JOURNAL LA EDUSCI

VOL. 02, ISSUE 01 (028-034), 2021
DOI: 10.37899/journallaedusci.v2i1.366

Problem Based Learning Model Effectiveness in Improving Learning Achievement of Class X MIA Students on Newton's Law II Material in Offline and Online Learning

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Article Info

Article history:
Received 13 April 2021
Received in revised form 18 May 2021
Accepted 27 May 2021

Keywords:
Problem Based Learning
Online Learning
Learning Achievement

Abstract

This study aims at investigating the effectiveness of Problem Based Learning in enhancing students' achievement. The design of this research is that of a quasi-experimental kind. The information was collected from two different courses that were both at the same grade level and covering the same subject. The data that was compared came from a variety of historical periods. The control group was recruited before to the outbreak, while the second group was recruited via an online learning session after the pandemic had begun. A pre-test is administered to see if any of the students have previous knowledge of the subject matter that will be taught. Pre-testing may also be thought of as an activity that is used to assess the level of knowledge of the students prior to the delivery of the learning activities itself. The results of the study suggest a slight difference when students are taught using PBL with online and offline learning. There is a conspicuous challenge in online learning due to teacher's and students' customization to online learning.

Introduction

PBL (Problem-Based Learning) is an educational paradigm that is very successful in teaching higher-order thinking processes (Nabilah et al., 2019; Kim et al., 2018). We attempted to integrate online-based PBL learning paradigms into our study in order to address classroom-based learning problems. Online education is intended to function effectively despite the absence of face-to-face interaction.

Despite the fact that it is done online, it is expected that internet-based PBL (Problem Based Learning) would be able to address learning problems by using students' problem-solving abilities in fundamental Newton II law topics encountered in everyday life. Given the above, it is worthwhile to investigate if the online-based PBL learning paradigm may assist students improve their problem-solving abilities. PBL is divided into the following stages: 1) alerting students to pertinent problems 2) problem-solving and data collection 3) information gathering/independent investigations 4) the process of producing and presenting work; and 5) the process of reviewing and assessing work. So that teachers and students may refer to this research while learning the substance of Newton's second law.

The constraints of online learning include the fact that not all children have access to the internet while their parents work, that not all parents are technologically savvy, and that it takes time for children to adapt to changes in the learning process. Inadequate network connectivity, inability of teachers to monitor student progress, and parental monitoring (Grant et al., 2015). Alternative solutions to classroom learning problems were explored by combining online-based but not face-to-face PBL learning paradigms. Problem-based learning is a method of instruction that utilizes issues and forces students to seek out information in order to resolve

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

them (Alamro, 2014). Additionally, PBL was created to help students in improving their conceptual understanding of information and problem-solving skills by connecting them to real-world scenario situations (Akcay, 2009). Students' problem-solving abilities were evaluated using the results of an online classroom action research project. During Cycle I, the researcher used the PBL technique to a Whatsapp group and Google Classroom. Lesson plans, teacher and student observation sheets, Newton's Law II materials, and learning facilities were created by the researchers. The researcher started by reviewing the course plan in a WhatsApp group and then gave pre-test questions through Google Classroom. The educational materials are delivered through audio-enhanced PowerPoint presentations (Pastore & Ritzhaupt, 2015). Due to the problem-solving nature of learning, the researchers conduct the learning process through whatsapp groups by providing issue simulations.

Consider a toy car as an example of Newton's second law. When you pull on the toy vehicle, it will begin to move. The more force you apply to the accelerator, the faster the car accelerates. This corresponds to the axiom "The larger the applied force, the greater the acceleration." Newton's second law addresses the link between an object's constant force and the resulting acceleration, as well as the relationship between an object's mass and the resulting acceleration.

To date, PBL has been the most often used method of teaching in Mathematics and Natural Sciences (MIA). However, since the COVID-19 pandemic started, all forms of education have shifted away from face-to-face teaching toward remote instruction. As a consequence, this study examines the effect on physics subjects of direct and online learning media that use a PBL strategy.

The results of this study will help in comprehending the effect of combining online and offline learning within a certain instructional style. Is it true that the use of different media generates outcomes that are radically disparate? Additionally, the results of this study will serve as a guide and point of reference for researchers creating PBL forms for use with various instructional media.

Methods

This study makes use of a quasi-experimental design. The data were gathered from two distinct classes with the same grade level and the same content. The data that were compared were from various eras. The control group was recruited before to the epidemic, while the second group was recruited during online learning after the outbreak. A pre-test is conducted to see if any of the pupils have prior knowledge of the subject to be taught. Pre-testing may also be understood as an activity used to determine the students' level of knowledge before to the delivery of the learning activities. Pre-testing activities are performed prior to the delivery of the learning activities. The purpose of the pre-test is to ascertain the pupils' initial capacity to comprehend the courses being given. If the teacher is aware of the students' initial abilities, he or she can plan how the lesson will be delivered later. Posttest assessment is a type of inquiry used after classes to determine the degree of problem-solving skills after therapy. The post-test is a summary. A sample paired test was used to infer the significance of the pre- and post-test findings from the experimental and control groups. To compare the means of the two groups, descriptive statistics were used.

Results and Discussion

Table 1. Pretest and Post Test Results of Control and Experimental Group

Control Group			**Experimental Group**		
No	Pretest	Post Test	No	Pretest	Post Test

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

1	75	78	1	75	77
2	74	76	2	75	78
3	70	80	3	78	80
4	76	76	4	76	80
5	80	85	5	75	78
6	81	84	6	78	80
7	76	76	7	76	78
8	76	78	8	75	79
9	75	79	9	60	78
10	78	80	10	76	80
11	82	85	11	65	76
12	69	79	12	78	80
13	78	78	13	87	89
14	65	76	14	67	70
15	78	79	15	76	77
16	77	79	16	81	82
17	79	80	17	67	78
18	80	87	18	78	80
19	77	83	19	78	85
20	78	80	20	67	78
21	77	78	21	78	80
22	75	78	22	76	80
23	76	78	23	76	80
24	76	87	24	78	80
25	71	78	25	65	70

To better illustrate the study results of the control and experimental group, below is a visual image of the average score results.

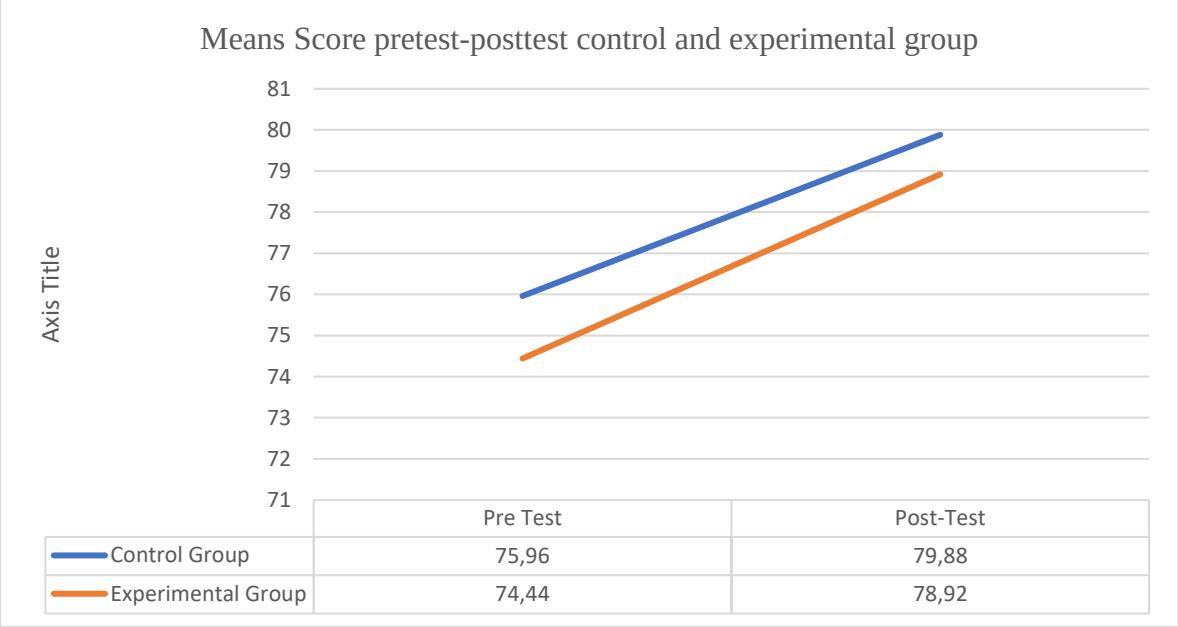

Figure 1. Means Score pretest-posttest control and experimental group

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Statistical Results

Table 2. Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Pre_test_Control Group & Post_Test_Control	25	.534	.006
Pair 2	Pre_Test_Experimental & Post_Test_Experimental	25	.735	.000

Source: Data Processing, 2021

The aforementioned statistical result for the control group shows a sig. value of.006 (>0.005), indicating a negative correlation between the pre- and post-test results for the control group. This implies that when students are taught utilizing problem-based learning in a face-to-face setting, there is a noticeable difference. While the distant learning signature findings indicate a positive connection, this indicates less effective learning.

Table 3. Paired Samples Test

		Paired Differences					**t**	**df**	**Sig. (2-tailed)**
		Mean	**Std. Deviation**	**Std. Error Mean**	**95% Confidence Interval of the Difference**				
					Lower	**Upper**			
Pair 1	Pre_test_Control Group - Post_Test_Control	-3.92000	3.51094	.70219	-5.36924	-2.47076	-5.583	24	.000
Pair 2	Pre_Test_Experimental - Post_Test_Experimental	-4.48000	4.10406	.82081	-6.17407	-2.78593	-5.458	24	.000

Source: Data Processing, 2021

Both pairings indicate statistically significant findings for face-to-face and distance learning, respectively, with a sig. (2-tailed) value of 0.000 (0,0005). This result should take the paired samples correlation test into account, since it indicates a small difference in outcome.

Table 4. Descriptive Statistics

	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Pre_test_Control Group	25	65	82	75.96	3.867
Post_Test_Control	25	76	87	79.88	3.346
Pre_Test_Experimental	25	60	87	74.44	5.980
Post_Test_Experimental	25	70	89	78.92	3.763
Valid N (listwise)	25				

Source: Data Processing, 2021

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

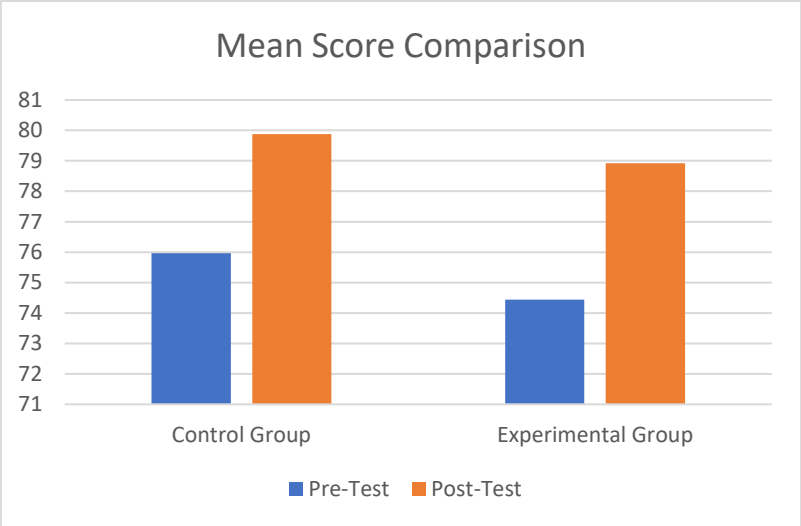

Figure 2. Mean Score Comparison

As seen in the figure and statistical findings above, although the experimental group indicates poorer post-test results, the control group indicates a mean distance value of 3,92, while the experimental group indicates a mean distance value of 4,48. This finding shows that, despite the fact that Problem-Based Learning (PBL) is conducted through remote education, it is still deemed successful in terms of student performance.

However, the study's findings cannot be accepted at face value. Numerous instances may result in the kids' academic success.

Although the findings of distance learning imply a relatively large gap score, in practice, the study's results should indicate the same score level owing to the same treatment and content but with a different learning environment. This implies that remote education is a challenge for both teachers and students in terms of teaching and learning activities.

Online Education Has an Impact on the Efficacy of Instruction

Online education is a kind of education that aims to simplify learning methods via the use of the internet (Romero et al., 2009). As a consequence, distance and time become irrelevant. The online learning process demonstrates how technological advances in the field of information impact education through educational media. The purpose of online learning is to address the problem of space and temporal separation between students and instructors through computer-mediated communication that occurs over a very long distance and at a distant location (Bower et al., 2015). Students may still access learning materials created via learning designs and made available through school-provided internet sites in this situation. As a consequence, the online learning system must adhere to rigorous preparation procedures and must not let students to leave the system. The next part explains how the online lesson should be conducted. A web-based lesson prepared using a learning management system. The distance learning system has an extraordinary level of media development, since it is one of the factors that influence the selection of an effective learning medium and therefore the overall quality of student learning.

The Difficulty and Ease with which Teachers and Students Can Engage in Online and Offline Learning

Mehdipour & Zerehkafi, 2013) Individuals are growing increasingly interested in e-Learning (distance education) for a variety of reasons, including the following: For students, this means that they can interact with teachers, friends, and educational materials without regard for

ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)

distance or time constraints; they can communicate with their teachers via e-mail; and they can more easily access the internet if they require additional information about the material they are studying. The roles of students are being transformed from passive to active. For educators, the internet allows them to monitor and control their students' learning activities; educators may also use planned and scheduled teaching materials or online learning instructions to encourage conversation with students. The educational process: the availability of e-moderating tools that allow instructors and students to interact quickly and often through the internet, regardless of distance, geography, or time restrictions; e-learning may deliver courses in an interesting way (Roe et al., 2010). Meanwhile, advances in online education are improving learning experiences by communicating information via the use of text, audio, video, and animation. Activities for teaching and learning become more flexible, enabling them to occur anywhere and at any time. Teachers may provide materials and worksheets through chat applications such as WhatsApp or Gmail, which are available from any place and at any time, regardless of time or space restrictions (Alamer & Al Khateeb, 2021).

The challenges associated with online education for students: individuals who lack a strong desire to study often fail (Becker, 2017). Concerning educators: the change in educators' responsibilities from mastery of conventional learning techniques to understanding of ICT-based learning methodologies; a scarcity of individuals with online knowledge and skills. Throughout the academic year The learning process, as well as a lack of contact between instructors and students, or even amongst students themselves, may all obstruct the development of values throughout the learning and teaching processes. a tendency to ignore academic or social responsibilities in favor of business/commercial development; a teaching and learning process oriented around training rather than education; not every place has I Students and instructors have less interaction; certain types of e-learning are one-way. This decreases teacher-student interaction, making it more difficult to get further explanations for difficult-to-understand concepts.

Conclusion

Problem-Based Learning (PBL) is conducted through remote education, but the study's findings cannot be accepted at face value. The control group indicates a mean distance value of 3,92, while the experimental group indicates 4,48. This implies that remote education is a challenge for both teachers and students in terms of teaching and learning activities. In practice, the results should indicate the same score level owing to the same content but with a different learning environment. The result of the study suggests that there is a slight difference when using PBL in offline learning with online learning.

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ISSN 2721-0979 (Print), ISSN 2721-1258 (Online)