



Managing Education in the Global Pandemic: Best Strategy to Carry Out Natural Science Learning

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ABSTRAK

Pandemi covid-19 sangat berdampak pada sektor pendidikan. perubahan proses pembelajaran tatap muka menjadi daring menuntut para pendidik untuk berinovasi menciptakan strategi terbaik dalam pembelajaran tekhusus mata pelajaran ilmu pengetahuan alam di sekolah dasar. Eksplorasi alternatif model belajar mengajar penting dilakukan praktik pendidikan yang optimal kepada para siswa. Penelitian ini bertujuan untuk mengevaluasi prestasi pembelajaran siswa pada pembelajaran IPA, menganalisis dampak metode belajar mengajar dan sumber materi terhadap prestasi siswa, serta menentukan strategi terbaik dalam pengelolaan praktik pendidikan mata pelajaran ilmu pengetahuan alam selama pandemi Covid-19. Eksperimen survei digunakan sebagai desain penelitian, menempati desain faktorial 2x2. Faktor-faktor itu termasuk metode belajar mengajar yang mencakup pembelajaran online dan campuran serta sumber materi belajar mengajar yang mencakup buku pelajaran dan internet. Pengumpulan data dilakukan melalui survei online menggunakan google form. Analisis data dilakukan melalui uji t dan Anova faktorial. Sebagian, hanya metode belajar mengajar yang berdampak signifikan terhadap prestasi belajar siswa, yang ditunjukkan dengan hasil tes-t sebesar -2,610 ($p=0,010$). Metode belajar mengajar dan sumber belajar mengajar secara serentak mempengaruhi prestasi siswa terhadap pelajaran ilmu pengetahuan alam. F-test memperoleh nilai 80.335 ($p=0.001$). Perpaduan antara blended learning dan materi belajar mengajar yang bersumber dari internet menghasilkan pencapaian skor yang jauh lebih tinggi.

ABSTRACT

The Covid-19 pandemic has had a major impact on the education sector. changing the face-to-face learning process to online requires educators to innovate to create the best strategies in learning specifically natural science subjects in elementary schools. Exploration of alternative teaching and learning models is important for optimal educational practices for students. This study aims to evaluate student learning achievement in natural science learning, analyze the impact of teaching and learning methods and material resources on student achievement, and determine the best strategy in managing natural science education practice during the Covid-19 pandemic. The survey experiment was used as the research design, occupying a 2x2 factorial design. These factors include teaching and learning methods that include online and mixed learning as well as teaching and learning material resources that include textbooks and the internet. Data collection was carried out through an online survey using google form. Data analysis was performed through t test and factorial Anova. Partly, only teaching and learning methods have a significant impact on student achievement, as indicated by the t-test result of -2.610 ($p = 0.010$). Teaching and learning methods and teaching and learning resources simultaneously affect student achievement of natural science lessons. The F-test obtained a value of 80,335 ($p = 0.001$). The combination of blended learning and teaching and learning materials sourced from the internet resulted in the achievement of a much higher score.

1. INTRODUCTION

Even though the education system is under disruption caused by Covid-19 pandemic, education practice needs to keep its performance in delivering education to the students (Almaiah et al., 2020). Many countries are currently trying to find the best alternative model of education practice (Bozkurt et al., 2020; Munastwi, 2014). However, since every country has its own characteristic, the best option must be different one and the other. The changes in the paradigm of educational during Covid-19 has shown alternatives in education practice. However, there is no definite model that can be applied in every learning condition, subject, and level. Therefore, continuous development of education model needs to be carried out to improve the performance (Moskal et al., 2013).

The application of online learning has been a standard education system during Covid-19 pandemic (Bozkurt et al., 2020). However, what's further needed is the management of education so that the implementation could be more effective and efficient (Ibrahim et al., 2020). Rather than taking online

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learning as a temporary measure for Covid-19 pandemic, it would be better to maximize its potential. Moreover, online education has been viewed as the potential system of education in the future (Nguyen, 2015). The disruption in educational practice due to Covid-19 pandemic had brought up various strategies in the teaching/learning activity. Education that previously delivered in class base were forced to transform into a digital base (Ibrahim et al., 2020). The change of education system had arisen the concern on the effectiveness of teaching/learning method (Bahasoan et al., 2020; Kaur et al., 2020; Khan et al., 2021). Online teaching/learning was brought up in order to overcome the limitation of physical interaction in education (Müller et al., 2021; Rasmitadila et al., 2020). However, it could not be implemented comprehensively. There were many obstacles in the implementation of online teaching/learning, such as unsupportive infrastructure and facility, incompetency of teachers, students, and parents (Putri et al., 2020), to the extent of community's capability to enroll the activity.

Before the Covid-19 pandemic, online learning has never been a part of education system in Indonesia (Putri et al., 2020). Therefore, many school managers still try to find appropriate strategy to optimize the educational practice. Due to the sudden change of education practice, stakeholders such as educational bodies, school managers, teachers, students, and parents were unprepared with standard emergence response. Therefore, school managers and teachers tried to make adjustment of education model in order to deliver education effectively and efficiently (Alea et al., 2020). Because of the limitation in the online teaching/learning practice, many institutions also implemented the blended learning to overcome the problem. Through the implementation of blended learning, the information that cannot be delivered through online teaching/learning activity could be delivered in offline class (Nuraini et al., 2020; Wargadinata et al., 2020). Therefore, the gap of information could be minimized. Another problem that arose was the teaching materials. Covid-19 pandemic had caused disruption in curriculum (Daniel, 2020). Shortage of time and space for education had caused the failure in the delivery of education curriculum comprehensively (Tyagi, 2020). Therefore, modification of curriculum was commonly occurred (Rasmitadila et al., 2020; Roesminingsih et al., 2020). Since the teaching/learning materials should be adjusted to meet the capacity. As the impact, teachers needed to find alternative teaching materials (Martarelli et al., 2021).

Alternative teaching material is important to adjust the teaching/learning program to the current situation. However, education in primary school is generally provided with textbook (Damayanti, 2014; Ibáñez et al., 2019; Kazemian et al., 2014). Textbook had been the main source of teaching materials in education. Fortunately, due to the advancement of information and communication technology, many sources of learning materials become available in the internet (Fasihuddin et al., 2013; Goldman et al., 2012). These are potential source of information that could be used as source of teaching/learning materials. Therefore, many teachers also used the internet as the source of teaching materials (Amenyedzi et al., 2020; Olowa, 2012). Natural science is a study subject that has complexity and difficulty. Natural science for elementary school is an integrated subject that consists of physics, chemistry and biology sciences (Faisal & Martin, 2019). Therefore, students need both calculation and memorization skills. However, since learning natural science involves experiments and observations (Suendarti, 2017), it would be difficult to perform a full online teaching/learning. Thus, blended learning could be considered as the alternative.

Based on the exposure on trying the best strategy in carrying out primary school science learning, comparing each use of science learning strategy is considered able to help teachers in using science learning strategies in the era of the covid-19 pandemic. Previous research has investigated the implementation of science learning strategies during the pandemic. However, the research still focuses on literature reviews, such as the implementation of science learning using Learning Cycle strategies, Blended Learning, STEAM, E-Learning (Learning Management System) and ethnoscience (Nur Umi Rahmawati & Rahmawati, 2021). Researchers previously only focused on the final results such as analysis of science process skills during the Covid-19 pandemic there was a good influence in aspects of learning achievements during the covid-19 pandemic (Eliyana, 2020; Sobron et al., 2019). In addition, the researchers also said that in the online implementation of science learning is less effective because it only provides tasks and collects so that the less developed aspects of critical thinking (Handayani, 2021; Rosyada et al., 2021). However, there is still little to test about the influence of science teaching strategy in 4th grade in elementary schools.

Therefore, this study was conducted to evaluate student learning achievement in natural science learning, analyze the impact of teaching and learning methods and material resources on student achievement, and determine the best strategy in managing natural science education practice during the Covid-19 pandemic.

2. METHOD

The method used in this study was a factorial experiment method (Hajiyakhchali, 2013; Lu et al., 2017; Supriadi et al., 2019). Factorial experiment design is used as a treatment design involving two factors, namely learning methods and material resources. The learning method consists of online and blended learning, while the source material consists of textbooks and the internet. In terms of the internet as a source of learning materials, students access it independently. This study focused on the learning achievement of 115 students of 4th grade, three classes each consisting of 29 students, while one class consisted of only 28 students. The 4th grade was chosen as the object of research because it was a time when science was separated as independent subjects. Because the experiment used was a factorial design of 2×2 , four classes were involved in this study. The four classes integrate different teaching models that combine learning/teaching methods and material resources. The combination is: online learning with textbooks; online learning with the internet; blended learning with textbooks; and integrated learning with the internet.

Due to the actual condition of the Covid-19 pandemic that limits communal activities, the data collection is done through online surveys. Information on management applied in educational practices is provided by the homeroom teacher. Data is collected using google forms. Teachers provide the information needed for research, such as teaching methods and materials used in teaching and learning activities. Analysis data was carried out through t-test and factorial Anova. T-test was used to analyze the partial impact of teaching/learning method and material source, while factorial Anova was used to analyze the simultaneous impact of both factors. Data analysis was carried out using SPSS with error interval of 5%.

3. RESULT AND DISCUSSION

The result showed that students generally got great achievement on natural science subject. Students' score was ranging between 83 to 97 with average of 91.26 ± 2.85 . The score indicates that there was a significant variation of students' learning achievements. Noticeable difference of score achievement due to the difference of teaching/learning method and material source were obtained. However, significant different was only shown by the effect of teaching/learning method, while the impact of different material source did not signify the impact to the students' learning achievement. The result of the statistical analysis of partial effect of teaching/learning method and material source is presented in Table 1 and

Table 2.

Table 1. Impact of teaching/learning method on 4th grade students' learning achievement in natural science subject

Teaching/Learning Method	Score	
	Range	Average \pm StDev
Online	83 - 95	$90.58 \pm 2.66a$
Blended	83 - 97	$91.93 \pm 2.89b$

Table 1 shows that students' score achievement due to the implementation of blended learning was more variative than the online learning. The average score achievement was also significantly higher. Statistical analysis with t-test showed t-value of -2.610 and probability of 0.010 ($p < 0.05$) which indicated that there was a significant impact of teaching/learning method on the score achievement of 4th grade students in natural science subject.

Table 2. Impact of material sources on 4th grade students' learning achievement in natural science subject

Material Source	Score	
	Range	Average \pm StDev
Textbook	83 - 94	$90.95 \pm 2.43a$
Internet	83 - 97	$91.58 \pm 3.21a$

Statistical analysis on the impact of material source on the students' learning achievement indicated an insignificant difference. The analysis result showed t-value of -1.190 and probability of 0.237 ($p > 0.05$), which means that the difference between two groups was not significant even though it was

noticeable. According to the result, the score achievement was higher in the internet group compared to the textbook group. Further analysis was carried out to evaluate the combined effect of teaching/learning method and material source. The combination distinguished further students' learning achievement and extended the result to a deeper understanding. Table 3 shows the detailed difference of students' learning achievement due to the combination of teaching/learning method and material source.

Table 3. Combined effect of teaching/learning methods and material source on learning achievement of 4th grade elementary school students in natural science subject

Material Source	Learning Method	
	Online	Blended
Textbook	86 - 94	83 - 95
	91.10 ± 2.04a	90.79 ± 2.80a
Internet	83 - 94	89 - 97
	90.04 ± 3.12a	93.07 ± 2.55b

Table 3 shows how the combination of teaching/learning method and material source differed the achievement of 4th grade students in natural science subject. According to the result, there was a preference of combination between two variables. The implementation of online learning was better when combined with the utilization of textbook as the source of learning material. Blended learning in the other side was better when combined with learning material obtained from the internet. However, the implementation of blended learning that was combined with internet sourced material was significantly resulted in better learning achievement in the subject of natural science. The statistical analysis with factorial Anova showed the F value of 80.335 and probability of 0.001 ($p < 0.05$). However, the combination of blended learning and internet sourced material was the only treatment that was different significantly from the other treatments, while the other treatments were not different significantly one to the other even though the differences were noticeable. Referring to the result, the implementation of blended learning combined with internet sourced learning material is suggested to optimize the students' learning achievement in natural science subject for 4th grade elementary school students.

Discussion

Engagement of digital technology will be a normal model of education practice after the Covid-19 pandemic has passed (Dwivedi et al., 2020). This is because far before the pandemic, digital pedagogy had been considered to change the shape of education (Lancashire, 2010). Therefore, the outbreak of Covid-19 can be considered as the accelerator of the transformation. As the implication, there will be new standard of pedagogical skill competences, especially for teachers, students, and parents. In the other side, educational institution needs to develop strategic management to optimize the education activities. Implementation of online learning in the educational practice needs further concern on how lessons should be delivered. However, each lesson has different requirement (Gill & Kusum, 2017). Therefore, it needs different approach. Referring to the result, the implementation of blended learning along with the utilization of internet sourced material signified the improvement of students' achievement in natural science subject.

The result of this research suggested that the combination of blended learning and internet sourced learning material maximized the achievement of 4th grade students in natural science. This could be due to the character of natural science lesson that require deeper understanding through practices or experimentation (Devitasari et al., 2021; Suendarti, 2017). Therefore, students would learn better with assistance than without assistance (Tembang et al., 2018). Blended learning opens the opportunity for students and teachers to interact, communicate, and discuss the lesson (Kaur, 2013). Online learning activity acts as a media to deliver theoretical knowledge, while offline learning activity acts as an opportunity to carry out demonstration, experiments, or practices (Ibrahim et al., 2014; Tafa, 2012). In the meantime, by using internet as source of learning materials, students could explore their curiosity and obtain more information that could be brought up to discuss with the teachers (Bonk & Lee, 2017). Internet enables student to personalize their preference of materials and method of learning (Intayoad et al., 2017). Along with teachers' assistance during offline learning activity, it could improve their understanding (Ardiyani et al., 2020). Thus, students would obtain better learning achievement.

According to the result of the research, the other combinations provided good support to students' learning process, although the achievements were lower compared to the combination of blended learning and internet sourced materials. However, there was a trend where the combination of online teaching/learning along with the utilization of textbook also provided better achievement, although

it was still incomparable to the combination of blended learning and internet sourced materials. This showed the compatibility of teaching/learning method and the source of material used. Performing a full online requires an exact or predefined material so that teacher and students have the same topic to discuss. This enables teacher and students to have similar understanding. Therefore, teaching/learning activity can be synchronized even without physical interaction. However, in the natural science learning, it is only effective in delivering the theory only (Bahasoan et al., 2020). Hence, students understanding is shortened.

Full online teaching/learning activity is not effective to be carried out (Ilmadi et al., 2020). Therefore, education practice should not be relied on the full online teaching/learning method. The implementation of online learning by the subject of the study referred to synchronous online learning because it was carried out as a replacement of class learning. Therefore, students did not have the independence to learn according to their own interest. The combination of blended learning and internet sourced materials can be developed into problem-based learning (Liu, 2016). Students who obtain their learning materials from the internet may obtain different kind of information (Fleck, 2012). The raw information needs to be refined through offline class. Thus, teaching/learning activity would have richer content compared to using textbook (Lee et al., 2013). The implementation of one directional teaching in natural science is considered as weakness (Suendarti, 2017). Natural science education requires the integration of laboratory practicum or experiment (Tafa, 2012). Laboratory practice is an important process in natural science learning to develop practical knowledge of the students. Neglecting the practical skill development would result in long-term disadvantage to the students (Gamage et al., 2020). Therefore, relying on full online learning is not appropriate to be applied in natural science subject.

Implementation of discovery learning in natural science is better than conventional learning (Suendarti, 2017). This is comparable to the result of this research which proved that blended learning combined with internet sourced materials was better than online learning or the utilization of textbook. The approach used in discovery learning is problem solving due to the experience and knowledge students obtained (Supriadi et al., 2019). Similar pattern was could be found in the combination of blended learning and internet sourced material in the research. Students independently access the internet to collect learning materials which topic had been determined. Thus, there was a probability that students also obtained additional information that develop their courage. The results of this study contributed as an online learning strategy solution of natural science subjects. through blended learning strategies and utilizing internet access was able to optimize the learning process of science in elementary schools. Thus this research is able to add empirical evidence about effective strategies in carrying out online learning of natural science subjects, as previously researched by (Handayani, 2021; Nur Umi Rahmawati & Rahmawati, 2021).

4. CONCLUSION

The application of blended learning combined with internet sourced learning materials showed significantly better result that can be suggested as the best option to carry out natural science teaching. But, if the students are unable to contain themselves, the implementation of online learning combined with textbook utilization would be a suitable alternative to optimize students' learning performance. This research still has many shortcomings, so that further research is needed. However, this research can contribute to opening up preliminary information for further research.

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