The effectiveness of the flipped classroom learning model with the assistance of learning videos on mathematics learning "Data" material

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Abstract: This research was conducted with the aim of finding out the effectiveness of the flipped class learning model in understanding mathematical concepts in class IV "Data" material in elementary schools. Based on existing phenomena, students still experience learning difficulties in elementary school mathematics lessons, especially in "Data" material. The research method used is the quasi-experimental method. The population taken was students in class IV of state elementary schools in Cimalaka and North Sumedang subdistricts, Sumedang Regency. The samples used were Sukamaju Elementary School as the experimental class and Karangpawulang Elementary School as the control class. The instrument used in this research is a test of the ability to understand mathematical concepts. The results obtained from three meetings were that mathematics learning could not be said to be effectively implemented using the flipped class learning model when compared with the conventional/lecture method.

Keywords: flipped class; learning model; mathematics learning

Introduction

The occurrence the condition of passive learners is what results in learning difficulties. Since instruction is teacher-centered (Goodyear & Dudley, 2015), students are only contributors when they don't engage in activities that encourage active learning (Chen & Yu, 2019). Teachers of mathematics need to use a diverse approach. Teachers must therefore be able to approach mathematics learning with more diversified and enjoyable learning models in order to eradicate the stigma that mathematics is difficult (Datnow & Hubbard, 2016; Lui & Bonner, 2016). As a result, an educator may find that the flipped class approach is a useful tool for achieving learning objectives.

According to (Bergmann, J., & Sams, 2012), “The basic idea behind the flipped class is that homework that was previously completed in class is now completed at home, and what is usually done as homework is now done in class.” This means that the basic concept of the flipped class learning model is a learning program that is usually done in class and can be completed at home, and learning activities that are usually done at home can be completed in class.

In this flipped class learning model, applying the concept of “flipped class” means that not only does it include activities that are usually carried out in class and at home, but there is also a certain syntax that will bring out several attitudes and characters caused by students’ learning activities such as collaborative learning (Wu et al., 2017), independence (Fajri et al., 2021; Zainuddin & Perera, 2017) and critical thinking (Cevikbas & Kaiser, 2020; Strohmyer, 2016).

In accordance with the opinion of Bawaneh & Moumene (2020; Rehman & Lakhan (2021) stated that the flipped class is a way of learning process that minimizes learning activities in the classroom by maximizing mutual interaction between teachers, students and the environment. This model is not just about learning who use videos in learning, but there is more emphasis on utilizing time in class to optimize students’ ability to understand concepts (Bhagat et al., 2016) and improve their cognitive abilities (Sergis et al., 2018; Shi et al., 2020).

In order to help students learn mathematics, educators need to prepare effective learning media to increase students’ understanding of mathematical concepts (Dwijayani, 2019; Warner
and Kaur, 2017), namely by providing learning videos. Videos can be used in learning materials that are in the behavioral or psychomotor realm (Sunardi et al., 2023). However, video details from slide to slide may be lost. Most student participants think that learning using videos is easier than through books or texts (Bajrami & Ismaili, 2016; Scagnoli et al., 2019). Video shows can depict the actual situation of an object, phenomenon, or event which can help broaden exposure and insight (Bajrami & Ismaili, 2016; Long et al., 2016). The development of students’ mentality in learning needs to be paid attention to, especially at the elementary school level which is in the concrete operational stage (Blodgett & Lanigan, 2018; Chu et al., 2015; Yeager & Dweck, 2020). Tutoring starts with training students directly with the help of image media until students are able to use abstract symbols.

Learning using videos has many advantages that students need (Akdemir et al., 2015; Arnavutt & Özdamli, 2016) including being able to increase the social interactions that students build when watching videos and explaining the material explained in the videos (Yousef et al., 2014), can access unlimited information through various tools that support video and can be accessed at any time when needed (Distasio, 2016), provide learning space for individuals so that students can better enjoy innovative learning processes that encourage them to be involved (Stanic, 2014), improve motivation and concentration when receiving lessons due to the combination of audio and images that explain each other (Kelly, 2015).

The disadvantage of video media is that it requires expensive costs and complete equipment (Al Rawashdeh et al., 2021), parents need to spend more to support this learning process, they need skills to edit videos so it requires more additional time (Michael, 2015) the time used is usually only to repeat the material and teaching, but with this method, the teacher needs to think about the plan and process of making this video, control ventilation for students whose motivation is low (Sondermann & Merkt, 2023), a learning method that may not be liked by all students so it becomes an obstacle for some of them (Puspaningtyas & Ulfa, 2020).

From the description above, the concept of material packaged in the form of moving images must make it easier for students to understand the material. Therefore, a content creator or educator who creates it needs to pay attention to the language used, the symbols or symbols that appear, the size of the letters and images that of numbers or symbols. So, data is true and real information that can be used as a basis for study attract the attention of students (Almurashi, 2016; Brame, 2015), because elementary school students usually prefer display the images in color and decorated with children’s animations so that students will be more interested in watching learning videos (Goyal et al., 2017; Perazzi et al., 2017). However, this does not eliminate the aim and purpose of the video, namely to help the learning process.

Mathematics learning activities are always tied to numbers or symbols and rely more on logic, analytical, systematic, and orderly thinking (Doran, 2017; Ferreira, 2015; Hawes & Ansari, 2020; Stewart & Tall, 2015). Therefore, learning mathematics is often associated with difficult learning and students who find it difficult to receive or retain information (Widodo, 2018; Zhang et al., 2015) so it requires a learning flow that can attract students’ attention. The flow of learning activities is presented in a learning model also called syntax (Hartsuiker & Bernolet, 2017). Learning syntax means a way to connect learning components. The syntax in the learning model is conditional depending on learning needs (Resnick, 2020). So learning activities can be influenced by the situation and conditions when learning takes place which requires educators to develop their creativity in teaching.

Considering that the role of understanding mathematical concepts is very important (Simon, 2017; Vergnaud, 2016), serious attention is needed in the process of increasing the ability to understand mathematical concepts, especially at the elementary school level. Because there are quite a few research results that examine mathematics learning in an effort to achieve conceptual understanding, it is believed by most people that achieving understanding and meaning in mathematics is not easy (Riccómini et al., 2015; Torbeyns et al., 2015). The ideal learning method for improving students’ mathematical understanding and communication skills is by using reality-oriented learning and activities related to daily life (Verschaffel et al., 2020) needs to pay attention to students’ cognitive and mental development so that the environment can also support the learning process (Boaler, 2015; Niklas et al., 2016).

In society’s social life, mathematics can be used with the hope that people who study it can think rationally and logically in facing challenges in society (Genc & Erbas, 2019; Umbara et al., 2021). The teaching material presented is about “Data”, this material is taught in class IV in mathematics. Data itself is information obtained from observation or research collected in the form Students are taught how to collect and present data in diagram form. This requires students to...
understand mathematical concepts in order to be able to solve mathematical problems. Therefore, researchers chose a flipped class learning model with video assistance to help students understand the material.

**Method**

Judging from the method of research, the researcher deliberately provides treatment, and then examines the consequences, so this research is considered experimental research. Experimental research is a detailed and planned research method to determine the effect of treatment of a certain variable on other variables without treatment under controlled conditions (Gile, 2015; Ledyard, 2020). Therefore, experimental research has two elements, namely a control group and an experimental group (Campbell & Stanley, 2015). The control group is the group that was not treated, while the experimental group is the group that was treated. In the experimental group, researchers were given treatment in the form of a flipped class learning model with the help of learning videos, while in the control group, it was not given (conventional/lecture method).

Next, the research process will be observed to determine the differences or influences that occur in the experimental group. Apart from that, through this research, it is hoped that we can find out the effectiveness of the flipped class learning model assisted by learning videos on elementary students’ understanding of mathematical concepts. The type of experiment used in this research is quasi-experimental or quasi-experimental.

Quasi-experimental research aims to obtain information obtained through actual experiments under circumstances that do not allow for control or manipulation of all relevant variables. Researchers only controlled certain variables, namely the flipped class learning model with learning videos and understanding mathematical concepts. In a quasi-experiment or quasi-experiment, measurements are carried out using research instruments. The research instrument is a data collection tool. Useful instruments for collecting data in the field.

**Result**

When the average pretest score for students in the experimental class was analyzed, it showed that on average they understood mathematical ideas with a score of 48.74, whereas in the control class, it was 34.11. The pretest score data in the experimental and control classes showed a difference in the mean score and the probability value (sig.) = 0.003 < 0.05, according to the mean difference test results. This indicated that the experimental class started off with superior skills than the control group. The table that follows shows this.

<table>
<thead>
<tr>
<th>Class</th>
<th>The Number Of Students</th>
<th>Value Range</th>
<th>The Highest Score</th>
<th>Lowest Value</th>
<th>Grade Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>30</td>
<td>0-100</td>
<td>78</td>
<td>19</td>
<td>48.74</td>
</tr>
<tr>
<td>control</td>
<td>23</td>
<td>0-100</td>
<td>63</td>
<td>0</td>
<td>34.11</td>
</tr>
</tbody>
</table>

After the second class was given treatment, the average posttest score for understanding mathematical concepts for students in the experimental class was 62.67 and in the control class also increased, namely 46.74. The data collected in this study was not normally distributed so the Mann Whitney U-test analysis was used. The conclusion from the results of the mean difference test using the Mann-Whitney U-test shows that the results of the posttest scores in the experimental class and control class can be determined to have a big value. 0.004 means less than α in the sense that H_0 is rejected, which means there is an average difference between the post-test scores in the experimental class and the control class. The above has been tested and obtained results as in the following table.

<table>
<thead>
<tr>
<th>Class</th>
<th>The Number Of Students</th>
<th>Value Range</th>
<th>The Highest Score</th>
<th>Lowest Value</th>
<th>Grade Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>30</td>
<td>0-100</td>
<td>97</td>
<td>31</td>
<td>62.67</td>
</tr>
<tr>
<td>control</td>
<td>23</td>
<td>0-100</td>
<td>88</td>
<td>25</td>
<td>46.74</td>
</tr>
</tbody>
</table>

Improve the results of students' understanding of mathematical concepts, it can be seen from the results of the Mann-Whitney U-test which shows the sig value. 0.699 means more than α in the sense that H_0 is accepted or there is no difference in the average between the N-gain values in the experimental class and the control class. So, based on the test results in the n-gain value analysis test, it can be concluded that there is no significant difference in increasing students'
understanding of mathematical concepts in the experimental class and the control class. In the experimental class, the average n-gain value was 0.23, while in the control class it was 0.196.

Table 3. Statistical test results for N-gain values in the experimental class and control class

<table>
<thead>
<tr>
<th>Class</th>
<th>N</th>
<th>Average</th>
<th>Levene’s Test of Mean Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>30</td>
<td>0.230</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>23</td>
<td>0.196</td>
<td>There is no difference in the average n-gain value in the experimental class and control class</td>
</tr>
</tbody>
</table>

Table 3 demonstrates that there is no discernible difference in the conceptual knowledge of students who study using the flipped class method and students who study using the traditional way. This indicates that despite using differing teaching strategies, the two classes are conceptually equivalent. Students noticed a boost in their knowledge of mathematical ideas, despite the fact that the rise was rather small in both the experimental and control classes.

Discussion

When a method is inappropriate for the needs of students at a school, it may result in conceptual knowledge that is not appreciably different between students who study using the flipped classroom method and students who study using traditional methods. This is due to there are students who are not suited to learning using videos (Kinnari-Korpela, 2015). Flipped classes can be run well if all students have good motivation to learn mathematics (Shi-Chun et al., 2014). Without motivation, flipped class learning will seem boring and unacceptable to all students. Apart from that, students who study with flipped classes do not utilize study time in class effectively compared to conventional classes (Wasserman et al., 2017).

Not all learning methods are suitable for application in every class. Students’ abilities vary greatly in each class so not all methods can be applied in that class (Harandi, 2015; Leong & Ahmadi, 2017). This is caused by the level of students’ ability to absorb information and students’ ability to understand mathematics. Choosing an appropriate method is very necessary to create effective learning. So it requires more information about students’ abilities through observation and interviews. Only then do a pretest and provide treatment according to the student’s needs.

Apart from inappropriate methods, the lack of significant average differences between flipped and conventional classes can also be caused by the presentation of material that is difficult for students to understand in the video (Yildirim & Kiray, 2016). Missing information can damage students’ flow of understanding. Therefore, the video recording process requires a complete script to predict and explain questions that may arise in students’ minds.

Writing scripts can minimize information that is not conveyed so that students are able to bridge the thought process to understand mathematical material. Lo & Hew (2020) revealed that innovative mathematics learning will have a better impact compared to conventional learning, so there is a need for strategies that can make students learn and apply their learning results to everyday life. This research is limited to “Data” material and examines understanding of concepts. So that for further research development, the flipped class learning model can be applied to different materials and other levels.

This section is the core and most important part of the contents of the manuscript that will be loaded for publication. The discussion section is intended to interpret the results of the study in accordance with the theories used and not merely explain the author’s founding. The discussion must be enriched by referring to the results of previous studies published in scientific journals or findings from international studies. It is advisable to integrate findings into a collection of theories or established knowledge, development of a new theory, or modification of existing theories. A conceptual framework needs to be made clear to get the appropriate discussion.

Conclusion

It may be stated that while students using the flipped class learning model with the aid of learning videos have a greater knowledge of mathematical ideas, the model’s efficacy cannot be compared to learning via traditional techniques. because there is no discernible difference between the experimental class and control class according to the average n-gain difference test results. Comparatively little has changed in the mathematical ideas that students in the experimental class—which employs the flipped class learning model—and the control class—which employs traditional methods—understand.
Disclosure statement

No potential conflict of interest was reported by the authors.

References


