characteristics of the class and the role of the teacher.

At the design experiment stage, the necessary data were collected covering the learning process that occurred in the classroom and the students' thinking processes. The experimental design is carried out in the form of cyclical activities, in this study it will be carried out in two cycles.

The first cycle is called the pilot experiment. The purpose of this cycle is to improve the quality of the hypothetical learning trajectory (HLT). In this cycle, a trial was conducted on HLT. HLT was piloted into small groups with heterogeneous abilities. Students in the first cycle were students who were non-subjects of the study, totalling 8 people. The results of the first cycle trial became the basis for researchers and teachers in developing and improving HLT.

The second cycle is called the teaching experiment. The purpose of this cycle is to see the quality of the hypothetical learning trajectory which will become the learning trajectory. Students in this cycle are research subjects. Learning in this cycle is an open class activity with the model teacher being the mathematics teacher who teaches in the class. Implementation of learning (do stage) in the first and second cycles include: pre-test - apperception - project work - post-test.

Analysis of data from observations, interviews, and documentation was carried out descriptively. Data from observations made during learning were analysed descriptively and then matched with the designed trajectory. The results of the interview will be made in the form of a transcript. The interview transcript will clearly describe the dialogue that took place. Documentation data were analysed descriptively related to the preparation and learning process and then matched with the designed learning trajectory.

The test result data consisting of pre-test, project activity sheet, and post-test were examined and analysed to see the success of students' learning using project based learning. The test results are checked and scored according to the scoring rubric.

3 Result and Discussion

The learning design for statistical material based on a survey of gadget playing behaviour was carried out in three stages, namely preparing for the experiment, the design experiment, and the retrospective analysis. The three stages of the process include:

3.1 Preparing for the Experiment

At this stage the researcher discusses with the teacher to determine the initial conditions of the school, determines the model teacher, and determines the research subject. Furthermore, the researcher and the mathematics teacher collaborate to design and validate the learning instruments to be used such as lesson plans, grids, question cards, student activity sheets and generate a learning trajectory.

3.2 The Design Experiment

This stage consists of two cycles, namely the pilot experiment as the first cycle and the teaching experiment as the second cycle. Each cycle is analysed based on the steps in Project-based learning (PjBL), namely determining the basic questions; designing

project plans; schedule; monitor project progress; test learning outcomes; and evaluation of learning experiences [15].

The research subjects in the first cycle consisted of 8 students, each 4 male students and 4 female students with heterogeneous abilities. Then the subjects were divided into 2 groups. The implementation steps in the pilot experiment stage are in accordance with the project-based learning syntax, as follows:

3.2.1 Pilot Experiment

3.2.1.1. Determination of Basic Questions

This stage is carried out offline in the classroom. At the beginning of the learning model, the teacher asked the students basic questions related to the survey project on the behaviour of playing gadgets with the aim of starting learning activities. The teacher starts the lesson by providing information about the impact of the pandemic on the behaviour of playing gadgets. Social activities through gadgets have increased. Many people have the duration of playing gadgets beyond the recommended time limit. Some of the basic questions given by the teacher include the following:

G: Do you think the use of gadgets that you do in one day has exceeded the limit?
G: What application do you use most often? Then what about the applications that are most often used by students in this class?

Further providing other information that assists the implementation of the project.

3.2.1.2. Design Project Planning

On the same day, the teacher provides initial guidance in completing student project activity sheets in the form of project titles, KD, KI, and objectives to be achieved in project-based learning, as well as instructions for completing projects. Furthermore, students understand the information contained in the activity sheet, understand the project activities to be carried out, and plan the steps for completing the project.

3.2.1.3. Schedule

The teacher and students agreed that the project completion time was carried out in two meetings after the first meeting. Because it is still in the pandemic period, the second and third meetings are held online through the Zoom meeting application and coordinate through the WhatsApp chat group that has been created.

3.2.1.4. Monitoring Project Report

This stage is carried out online through the Zoom Meeting application as shown in Fig. 1.

The teacher monitors the discussion and provides answers regarding the difficulties students ask. The teacher divides the students into breakout room 1 and breakout room 2 in zoom. Students ask group members if they have difficulty, but if group members do not understand the teacher directs students to ask other group members or provides instructions in the form of questions to direct students to think how to solve the problem given. At the third meeting as well as the last day of project completion, the teacher

Fig. 1. Monitoring project progress

again monitored the progress of the project being carried out by the students and gave instructions for collecting the results of the activity on the gadget use survey project.

3.2.1.5. Testing Learning Results

The teacher measures the achievement of learning objectives based on student answer sheets and evaluates the progress of students from the beginning of learning to the end of learning. Students who have difficulty are directed to present the results of their group work in front of the class and are responded to by other groups if they have different answers.

3.2.1.6. Evaluation of Learning Experience

The teacher asks the learning experiences they get during the lesson as a form of evaluating the learning experience. The learning experiences felt by students include, students feel happy and interested in the learning, students get new experience in completing survey projects for the duration of using cell phones, students are able to solve data presentation problems and central tendency.

Furthermore, the stages in the teaching experiment are the same as the pilot experiment, therefore the results of the teaching experiment focus on students' answers. Here are the results of student work.

3.2.2 Teaching Experiment

3.2.2.1. Activity 1

Activity 1 consists of 3 questions related to a survey of individual gadget use behaviour. In question number 1, students display a summary of battery usage on the cell phone by describing or writing the name of the application and the duration of using the application. There were 2 students who did not write down the duration of using their cell phones in units of time. Questions 2 and 3 have been done well by students.

3.2.2.2. Activity 2

In activity 2 there are 8 questions related to the survey of gadget playing behaviour of all students in one class. In question number 1, students were instructed to collect data on the duration of using gadgets for all students in one class. In question number 2, all students are able to present data on the use of gadgets for all students in tabular form. In question number 3 students were asked to write down the average use of each type of application used by 15 students. There are 5 students who did not write down the

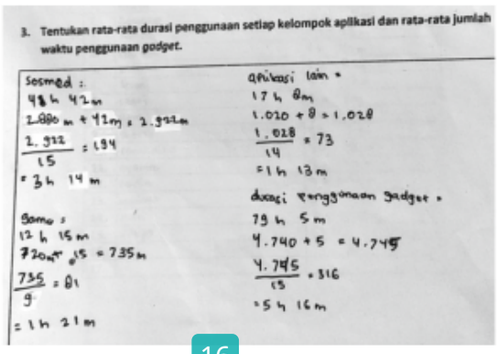

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Fig. 2. Students write down the steps for solving problem number 3

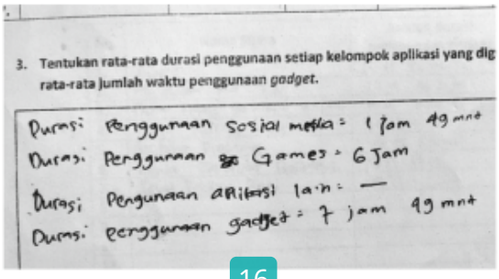

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Fig. 3. Students do not write down the steps for solving problem number 3

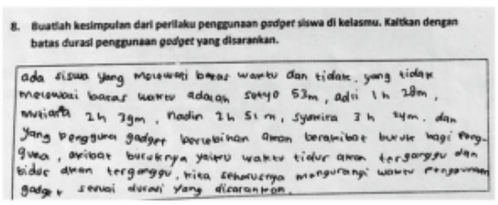

Fig. 4. Student's answer number 8

completion steps and 10 students wrote the steps to determine the average. As in Figs. 2 and 3.

3 In question number 4 students present the average of the 3 types of application groups in the form of a bar chart. Students are able to present data in the form of bar charts. In question number 5, all students did not experience difficulties and were able to sort the data on the duration of cell phone use starting from the highest to the lowest and rewrite the dam in the form of a table correctly. In questions number 6 and 7 students did not experience difficulties.

In question number 8 students conclude about the behaviour of students using gadgets in one class and relate it to the recommended time limit for using gadgets. All students wrote conclusions but there were 3 students who did not relate it to the recommended time limit for using gadgets. Figure 4 shows one student's answer to question number 8.

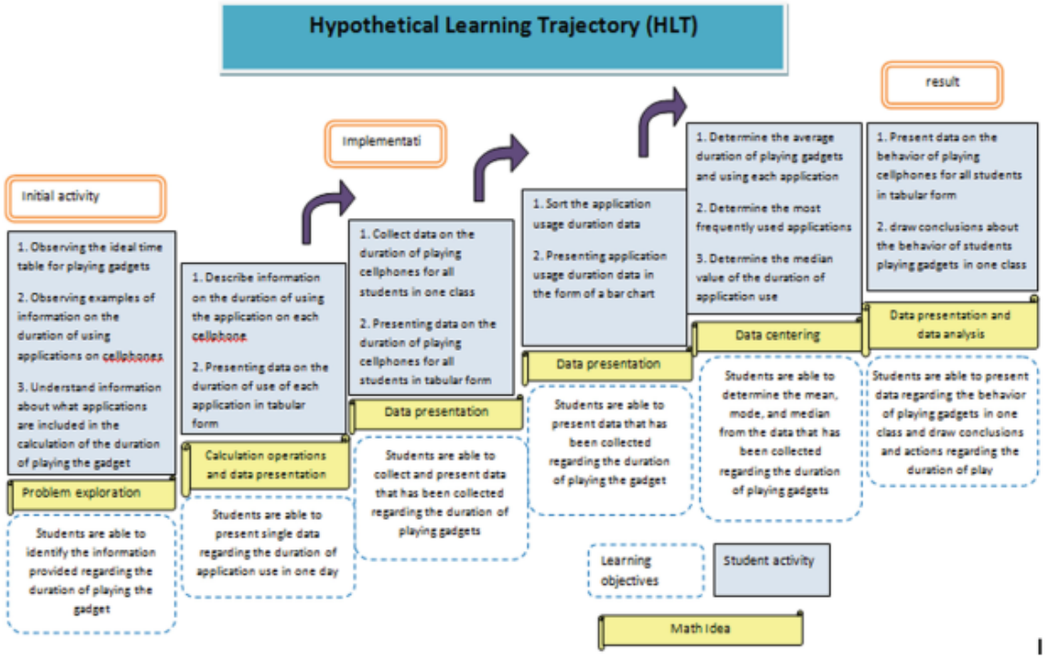

Fig. 5. Learning Trajectory Project-based blended learning

After carrying out project-based learning, the student's work was examined and got good results. This shows that project-based learning provides a good learning experience for students accompanied by student collaboration in learning. This is in accordance with the collaborative activities of lesson study which make students support each other to make progress for each individual in particular and the achievement of the whole group in general [13].

3.3 The Retrospective Analysis

After completing the pilot experiment cycle, the researcher conducted the retrospective analysis stage which aims to improve the quality of the hypothetical learning trajectory. The researcher decided that there were no changes made to the hypothetical learning trajectory to go to the teaching experiment cycle. Learning tools such as pre-test questions, lesson plans, lesson plans, teacher instructions, prerequisite materials, student project activity sheets, and hypothetical learning trajectories used in the pilot experiment cycle will also be used during the teaching experiment stage. Figure 5 shows learning trajectory of project-based blended learning on statistics material in class VIII.

The conjecture of students' thoughts on the activities carried out is shown in Table 1.

Table 1. Conjecture of students' thoughts on the activities carried out

Activities	Actual Learning Trajectory (ALT)
Observing the ideal time table for playing gadgets	• Students read the recommended time table for the recommended duration of gadget use for several age categories • Students understand the age limit for using gadgets according to their age
Observing an example of information on the duration of application usage on a cellphone	• Students observe examples of using cellphones • Students determine examples of using cellphones that exceed the recommended limit • Students identify the type of application that will be counted in the duration of cellphone use • Students make hypotheses about the use of their cellphones
Describing information on the duration of application use on their respective cellphones	• Students look for information on the use of their cellphones • Students present information on the use of their cellphones for one day in the form of pictures or writing
Presenting data on the duration of use of each application in tabular form	• Students know the data presentation material used in completing projects • Students identify groups of applications used on cellphones • Students add up the duration of cellphone use based on the application group on the cellphone • Students add up the duration of using gadgets in one day • Students present information on the use of cellphones in tabular form
Collecting data on the duration of playing cellphones for all students in one class	• Students in groups work together to collect data on student cell phone usage in one class • Students identify the application used based on the type of application on the cellphone
Presenting data on the duration of playing cellphone for all students in tabular form	• Students make tables to present data on student cell phone usage in one class • Students write down the duration of using each student's cellphone in one class

(*continued*)

Table 1. (*continued*)

Activities	Actual Learning Trajectory (ALT)
Determine the average duration of playing gadgets and the use of each application	• Students add up the duration of use of each type of application used by all students • Students calculate the average duration of use of each type of application • Students add up the duration of cell phone usage of all students in one class • Students calculate the average duration of student cell phone usage in one class
Presenting application usage duration data in the form of a bar chart	• Students classify the average duration of cellphone use based on the type of application used • Students present data on the average duration of use of each type of application used in the form of a bar chart
Determines the median value of the app usage duration data (median)	• Students sort the data on the duration of cellphone use from the highest to the lowest • Students rewrite the data on the use of cellphones that have been sequentially in the form of tables • Students determine the median data usage of cellphones
Determine the most used application (mode)	• Students write a list of applications used by all students in one class • Students determine the number of students who use each application • Students write down the usage data of each application in tabular form • Students determine the application with the most users in one class as the data mode
Presents the mean, median and mode in a table	• Students recap the mean, median, and mode of data that they have obtained • Students present the mean, median, and mode data in tabular form
Drawing conclusions about the behavior of students playing gadgets in one class	• Students draw conclusions from the activities they have done • Students relate the conclusions to the suggested gadget usage duration limit table • Students take action on the behavior of using students' cellphones in one class as an implementation of the project that has been done

4 Conclusion

From the results of the research and discussion, it can be concluded that the learning trajectory based on a survey of gadget playing behaviour in statistical material includes, among others, the initial activity stage; the learning objectives to be achieved are that students are able to identify the information provided regarding the duration of playing gadgets; the mathematical idea of the goal is problem exploration; The activities carried out by students are observing the information presented regarding the recommended ideal time limit for playing gadgets, observing information about the use of applications on gadgets, and observing information related to how to calculate the duration of playing gadgets according to the application used.

At the implementation stage; learning objectives to be achieved include students being able to present single data, collect data, present group data, determine the mean, median, and mode, as well as draw conclusions and actions regarding the behaviour of playing gadgets; mathematical ideas at the implementation stage are arithmetic operations, data presentation, central tendency, and data analysis; the activities carried out by students at the implementation stage include presenting data on the duration of application use on their respective cell phones, presenting data in tabular form, collecting data on the duration of cell phone use of all students in one class, presenting data on the duration of cell phone use of students in one class in the form of tables and diagrams., sorting the data on the duration of cell phone use, determining the average, median and mode of data for the duration of cell phone use for one class students, presenting the data in tabular form, and drawing conclusions and taking attitudes about the behaviour of using cell phones for students in one class. This is in accordance with Lesson Study learning procedures and project-based learning stages [13, 15].

Should be able to use and develop a project-based learning trajectory of gadget usage behaviour surveys in learning statistics material. Project-based learning with the LSLC system can be carried out on both online and online learning so that even in the distance learning period, learning can still run.

Obstacles in blended learning research include the number of student attendance when the online learning process is different from that of off-network learning. In addition, students' activities when discussing with groups were not recorded as a whole because many of the discussions they carried out were only private.

This research can be further deepened, such as ensuring student attendance, increasing student discussion activities carried out in groups in the provided groups, and conducting comparative tests regarding the effectiveness of project-based learning with other methods.

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Authors' Contributions. The first author designs the project, conducts the research and writes the report. The second and third authors provide the main conceptual ideas, technical, and research processes.

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