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RESEARCH ARTICLE

The Impact of Multi-Stage Discussions Using Google Classroom and WhatsApp on Higher Order Thinking Skills in Learning Newton's Law of Gravity

Rohantika Zainah*

Madrasah Tsanawiyah Pondok Pesantren Tahfidz Al Quran Assalaam, Indonesia

**Corresponding Author, E-mail: rohantikaz@gmail.com*

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Abstract

Online learning utilizes internet networks to provide accessibility, connectivity, and flexibility. One innovative approach is employing multi-stage discussion learning models through platforms like Google Classroom and WhatsApp. This model is particularly effective in enhancing students' higher-order thinking skills (HOTS). This study investigates the impact of implementing multi-stage discussions using Google Classroom and WhatsApp on the HOTS of 10th-grade students studying Newton's Law of Gravity at SMAN 1 Tanjung Raja. The research adopts a quasi-experimental method with a matching-only posttest control group design, involving 35 students in the experimental class and 36 students in the control class over three sessions for each class. Pretest results showed a similar baseline between the two classes, with a difference of 9.1%. However, post-test results revealed a 15.9% difference, with the control class improving by 16.5% and the experimental class by 41.5%. The N-gain scores were 0.42 for the control class and 0.54 for the experimental class, both in the moderate category. Normality tests indicated that all data were normally distributed ($p > 0.05$), and homogeneity tests showed no significant difference ($p = 0.264$). The independent t-test hypothesis test revealed a significant effect ($p < 0.05$) with t_{count} 97.158 > t_{table} 1.995, indicating that the multi-stage discussion model using Google Classroom and WhatsApp significantly influences the learning process and enhances HOTS. These findings suggest that integrating digital platforms in learning can effectively improve students' critical thinking and problem-solving abilities.

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INTRODUCTION

Education provides a platform for realising one's dreams and aspirations in the world of work; it also helps us become aware of the things we do not know and helps us change as individuals (Hardiaman, 2020). According to Sari (2017), education is an intentional and methodical endeavour to establish a learning environment and process that will enable students to develop the necessary skills as well as a spiritual, religious, controlled, reasoned, and noble personality for themselves, society, and the country.

The education of its citizens can influence the success of a country. Through education, humans are expected to become better people in all aspects of their lives and develop according to their abilities. Education is an effort to prepare humans through guidance, education, and training activities that are expected to be useful for future roles (Agustiana et al., 2018). Education is usually closely related to learning. Learning activities are an interactive educational process between students and educators, with the aim that students can develop knowledge with extraordinary personalities and play an active role in all learning. Learning is essentially a conscious effort made by the teacher to teach students to achieve the expected goals (Tama et al., 2018). Educators are known to be experts when they can master and understand the learning model of the learning material given to their students.

Online learning refers to education that takes advantage of the internet network to provide accessibility, connectivity, flexibility, and the capacity to design different kinds of learning experiences. Zhang's research demonstrates that the internet and multimedia technologies can revolutionise the way information is disseminated and can serve as a substitute for traditional classroom instruction (Herliandry et al., 2020). Online learning refers to any type of learning that uses the internet to facilitate interactions between teachers and students.

Mobile devices that can be used to access information anywhere at any time, such as laptops, tablets, and smartphones, are necessary for the adoption of online learning. Mobile technology use plays a major role in education, helping to meet the objectives of distance learning. The utilisation of various media can aid in the execution of online learning as well. For instance, using instant messaging services like WhatsApp and online learning environments like Google Classroom, Edmodo, and Schoology. It is even possible to learn online via social media platforms like Facebook, Instagram, and WhatsApp. There is a strong correlation between the rapid growth of Information and Communication Technology (ICT) and the rise of internet users in Indonesia. In 2018, 20.05% of Indonesian households possessed a computer, and 62.41% of the country's population owned a smartphone. This information is pertinent to the study's findings, which show that while some students do not have access to computers, the majority of students do have cell phones, which they may use to access apps like WhatsApp, Google Classroom, Zoom, and more. In 2020, Herliandry et al.

Based on the pre-research results, it shows that many students in Grade X Science 1 and X Science 2 at SMAN 1 Tanjung Raja scored below the school's minimum standard on the pre-research physics test. The school uses the 2013 curriculum, which sets the minimum standard score at 70. Among the 54 students in both classes, only 5 students (8.5%) scored above 70, while 49 students (92.6%) scored below 70. This indicates that the learning process has not been maximised. The main reasons for this are that students

struggle with higher-level mathematical thinking, especially when solving essay questions, and student learning motivation is low, influenced by their middle to lower intellectual abilities. Additionally, there is a lack of interest and difficulty in lessons without face-to-face interaction. Furthermore, the school environment, particularly the facilities and infrastructure, is inadequate as learning facilities are still lacking. This situation highlights the need for improvements in the learning process to enhance students' HOTS.

In other words, teaching and learning activities that are not as effective as helping in the learning process are still teacher-centric. Various challenges arise as educators are ready to implement problems in the field, such as students having access to online learning courses with limited existing infrastructure. The difficulty of online learning is that students still have difficulty using cell phones because the cell phones are sometimes used alternately by their siblings or family. However, what is good is that with the implementation of online learning at home, teachers need to be more innovative in the preparation of learning stages. This pedagogical change will adapt to online learning from face-to-face learning in the classroom as well as teachers and students (Herliandry et al., 2020).

Facing the covid-19 pandemic which requires the learning process to be done remotely / online forces all educators to choose learning media that can be done online. One of the things that has been done is to innovate learning by using multi-stage discussion learning models using media such as Google Classroom and WhatsApp. The multi-stage discussion learning model is very appropriate to use to develop the quality of HOTS of students. In addition, this model can obtain quality data in a short time, very suitable for solving local and specific problems. In this learning model, educators can direct students to be able to solve the problems given by discussing them with their friends. During learning, educators can direct students to form groups with their friends in the learning process. They can discuss and exchange ideas when learning takes place and there is a question and answer between other groups.

In addition to the right learning method, the learning media used in the learning process plays an important role in the success of the teaching and learning process. Google Classroom is a blended learning platform for any educational setting that is intended to find a way around the difficulties of creating, sharing, and classifying paperless assignments (Herliandry et al., 2020). Besides Google Classroom, the media that can be used in the learning process is WhatsApp. WhatsApp is a chatting application that is useful for sending text messages, images, sounds, locations, and even videos. However, a study conducted by Suparman et al. (2022) shows that Google Classroom has a positive and significant effect on learning activities, while WhatsApp does not.

Online learning tools with Google Classroom and WhatsApp using multi-stage discussion learning methods have their respective advantages and disadvantages in helping to improve students' HOTS (Herliandry et al., 2020). For this reason, this study aims to determine the effect of Multi-stage discussion with Google Classroom and WhatsApp in learning Newton's law of gravity on HOTS of students at SMAN 1 Kalirejo Grade X.

METHOD

In order to test the hypothesis of a causal form through treatment and evaluate the changes brought about by the treatment, this study used a quasi-experimental method. The matching-only posttest control group design was the research strategy employed in this study (Hamdi & Baharuddin, 2014). From April to August 2020, SMA Negeri 1 Tanjung Raja served as the research site for this study. The study's population consisted of all Grade X Science students, and the sample was split into 35 experimental and 36 control participants. A questionnaire with a total of 15 items was used for data collection, and the n-gain, normality, homogeneity, and t-test tests were used for hypothesis testing during data analysis.

Research Design

This study used a quasi-experimental design to investigate the effect of multi-stage talks using Google Classroom and WhatsApp on students' HOTS, with a matching-only posttest control group. The design was used to enable a clear assessment of the intervention's efficacy by comparing the results between an experimental group that got the multistage discussion learning method intervention and a control group that did not.

Population and Sample

The population for this study consisted of tenth-grade students at SMAN 1 Tanjung Raja. A purposive sampling technique was used to select two classes: one as the experimental group (35 students) and the other as the control group (36 students). The selection ensured that both groups were comparable in terms of academic performance and other relevant characteristics at the outset of the study.

Data Collection and Instrument

Data were collected using a combination of pretests and posttests designed to measure students' HOTS in the context of learning Newton's Law of Gravity. The tests included questions that assessed various levels of cognitive skills, such as analysis, evaluation, and creation, based on Bloom's taxonomy. Quantitative data were obtained by administering pretest and posttest questions, which consisted of 15 descriptive questions aimed at evaluating students' HOTS. Prior to their use, the instruments underwent validity and reliability testing. The questions were deemed valid with a value of r count > r table 0.632. Additionally, the reliability of the instrument was confirmed with a Cronbach's Alpha of 0.848, indicating a high level of reliability. Student engagement and participation were also monitored through their interactions in Google Classroom and WhatsApp discussions.

Data Analysis

The data were analysed using statistical methods to determine the effectiveness of the intervention. Normality tests ($p > 0.05$) were conducted to ensure that the data were normally distributed. Homogeneity tests ($p = 0.264$) confirmed comparable variances between the groups. An independent t-test (Sig. 2 = 0.000) was used to assess the significance of the differences in HOTS improvement between the experimental and control groups. N-gain scores were calculated to quantify the magnitude of improvement in each group, with results indicating moderate gains for both.

RESULT AND DISCUSSION

The control class and experimental class had three sessions in the study stages. During the first meeting, each class used a traditional learning model and completed a pretest questionnaire. During the second meeting, the researchers used a multi-stage discussion approach to teach Newton's Law of Gravity. The experimental class used Google Class and WhatsApp, whereas the control class used traditional learning methods. The researcher gave each experimental class and control class a posttest at the third meeting after reflecting. The following are the findings of the pretest and posttest.

Table 1. Average n-gain of pre-test and post-test results

Class	*Pretest*	*Posttest*	Improved	N-Gain	Categories
Control	39.1	55.6	16.5	0.42	Medium
Experiment	30.0	71.5	41.5	0.54	Medium

The pretest and posttest outcomes between the experimental class and the control class in studying Newton's law of gravity on high-level thinking skills are both in the medium group, according to the N-Gain data above. There was a 41.5% increase in the experimental class and a 16.5% increase in the control class. This indicates that there has been a 25% increase in the experimental class's use of the Multi-Stage discussion approach with Google Classroom and WhatsApp to teach high-level thinking abilities in physics disciplines, including Newton's law of gravity. The SPSS 21 software was used to analyse the normalcy test findings. The following are the outcomes of data processing:

Table 2. Normality test

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Class	Statistic	df	Sig.	Statistic	df	Sig.
Results	Experiment	.119	35	.200*	.952	35	.131
	Control	.164	36	.115	.939	36	.067

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

The results obtained in the experimental class Significance value p = 0.131, so p > 0.05, and in the control class Significance value p = 0.067, so p > 0.05, based on data processing using the SPSS 21 program, lead to the conclusion that the sample originates from a normally distributed population. According to study by (Kartika, E. 2021), all data>0.05, Ho is accepted, indicating that all data is normally distributed. This is based on the outcomes of the normality test of pretest and posttest scores as well as the average n-Gain in the control and experimental classes. The variance of the experimental class post-test and control class post-test groups is the same or homogeneous, according to the findings of the homogeneity test of the two classes, which had a significance of 0.264 > 0.05. Consequently, it is possible to meet the independent sample t-test requirements. The SPSS 21 software was used to analyse the homogeneity test findings. The following are the outcomes of data processing.

Table 3. Homogeneity test

		Levene Statistic	df1	df2	Sig.
Result	Based on Mean	18.922	1	69	.324
	Based on Median	15.514	1	69	.324
	Based on Median and with adjusted df	15.514	1	44.97	.328
	Based on trimmed mean	17.928	1	69	.324

The experimental class post-test group's variance is the same as the control class post-test group's, according to the findings of calculations made with the SPSS 21 program. The sig. based on the Mean is 0.324 > 0.05. Consequently, it is possible to meet the independent sample t-test requirements. The following are the findings from this study's independent test processing:

Table 4. Independent sample t-test

		t-test for Equality of Means		
		t	df	Sig. (2-tailed
Results	*Equal variances assumed*	17.018	69	.000
	Equal variances not assumed	17.200	45.412	.000

Since the independent sample test value is known to be 0.000 <0.05 based on the output above, Ha can be accepted when using this information as the foundation for the independent t-test decision-making process. Thus, it can be said that the experimental class and the control class learnt Newton's law of gravity on HOTS using a significantly different average multi-stage discussion technique using Google Classroom and WhatsApp.

Since the value (Sig.2) of the independent t-test hypothesis test is 0.000 <0.05, it can be argued that Ha is accepted based on the results of the independent t-test. Thus, it can be said that the experimental class and the control class learnt Newton's law of gravity on HOTS using a significantly different average multi-stage discussion technique using Google Classroom and WhatsApp. The findings of learning motivation are positively impacted by the use of the Google Classroom application in blended learning (Dewini et al., 2022). Learning resources are accessible at any time and from any location using Google Classroom, an application-based learning platform. Therefore, there's no excuse for pupils to sit out the Covid 19 time without actively studying. The findings of this study are consistent with those of a study conducted in 2019 by Ramadhani et al., which found that high school students using Google Classroom had much better learning outcomes than those using traditional methods of instruction.

Additionally, the t_{count} value is 97.158 > t_{table} 1.995, which means that the basis for decision-making is that Ha is accepted and Ho is rejected. This indicates that there is a difference between the experimental class and the control class in terms of learning Newton's law of gravity on higher order thinking skills at SMA Negeri 1 Tanjung Raja 2020/2021 before and after using the Multi-stage discussion method with Google Classroom and WhatsApp. This suggests that WhatsApp and Google Classroom integration has a beneficial effect on HOTS when used in multi-stage discussions. WhatsApp enhances critical thinking and problem-solving through interactive and reflective learning (Baguma et al., 2019), while Google Classroom facilitates structured

large-group discussions (Suparman, 2022). Effective peer interaction and learning motivation are crucial in these environments (Lu et al., 2021), underscoring the importance of well-designed instructional strategies to maximise the benefits of these digital platforms.

This is in line with research by Abidin et al. (2023) which states that learning with Google Classroom makes students better master the material because students are directly involved in the problems given when students study, do assignments, and interpret them, so students are more motivated to learn. Next, the process discussion in the multi-stage online learning discussion starts with posting the initial assignment to the class forum and then analysing and responding to it by classmates; The responses given can be used to find solutions to the problems on the topic being discussed. Students can compare knowledge or information obtained from other groups against students' views and understanding of themselves (Ningsih et al., 2021). The use of the WhatsApp application in learning has a positive impact because it can be used to convey information messages, learning materials, and evaluations to students (Hasanah, 2021). Apart from that, students can also discuss with the teacher by sending solutions to practice questions to find out whether they are right or wrong and get a direct response from the teacher (Munawaroh, 2019). In this way, students can still learn effectively even though learning is done online via Google Classroom and WhatsApp.

The findings of this study are consistent with those of Vertika's (2021) research, which found that there was a statistically significant difference between students' problem-solving performance before and after receiving treatment with a Sig (2-tailed) value of 0,000. With an average N-gain result of 52.55%, included in the medium category, the pre-test average was 45.5, and the post-test average was 73.98. When taken as a whole, the useful description, physics approach, specific application of physics, mathematical procedures, logical progression, and useful description all saw increases in problem-solving ability indicators of 88%, 83%, 74%, and 60%, respectively. This demonstrates how teaching students about Newton's Law of Gravity through multistage discussions on Google Classroom and WhatsApp impacts their ability to solve problems (Vertika, 2021).

The current paradigm of education requires that instruction be focused on improving students' literacy, numeracy, and HOTS. The introduction of national tests, a symbol of the shifting paradigm in educational evaluation, supports this. The primary goal of national assessments is to promote student accomplishment of cognitive learning goals, such as literacy, numeracy, and HOTS, and enhancements in the quality of education (Sudianto & Kisno, 2021). Understanding and HOTS are necessary for answering national assessment questions (Nurjanah, 2021). As a result, educators should teach pupils how to develop HOTS in line with their individual potential. By incorporating them into the learning process, HOTS can be trained (Nurhasanah & Yarmi, 2018). According to Widihastuti and Suyata (2014), learning should give pupils the opportunity to investigate different knowledge concepts through a variety of worthwhile activities. As a result, the instruction ought to include HOTS training. However, in practise, HOTS-oriented learning still can't be implemented as effectively as it could be. Teachers and students can present a variety of challenges. One of the challenges posed by students is their insufficient preparation for handling HOTS-related concerns.

The findings from this study suggest significant implications for educational practice, particularly in the context of online and blended learning environments. Integrating multi-stage discussions via Google Classroom and WhatsApp not only enhances HOTS but also promotes student engagement and motivation, especially in physics learning. These results are consistent with broader educational research that emphasises the importance of interactive and technology-mediated learning experiences (Dewini et al., 2022; Ramadhani et al., 2019). Implementing such methods can contribute to achieving educational goals aligned with national assessments focused on literacy, numeracy, and HOTS (Baguma et al., 2019; Sudianto & Kisno, 2021). For physics or other related educators, this implies the necessity to incorporate digital tools in their teaching strategies to foster a more engaging and effective learning environment. Future research should explore the long-term impacts of these methods and their applicability across diverse educational settings to generalise the findings and further validate their efficacy.

CONCLUSION

The results of this study indicate that the use of multi-stage discussions through Google Classroom and WhatsApp significantly improves HOTS among students. The experimental class showed a 41.5% improvement from pretest to posttest, with an N-gain of 0.54, compared to the control class's 16.5% improvement and N-gain of 0.42. The independent t-test results (Sig. 2 = 0.000) confirmed a significant difference between the two groups. This aligns with previous research showing that interactive and technology-based learning environments can enhance student engagement and academic performance.

There are a few restrictions on this study, though. First, the results may not be as broadly applicable as they may be because of the small sample size and restriction to a single institution. Secondly, the brief duration of the trial may have limited the ability to fully assess the intervention's long-term impact on HOTS. Furthermore, bias could be introduced by using self-reported data since students may overstate their understanding or participation.

Future research should address these limitations by involving larger and more diverse samples across multiple schools or educational contexts. Longitudinal studies would help in understanding the sustained impact of multi-stage discussions on HOTS. Moreover, incorporating qualitative data through interviews or focus groups could provide deeper insights into student experiences and the mechanisms through which these discussions impact learning outcomes. Exploring the integration of other digital tools and platforms alongside Google Classroom and WhatsApp could also offer a broader perspective on how different technologies can support HOTS development.

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