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The Relationship between Multiple Intelligences of Preservice Elementary Teacher toward Their Gender and Performances

Muhamad Ikhlas*, Kuswanto & Rosario F. Quicho

Central Luzon State University, Science City of Munoz, Philippines

*Email: muhammadikhlas@clsu.edu.ph

Keywords:	Abstract
multiple intelligences; *preservice elementary teachers;* *elementary education;* *performances;* *gender*	*This research studied whether there was a significant relationship between the multiple intelligences of pre-service elementary teachers, their gender, and their performances. The survey method had been used for this study. A "Multiple Intelligence Profiling Questionnaire III (MIPQ-III)" was used to collect the multiple intelligences of the participants. Reliability-test had been used to see the consistency of the questionnaire. In order to analysis of the data, descriptive statistics, independent sample t-test, and Pearson correlation were used for this study. Results showed that naturalistic intelligence has the highest mean score. Meanwhile, logical-mathematics intelligence had the lowest mean score. Results also showed that logical-mathematic, verbal-linguistic, spatial, bodily-kinesthetics, and interpersonal intelligence have differences based on gender, while other intelligence had no differences. Furthermore, results also showed that all intelligence, excluding naturalistic, positively correlates with the performances. Lastly, hierarchical regression showed that among the multiple intelligences, the logical-mathematics intelligence became a predictor for the performance of the pre-service elementary teachers. The implications of this study, such as the results, showed a relationship between multiple intelligence and elementary school pre-service teachers. Besides that, it was found that the multiple intelligence of elementary pre-service teachers had a wide variety of impacts on the performance of those pre-service teachers in the future. Thus, it was expected that relevant stakeholders can better review these aspects, especially in the curriculum*

INTRODUCTION

Background

In the whole process of education in schools, learning activities are the most basic activities. Learning is a necessity or obligation for all individuals. Pritchard (2008) states learning is the process of gaining more knowledge, or of learning how to do something. Furthermore, Domjan (2014) states if learning is defined in terms of a change in the mechanisms of behavior to emphasize the distinction between learning and performance. One of the places where the learning process takes place is at the elementary school level.

Elementary education is the most basic level of education in formal education. At this stage, students need to be directed, developed, and bridged towards their complex development. At this stage, also found a variety of students. That is because elementary students are unique children and need attention. Students come to class with their own distinctive characteristics to be directed according to the objectives of primary school education (Ocak & Dermez, 2008). Therefore, education in elementary schools is essentially education that is more directing and motivates more students to learn (So et al., 2019). The background of their uniqueness is seen in the changes in various aspects of both their attitude, movement, and intelligence so that it affects their development.

Theory that explains students' mental diversity is multiple intelligences by Gardner (Armstrong, 2009). Gardner (2011) explains that intelligence is not only interpreted as intelligence quotient "IQ" as it has been so far, but intelligence concerns a person's ability to solve problems and produce fashion products that are consequences in a particular cultural or community atmosphere. Based on Gardner's Multiple Intelligences, each human being is able to perform seven relatively independent forms of information processing, where each individual is different from one another in terms of the intelligence profile that they show (Gardner & Hatch, 1989; Işık & Tarım, 2009; Erdem & Keklik, 2020), which then added two more intelligences namely naturalistic and existential intelligence (Gardner, 2000).

Multiple intelligences explain that every human being does not have only one intelligence, but several intelligences. The theory of multiple intelligences not only recognizes these individual differences for practical purposes, such as teaching and assessment but also considers and accepts them as normal, reasonable, even interesting and very valuable. Furthermore, Gardner explains that there are nine intelligences that a person has. The nine intelligences are:

1. verbal-linguistic intelligence closely related to words, both oral and written along with the rules;
2. logical-mathematical intelligence related to the ability to process numbers or skills using logic;
3. spatial intelligence related to the ability to capture color, direction, and space accurately and change the capture into other forms such as decoration, architecture, painting, sculpture;
4. bodily-kinesthetic intelligence related to the ability to use the movements of the whole body to express ideas and feelings and the skill to use hands to create or change things. This intelligence includes specific physical abilities, such as coordination, balance, skills, strength, flexibility, speed and accuracy of receiving excitement, touch, and texture;

5. musical intelligence related to the ability to capture sounds, distinguish, compose, and express themselves through sounds that are pitched and rhythmic. This intelligence includes sensitivity to rhythm, melody, and sound color;

6. interpersonal intelligence that involve the ability to understand and cooperate with others. This intelligence involves many skills, such as the ability to empathize with others, the ability to organize a group of people towards a common goal, the ability to recognize and read the thoughts of others, the ability to make friends or establish contact;

7. intrapersonal intelligences related to internal aspects in a person, such as life feelings, range of emotions, the ability to distinguish emotions, mark them, and use them to understand and guide own behavior;

8. naturalist intelligence related to skills in recognizing and classifying flora and fauna in their environment. This intelligence is also related to human love for natural objects, animals, and plants. Naturalist intelligence is also characterized by sensitivity to natural forms, such as leaves, clouds, rocks; and

9. existential intelligence related to human ability to place oneself in the farthest reaches of the cosmos, with the meaning of life, the meaning of death, the fate of the physical and mental world, and with the meaning of deep experiences such as love or art (Armstrong, 2009; Gardner, 1993, 2000).

Every child has these nine intelligences and could develop that intelligence to a sufficiently high level of competence if the child has support, training and teaching. According to Gardner (1993) intelligence could be improved, modified, trained, and even changed. In fact, a person's intelligence and ability are flexible and could be guided (Ahmadian & Hosseini, 2012).

Problem of Study

In the current era, more advanced education which is supported and facilitated by various technologies certainly greatly helps students in the learning process, as well as elementary school students. Generational differences between teachers and students certainly make different ways of thinking and learning styles between the two generations. It is feared that students better understand the content taught by teachers because students better understand how to use the latest technology. Thus, learning multiple intelligences in elementary school students is very important as well as the importance to learn multiple intelligences on preservice teachers of elementary school students themselves. That is because later these preservice teachers would become instructors and educators for these students.

The intended teacher candidates are undergraduate students who majored in education, commonly referred to as preservice teachers. Preservice teachers are related to students who are enrolled in an undergraduate teaching degree in a university setting (Ferry & Kervin, 2011). Therefore, the preservice teacher in this study referred to the preservice elementary teacher. A good preservice teacher is a prospective teacher who is smart in the field of teaching or pedagogic abilities and their respective expertise (Nilsson & Loughran, 2012). Field of expertise for elementary school teachers, of course, these teachers master the material or content related to several subjects that are applied in each school based on the applicable curriculum. Some general subjects taught to elementary school students are mathematics and English (language) subjects. In the Philippines setting, courses applied to elementary education programs related to mathematics is temporary mathematics course while course related to English is speech communication course (Central Luzon State University Curriculum, 2016).

State of the Art

Some previous studies have shown that multiple intelligences have a significant relationship with learning outcomes (Ahmadian & Hosseini, 2012; Ekinci, 2014; Pour-Mohammadi et al., 2012; Zahedi & Moghaddam, 2016). More specifically logical-mathematical intelligence is positively related to students 'mathematical abilities, as well as verbal-linguistics intelligence which is positively related to students' language abilities. Based on these points, the researchers conducted research related to multiple intelligences from preservice elementary teachers who were connected with their performance, especially in mathematics, English, and general performance.

Gap Study & Objective

At this point, the main objective of this study consists in determining the preservice elementary teachers' multiple intelligences; and the relationship between their gender, their multiple intelligences and their performance. In this sense, the purpose of this research are: 1) to describe the level multiple intelligences of the preservice elementary teachers?; 2) to analyze the difference between multiple intelligences of the preservice elementary teacher according to their gender; 3) to analyze the difference between multiple intelligences of the preservice elementary teacher (verbal-linguistic, logical-mathematic, spatial, musical, bodily kinesthetics, interpersonal, intrapersonal, naturalistic, existential) according to their math, English and general performance; 4) to describe how gender and multiple intelligence of the preservice elementary teacher predict their performance in math, English and general performance.

METHOD

Design

The research study used a quantitative research design, which used to establish the relationship between two variables and sometimes explain the cause of such relationship (Ary et al., 2010; Fraenkel et al., 2011). Descriptive-survey approach was used in this study to explore the preservice elementary teacher multiple intelligences, and the relationship between their gender, multiple intelligences toward their performance, especially in math, English, and general performance.

Participant

This research was conducted at College of Education, Central Luzon State University. The data were collected from the students of Elementary Education Department in the first semester of 2018-2019 school year. The sample technique used in this study was purposive sampling, where researchers only limited the participant to first year preservice elementary teacher. Afterwards, these 60 preservice elementary teachers were handed out questionnaires, but the regular questionnaires handed in by 59 preservice elementary teachers were accepted for assessment, so the return rate of the questionnaires was 98.33%. The 59 preservice elementary teachers in the sampling were 19 males or 32.2% and 40 females or 67.8% (See Table 1).

Table 1. Demographic characteristics of the participants according to gender

Variables	Categories	N	Percentage
Gender	1. Male	19	32.2
	2. Female	40	67.8

Instrument and Procedures

Three instruments were used in this study. The first part was developed by the researcher covering the socio-demographic characteristics of the participants, asked the students of their socio-demographic characteristics such as gender, semester, and major. The students were asked to supply the information needed by writing answer whenever possible.

In term to explore the multiple intelligences of preservice elementary teachers, researcher uses questionnaire for the instrument tool. Mackey and Gass (2005) showed questionnaires allow researchers to gather the information that learners are able to describe themselves. The second part was about the multiple intelligences which was adapted the Multiple Intelligence Profiling Questionnaire III (MIPQ-III) by Tirri and Nokelainen (2008). This questionnaire consisted of 35 items concerning multiple intelligences of the students. It consisted by nine dimensions, there are: linguistic, logical-mathematical, musical, spatial, bodily-kinesthetic, interpersonal, intrapersonal, natural and existential intelligence. Each dimension was followed by four questions, except natural dimension that only followed by three questions. This part asked the students to rate their multiple intelligences. Using Likert-type scales, participants were asked to judge indicate how agree they with each statement. The last part was about the preservice elementary teachers' performance by asking directly to the lecturer concerned.

Data analysis

The data gathered from the students were analyzed by using the Statistical Package for the Social Sciences 25 (SPSS 25). From the parametric tests, descriptive statistics, independent sample t-tests and Pearson correlation coefficients were employed. Firstly, the reliability of each scale was tested. The Multiple Intelligence Profiling Questionnaire III (MIPQ-III) was analyzed and Cronbach's Alpha reliability was found 0.98. The Cronbach's alpha scores indicated that the scales used for the present study were highly reliable. Furthermore, the researchers analyzed the categories for each intelligence possessed by preservice elementary teachers. As a result, the findings ranging between 5.00 and 4.20, 4.19 and 3.40, 3.39 and 2.60, 2.59 and 1.80, 1.79 and 1.00 were interpreted as very high, high, medium, low, and very low respectively (See Table 2).

Table 2. The Ranges of Multiple Intelligences Questionnaire and Their category

Score	Category
4.20 – 5.00	Very high
3.40 – 4.19	High
2.60 – 3.39	Medium
1.80 – 2.59	Low
1.00 – 1.79	Very low

RESULTS

Firstly, multiple intelligences of the preservice elementary teachers were determined. When multiple intelligences types of the preservice elementary teachers were calculated, it was observed that logical-mathematic intelligence had the lowest mean score and naturalistic intelligence had the highest mean score (see table 3).

Table 3. Multiple Intelligences of the preservice elementary teachers Descriptive Statistics

Descriptive Statistics					
	N	Min	Max	Mean	SD
Logical-mathematic	59	2.00	5.00	3.06	.72
Verbal-linguistic	59	1.00	5.00	3.77	.61
Spatial	59	1.00	5.00	3.25	.62
Musical	59	1.00	5.00	3.33	.87
Bodily-kinesthetics	59	1.00	5.00	3.52	.66
Interpersonal	59	1.00	5.00	3.61	.63
Intrapersonal	59	1.00	5.00	3.83	.63
Naturalistic	59	1.00	5.00	4.21	.54
Existential	59	2.00	5.00	4.00	.53
Valid N (listwise)	59				

The difference between multiple intelligences types of students and gender were also examined. The result of descriptive statistics shows that some intelligence have significant differences between male and female participants, such as logical-mathematical, linguistic, spatial, bodily-kinesthetics, and interpersonal intelligence, while others intelligence did not indicate any significant difference (See Table 4).

Table 4. Result of Independent t Test for Gender and Multiple Intelligences

Types of Intelligence	Gender	N	M	SD	t	Df	Sig.
Logical-Mathematic	Male	19	3.45	.70	2.971	57	.004
	Female	40	2.89	.66			
Verbal-Linguistic	Male	19	3.37	.57	-3.845	57	.000
	Female	40	3.96	.54			
Spatial	Male	19	3.59	.72	3.059	57	.003
	Female	40	3.09	.51			
Musical	Male	19	3.47	.51	.842	57	.404
	Female	40	3.27	.99			
Bodily-Kinesthetics	Male	19	3.91	.53	3.298	57	.002
	Female	40	3.34	.65			
Interpersonal	Male	19	3.97	.50	3.248	57	.002
	Female	40	3.44	.62			
Intrapersonal	Male	19	3.92	.54	.719	57	.475
	Female	40	3.79	.67			
Naturalistic	Male	19	4.37	.52	1.575	57	.121
	Female	40	4.13	.54			
Existential	Male	19	4.12	.66	1.178	57	.244
	Female	40	3.95	.45			

The third objective of this study was to determine the relationship between preservice elementary teachers' multiple intelligences and their performances. It was revealed that most of the intelligence types and the performances had a moderate positive correlation (See Table 5).

Table 5. The relationship of the multiple intelligences and the performances

	Temporary Math	Speech Communication (English)	GPA
Logical-mathematics	.794**	.568**	.528**
Verbal-Linguistic	.140	.629**	.635**
Spatial	.710**	.439**	.477**
Musical	.566**	.550**	.531**
Bodily-Kinesthetics	.671**	.359**	.306*
Interpersonal	.730**	.392**	.388**
Intrapersonal	.521**	.598**	.554**
Naturalistic	.004	-.009	.156
Existential	.416**	.241	.232
*Correlation is significant at $p<0.05$.			
**Correlation is significant at $p<0.01$.			

The last objective of this study was to determine whether gender and multiple intelligences of preservice elementary teachers predict their performance in terms of math, English and general performance. Table 6 shows the model summary of hierarchical regression analysis used. Model summary shows that gender has a high influence on the hierarchical regression analysis model used

Table 6. Model summary of hierarchical regression analysis

	Parameter	Model 1	Model 2
Temporary Math	R	,535[a]	,893[b]
	R^2	0.287	0.797
	Adj. R^2	0.274	0.755
	R^2 Change	0.287	0.511
	Sig. F Change	0.000	0.000
Speech Communication (English)	R	,352[a]	,857[b]
	R^2	0.124	0.735
	Adj. R^2	0.109	0.680
	R^2 Change	0.124	0.611
	Sig. F Change	0.006	0.000
GPA	R	,380[a]	,842[b]
	R^2	0.144	0.709
	Adj. R^2	0.129	0.648
	R^2 Change	0.144	0.564
	Sig. F Change	0.003	0.000

a. Predictors: (Constant), Gender
b. Predictors: (Constant), Gender, Intrapersonal, Naturalistic, Existential, Bodily-Kinaesthetic, Linguistic, Musical, Interpersonal, Spatial, Logical Mathematic

Moreover, table 7 shows the hierarchical regression analysis. It was revealed if among the multiple intelligences, logical-mathematics intelligence becomes a predictor for the performance of the preservice elementary teachers.

Table 7. Result of hierarchical regression among gender and multiple intelligence toward performance

Model	Predictor Variable	Temporary Math		Speech Communication (English)		GPA	
		B	Sig.	B	Sig.	B	Sig.
1	(Constant)	3.007	0.000	2.985	0.000	2.369	0.000
	Gender	-0.441	0.000***	0.239	0.006**	0.316	0.003**
2	(Constant)	2.133	0.000	1.854	0.000	0.508	0.251
	Gender	-0.192	0.038*	0.394	0.000***	0.541	0.000***
	Logical Mathematic	0.234	0.022*	0.329	0.001**	0.293	0.019
	Linguistic	-0.056	0.451	0.005	0.948	0.028	0.755
	Spatial	0.175	0.063	0.065	0.457	0.217	0.057
	Musical	0.032	0.563	-0.008	0.879	-0.036	0.593
	Bodily-Kinaesthetic	0.030	0.648	0.010	0.869	-0.007	0.925
	Interpersonal	0.060	0.471	-0.101	0.202	-0.040	0.693
	Intrapersonal	-0.014	0.833	0.122	0.054	0.094	0.245
	Naturalistic	-0.246	0.000***	-0.075	0.148	0.034	0.613
	Existential	0.010	0.874	-0.041	0.505	-0.110	0.171

*** significant at p < 0.001;   ** significant at p < 0.01;   * significant at p < 0.05
gender = 1 – male, 2- female

DISCUSSION

The first question asks about the level of multiple intelligences of preservice elementary teachers. To answer this question researcher uses descriptive statistics. Based on Table 3, the type of intelligence with the highest mean is Naturalistic (M = 4.21), and the one with the lowest mean is Logical-Mathematic (M = 3.07). This indicates that the average intelligence possessed by preservice elementary teachers is more inclined to naturalistic intelligence, or it could be said that the naturalistic intelligence of the preservice elementary teachers is categorized as "very high". In contrast, the logical-mathematics of preservice elementary teachers are classified as medium. The results also showed that verbal-linguistic intelligence (M = 3.78), bodily-kinesthetic (M = 3.52), interpersonal intelligence (M = 3.61), intrapersonal intelligence (M = 3.83) and existential intelligence (M = 4.00) categorized as "high". Meanwhile, spatial intelligence (M = 3.25) and musical intelligence (M = 3.33) categorized as "medium".

The next question is whether there is a significant difference between the gender of the preservice elementary teacher according to their multiple intelligence. To answer this question researcher uses an independent sample t-test. Table 4 showed the differences between the multiple intelligences of the preservice elementary teachers according to their gender. The result showed that there are differences among the logical-mathematic

intelligence of the preservice elementary teachers based on the gender (t(57) = 2.971, p<0.05 (0.004)), where male participants have logical-mathematics (M = 3.45) higher than female participants (M = 2.89). This result is similar to a study by Furnham and Buchanan (2005); Lin (2009); Biria et al. (2014); and Loori (2005), where male participants tend to provide higher logical-mathematics intelligence than female participants.

Results also showed that there are differences among the verbal-linguistic intelligence of the preservice elementary teachers based on the gender (t(57) = -3.845, p<0.001 (0.000)), where female participants have verbal-linguistic (M = 3.95) higher than male participants (M = 3.36). This result is similar to the study by Saricaglu and Arikan (2009), Lin (2009), and Meneviş and Özad (2014), which shows that female participants tend to have higher verbal-linguistics than male participants. Afterward, the result also showed that there are differences among the spatial intelligence of the preservice elementary teachers based on the gender (t(57) = 3.059, p<0.05 (0.003)), where male participants (M = 3.59) have spatial intelligence higher than females participants (M = 3.09). This result is similar to the study by Lin (2009) and Shahzada et al. (2011), which states a difference in spatial intelligence based on gender.

Results also showed that there are differences among the bodily-kinesthetics intelligence of the preservice elementary teachers based on gender (t(57) = 3.298, p<0.05 (0.002)), where male participants have bodily-kinesthetics intelligence (M = 3.91) higher than female participants (M = 3.34). It is identical to a previous study by Lin (2009); and Biria et al. (2014), which shows that male participants tend to have higher bodily-kinesthetic intelligence than the female participant. Furthermore, the result also showed that there are differences among the interpersonal intelligence of the preservice elementary teachers based on gender (t(57) = 3.248, p<0.05 (0.002)), where male participants have interpersonal intelligence (M = 3.97) higher than females participants (M = 3.44).

Otherwise, other result showed there is no difference between musical intelligence (t(57) = 0.842, p>0.05 (0.404)), intrapersonal intelligence (t(57) = 0.719, p>0.05 (0.475)), naturalistic intelligence (t(57) = 1.575, p>0.05 (0.121)), and existential intelligence (t(57) = 1.178, p>0.05 (0.244)) of the preservice elementary teacher according to their gender. This result seemed same like previous study by Meneviş and Özad (2014) that found there is no difference between naturalistic intelligence according to gender.

Furthermore, to answer whether there is a significant difference between the multiple intelligences of the preservice elementary teacher according to their maths, English, and general performance, the researcher uses Pearson correlation. Table 5 shows the result of multiple intelligences of the preservice elementary teacher according to their performances. The result showed that some multiple intelligences such as logical-mathematics, spatial, musical, bodily-kinesthetics, interpersonal, intrapersonal positively correlate with math, English, and general performance. This result seemed the same as the previous study by Ekinci (2014), which showed a positive correlation between verbal-linguistic, logical-mathematic, intrapersonal, and interpersonal intelligence with students' performances; and Ahmadian and Hosseini (2012) that interpersonal intelligence correlates with students' English performance.

Meanwhile, naturalistic intelligence has no relationship with math, English, and general performance. This result is similar to the study by Razmjoo (2008); Sadeghi and Farzizadeh (2012); Ahmadian and Hosseini (2012); and Rad et al. (2014) that found there is no relationship between naturalistic intelligence and students' performances. As for the other intelligence, verbal-linguistics only has a positive relationship with English and general performance and is not related to math performance, whereas existential intelligence has only a positive relationship with math performance and is not related to English and general performance. It seemed the same as the study by Ahmadian and Hosseini (2012) that found verbal-linguistic intelligence correlates with English performance. Result also show that

relationship between logical-mathematic intelligence and math performance (r = 0.794, p<0.01 (0.000)) is the highest correlation, while bodily-kinesthetics intelligence and general performance (r = 0.306, p<0.05 (0.018)) is the lowest correlation.

Lastly, in connection with the final question about whether multiple intelligences predict participants' performance, the researcher uses hierarchical regression analysis. Table 7 shows the results of the model summary for hierarchical regression analysis. On the temporary math as a dependent variable, the first model shows that R Square and R Square Change were 0.287, which indicates that gender affects the temporary math equal with 28.7%, this is also indicated by the value of significance F change (<0.001). Thus, gender plays a role in influencing the model of the hierarchical regression tests performed. Furthermore, on the second model, by adding multiple intelligences to the model, it is seen that R Square experienced a change of 51.1%, from the previous 0.287 to 0.797. The significance F change (<.001) shows that gender and multiple intelligences simultaneously influence the hierarchical regression model that is performed.

Meanwhile, speech communication as a dependent variable is seen on the first model if gender as a predictor affects the hierarchical regression test model by 12.4% (0.124), with a significance F Change value of 0.006 (<.001). Then, after adding multiple intelligences to the model, the significance of the F change becomes 0.000 (<.001), which indicates gender and multiple intelligences as predictors simultaneously affecting the model of the hierarchical regression test. It could also be seen from the magnitude of R square changes by 61.1%, from the previous 0.124 to 0.735. Lastly, on the GPA as a dependent variable, the first model has shown if gender affects the model with a significance value of F change equal to 0.003 (<.001), with an effect of 14.4%. Then, the second model shows that gender and multiple intelligences as predictors simultaneously also influence the hierarchical regression test model conducted, with a significance F change value of 0,000 (<0.01). This could also be seen from the change in R Square by 56.4%, from the previous 0.144 to 0.709.

Table 7 shows the results of the hierarchical regression test for each different dependent variable. The first model for all dependent variables shows that gender is a very significant predictor of temporary math (p <0.01), speech communication (p <0.01), and GPA (p <0.01). Interestingly, in the temporary math results, the value of B has a negative value (B = -0.441), which means that males tend to have better grades than females. Whereas the results of speech communication (B = 0.239) and GPA (B = 0.316) show the opposite results, females tend to have good results compared to males. Furthermore, on the second model, it appears that gender still has an influence on the three dependent variables, such as temporary math (B = -0.192, p <0.05), speech communication (B = 0.394, p<0.01) and GPA (B = 0.541, p<0.01). Interestingly, when added to the nine multiple intelligences, in the temporary math as the dependent variable, only two multiple intelligences predict the math performance, namely logical-mathematics (p <0.05) and naturalistic intelligence (p <0.01). On the logical-mathematic intelligence, seen positive B value (B = 0.234), which indicates that if someone has high logical-mathematical intelligence, they will get high math performance. Conversely, the naturalistic intelligence obtained a negative B value (B = -0.246), which indicates that someone who has less naturalistic intelligence tends to get a good math performance.

On the speech communication as a dependent variable, only has one intelligence as a predictor of speech communication performance, namely logical-mathematic intelligence

(P <0.01), with a positive B value (B = 0.329), which indicates that someone who has high logical intelligence is predicted have an excellent speech communication performance. Likewise, with GPA as a dependent variable, which also only has one intelligence as a predictor, namely logical-mathematics intelligence (P <0.05), with a positive B value (B = 0.293), which also indicates that someone who has high logical intelligence predicted to have a good GPA or average performance. Based on the second model, other multiple intelligences do not predict the three performances, but the three performances are more influenced by gender. Some previous studies have found that multiple intelligences are not predictors of performance (Koura & Al-Hebaishi, 2014). It could be argued that there may be other factors that could predict performance (Javanmard, 2012). We could not predict a person's success in performance only from the basis of his/her scores on the multiple intelligences.

Multiple intelligences are vital to explore (Savas, 2012; Madkour & Mohamed, 2016) because we can see how the potential of each of us is seen from the intelligence we have. In this study, exploration of preservice teachers' multiple intelligences has been carried out. Before the teachers could educate and develop the potential of their students, the teachers themselves must first be intelligent and have good development in terms of various aspects of intelligence. For example, a teacher who teaches math subjects, then the teacher must have good mathematical intelligence. Likewise with other intelligence, of course, it is essential for each teacher to possess, especially preservice elementary teachers.

CONCLUSION

This study explores the relationship between elementary preservice teachers' multiple intelligence and their performances. Based on the study, the naturalistic intelligence of the participants has been found to have the highest mean score among other intelligence, and this could be due to the university's location, which is in an agricultural area surrounded by nature. Meanwhile, the logical-mathematics intelligence was found to have the lowest mean score among other intelligence, for the future preservice elementary teachers are expected to train more extra logical-mathematics abilities. After all, preservice elementary teachers are required to teach math subjects, which are compulsory in elementary school.

Furthermore, it was also found that there were differences between several bits of intelligence (logical-mathematic, verbal-linguistic, spatial, bodily-kinesthetics, and interpersonal intelligence) with gender. This could be due to the less balanced comparison of participants with fewer male participants than female participants. It is expected that research that could include more participants will be conducted in the future. Eight of multiple intelligences, except naturalistic intelligence, correlate with the performances, especially logical-mathematical intelligence has a very positive relationship with math performance, as well as verbal-linguistic intelligence that has a positive relationship with English performance. Lastly, hierarchical regression shows if gender considers as a predictor of temporary math, speech communication, and GPA or average performance. Hierarchical regression also shows if logical-mathematics and naturalistic intelligence could predict temporary math performance, whereas for speech communication and GPA only is predicted by logical-mathematics intelligence.

The findings obtained by this research can be input for related stakeholders, such as the department of education, teachers' supervisors, or preservice teachers themselves. For the department of education and teachers' supervisors, it could be included in terms of seeing how the multiple intelligences possessed by each teacher or preservice teachers, which with the results of intelligence, those related stakeholders can place the appropriate potentials of each teacher in mapping the class or grade to be taught. Meanwhile, for preservice teachers, it could be input for them in terms of improving the intelligence that is lacking and

maximizing the potential of intelligence that is categorized as good. Not limited to that, this study could also be input for other researchers who have the same interest. Lastly, future research could be carried out that looks beyond the relationship of multiple intelligences with other performances such as arts, sports, science, and others. And also, not limited to multiple intelligences, future research could add other variables such as attitude, motivation, interest, learning styles, and other related variables.

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Communication Skills Profile of Elementary Teacher Education Students in STEM-based Natural Science Online Learning

Duhita Savira Wardani[1*], Jajang Bayu Kelana[1] & Zingiswa Mybert Monica Jojo[2]
[1]Institut Keguruan dan Ilmu Pendidikan Siliwangi, Cimahi, Indonesia
[2]University of South Africa, South Africa
*Email : duhita@ikipsiliwangi.ac.id

Keywords:	Abstract
elementary education; communication skills; stem; online learning; natural science	This study aimed to determine the communication skill profile of Elementary Teacher Education (ETE) students enrolled in natural science online learning-based STEM. Pre-experimental research with a one-shot case study design was used in this study. The study's sample consisted of 25 ETE students from a university in Cimahi. Observation and documentation were the techniques used in this study. The paired sample t-test was used to analyze the data. The descriptive analysis and hypothesis testing with the t-test were used to check the data validity. The findings of this study revealed that (1) there is an effect of STEM-based online science learning on ETE students' communication skills, (2) that most students are still in the Intermediate category for written communication and "does not meet the Standards" for oral communication skills, and (3) that students' communication skills in STEM-based science online learning still need to be optimized. The study's findings suggest that ETE lecturers in Indonesia should broaden their knowledge and perspectives in STEM-based learning and communication management. Second, ETE lecturers in Indonesia must take the assessment of communication skills more seriously. Last but not least, the government, with the help of researchers, must devise an excellent assessment system to overcome time constraints. The results of this study revealed that STEM-based online science learning is being implemented.

INTRODUCTION

Background

Education is facing a number of increasingly serious challenges, in line with the evolution of the world's paradigm of what education means. One of the most significant challenges is that education must be capable of producing fully competent human resources. Unlike decades ago, the competencies expected of human resources professionals today are more focused on a few competencies, one of which is communication skills. This is one of the competencies that is emphasized in the twenty-first century, and it is one of the skills that a person must have when entering the workforce (Bybee, 2013). Human resources should be able to communicate in order to collaborate and communicate creative ideas at this time. Communication skills are seen as more than just soft skills; they are also seen as one of the keys to overcoming today's challenges. (Haryanti & Suwarma, 2018). Communication skills are defined as the ability to effectively convey verbal information, criticism, and the ability to reflectively and interactively use and write in a variety of media and technologies. Collaboration, interpersonal skills, personal responsibility, social responsibility, and public-interest thinking, as well as two-way communication, are all important aspects of effective communication. (Greenstein, 2012).

Problem of Study

The results of a study conducted by Marfuah (2017) on grade VII students at a junior high school in Depok City during the even semester of the 2015/2016 academic year demonstrate the lack of student communication skills in Indonesia, and it is also well known that students rarely receive assignments to make observations or assignments of natural objects and phenomena. Students are placed as recipients of information and the contents of the book are poured out so that when asked for arguments in the discussion process, students are unable to express their opinions, are insecure, and as a result, students do not understand the material, resulting in low learning outcomes. In a study conducted by Dipalaya et al. (2016), the same issue was discovered: learning Biology is still heavily geared toward developing and testing students' memory. Learning is often based on rote learning rather than student experience, causing students' abilities to be misunderstood as memorizing abilities, resulting in less-than-optimal communication skills. The teacher has recently begun to provide opportunities for students to communicate while learning, as evidenced by the frequent discussion and question-and-answer activities in class. However, the expected communication skills have not been fully developed during the learning process. Students are less interactive in their communication, use less technology, and deliver messages or information in a less assertive and effective manner.

Communication skills should be taught as part of the learning process, given their importance. STEM-based learning is an example of a successful learning strategy. Students are frequently required to communicate good ideas with peers, teachers, or other audiences to convey the results of the learning process they have gone through in this approach, which is based on Project-Based Learning. As a result, it is thought that the STEM approach will help students improve their communication abilities.

STEM learning is based on a multidisciplinary approach and Project Based Learning. The goal of STEM education is to prepare students to apply their knowledge to solve complex problems and to develop STEM skills. (Ritz & Fan, 2015). Through the systematic integration of knowledge, concepts, and skills, the STEM learning approach is expected to produce meaningful learning for students. Students become better problem solvers, inventors, independent, logical thinkers, and have greater technological literacy as a result of the STEM approach. (Stohlmann et al., 2012);(Kelana et al., 2020). Students are expected to not only solve STEM-related problems, but also to solve a variety of complex problems that will help

them develop their higher-order communication and thinking skills. STEM can also help students prepare for the needs of 21st-century human resources (Bybee, 2013);(Firdaus et al., 2020), even though it is still in the midst of the Covid-19 pandemic.

Covid-19 is a virus that has never been predicted before, and it is likely that it will become an endemic virus in the community. According to Dale Fisher, WHO Global Outbreak Warning and Response Network Official, the Covid-19 vaccine will most likely be available by the end of 2021. In this regard, the Indonesian Minister of Education and Culture issued Circular No. 4 of 2020 on the implementation of Education Policy in an Emergency for the Spread of COVID, which explains that students learn at home through distance learning to provide meaningful learning experiences (Kelana, J.B., Wardani, D.S., & Wulandari, 2021).

State of the Art

In fact, studies on student communication skills have been carried out both in Indonesia and abroad. These studies include Hausberg et al. (2012) which conducts development and evaluation in improving the communication skills of medical students, Maryanti et al., (2012) examines the relationship between communication skills and student learning activities. In line with this, Dharmayanti (2013) investigated the use of role-playing techniques in improving student communication skills, Wardani et al. (2020) used a Project-based learning model with a prop-making activity to improve students' written communication skills, and Thomas et al. (2009) developed SBAR communication techniques to improve medical students' communication skills. However, most of these studies focus on offline or face-to-face learning, and few have looked at communication skills in STEM via online learning.

Gap Study & Objective

This study aims to identify the profile of communication skills of Elementary Teacher Education students in STEM-based Natural Science Online Learning as a first step in analyzing the effect of STEM-based learning on students' communication skills through online learning. Oral and written communication skills are included in the measured communication skills profile.

METHOD

Type and Design

This research is a pre-experimental research with a One-Shot case study design. The One-Shot Case Study design is a research design consisting of one group that is given treatment which then observes these results and the absence of a comparison group and randomization (Dantes, 2012; Sugiyono, 2012). The design of the one shot case study can be seen in Figure 1 (Fraenkel, J.R., and Weelen, 2008).

$$\boxed{\text{X O}}$$

Figure 1: Pre-experimental research with a one-shot case study design

Note:
X: Treatment of independent variable
O: Observation or measurement of dependent variable

Convenience Sampling was used to select the sample for this study, which consisted of 25 Elementary Teacher Education (ETE) students from a university in Cimahi, Indonesia, during

the 2018/2019 academic year. The study's independent variable is STEM-based online natural science learning, and the study's object is student communication skills.
STEM has been used in lectures for the past few semesters, but due to the Covid-19 pandemic in the middle of the even semester, lectures have been transferred to online learning while still incorporating STEM.

Data and Data Sources

The data gathered in this study is in the form of results from students' oral and written communication skills tests. Oral communication and written communication are the two types of communication skills that are assessed in students. Data collection on oral communication skills was carried out through a presentation process which was assessed based on a rubric adapted from the University of Baltimore (University of Baltimore, 2010) with 6 indicators, namely: 1) Organization, (2) Eye contact, (3) Delivery, (4) Conclusion, (5) Responsiveness, and (6) Multimedia Support. The results of the student presentations will then be analyzed as a whole and will divide the students into three categories of oral communication skills which can be seen in Table 1.

Table 1. Oral Communication Assessment Criteria

Total score	Category
16-18	Exeed the standard
11-15	Meet the standard or avarage
≤ 10	Failed to meet standard

While data on written communication skills was gathered through the creation of a report, which was then evaluated based on predetermined criteria, which consisted of: (1) Objectives, (2) Background of the Problem, (3) Idea Finding, (4) Making Process, (5) Testing Process, (6) Analysis, (7) Results, and (8) Conclusions and fulfilling the Format and Style requirements that have been determined. The results of processing grades from student reports are then categorized into several categories based on the rubric adapted from the University of Baltimore, with the scoring criteria which can be seen in Table 2.

Table 2. Written Communication Assessment Criteria

Total score	Category
25-30	Advance
17-24	Intermediate
9-16	Emerging
≤ 8	Basic

Data collection technique

Observation

The observations used in this research are participatory observation and direct observation. The author evaluates both inside and outside of class activities by observing informants (lecturers). The author participates in lecturer activities when assessing students' oral communication skills which consists of 6 indicators

Documentation

The purpose of this study's documentation method is to obtain data through documentation, which entails studying documents related to all of the study's data requirements. The document used in this study is a document report on the results of

project implementation carried out by each student to assess students' written communication skills which consists of 8 indicators.

Data Validity

Furthermore, a T-Test (paired sample t-test) was used in this data processing activity to see if project-based learning improved the writing skills of elementary school teacher candidates' science teaching materials. H0 is accepted and interpreted as not having a significant improvement in the writing skills of science teaching materials for elementary school teacher candidates using the project-based learning model if the Asymp.Sig value is (2-tailed)>, where $\alpha = 0.05$.

Data analysis

The data analysis method used consisted of descriptive analysis of the data and hypothesis testing using the t-test. The hypotheses proposed in this study are: (1) there is an effect of using STEM-based online science learning on the oral communication skills of PGSD students, (2) there is an effect of using STEM-based online natural science learning on ETE students' written communication skills.

RESULT

The lecture begins by allowing students to identify problems using a student worksheet, which the lecturer guides through zoom in order to complete. The students were confronted with the problem of discovering a village that lacked access to electricity and relied on kerosene lamps, which are a non-renewable source of energy. It was also explained that because non-renewable energy sources will eventually run out, the price of fuel oil will continue to rise, and because the village is remote, there is no electricity serviceHowever, other suitable alternative energy sources, such as wind and water, are available in the village. Students are also required to create problem-solving designs in order to create tools that use alternative energy as solutions to problems they have encountered individually at this meeting. Students will begin to turn the results of their thoughts into products that can individually solve these problems at the second meeting, giving them the freedom to choose which designs to use. Students begin making tools individually after creating a complete design with scale and size. The product designs that each student is expected to create are propeller designs for wind power plants or turbine designs for hydropower plants that can produce the most electrical energy. Each student must analyze how to make their windmill produce more electrical energy once the propeller or mill in the product can move and produce electrical energy. Each student is allowed to redesign and remake the product or improve the product that has been made so that it can produce more electrical energy at the fourth and fifth meetings.

At the sixth meeting, students were asked to present the products they had created individually after all of the learning activities had been completed. This meeting will also include a presentation-based assessment of students' oral communication skills. Then, as a means of evaluating written communication skills, students are asked to prepare a structured report based on the product that has been created.

According to research, the majority of students (56%) still fall into the "failed to meet standards" category. None of the students, on the other hand, "exceed the standards," and some of the others "meet the standard." This suggests that STEM-based science education can help students improve their oral communication skills, but the implementation process still needs to be improved. The data can be seen in Table 3.

Table 3. Analysis of Oral Communication Skills

Total score	Number of students	%
Exceed the standard	-	
Meet the standard or average	14	56
Failed to meet standard	11	44

Table 3 shows that more than half of the students have oral communication skills that fall short of the minimum requirements. This is due to a lack of opportunities for students to practice their oral communication skills in the past. Aside from that, this can occur because not all knowledge can be conveyed through oral presentations. Table 4 shows the results of written communication skills testing.

Table 4. Analysis of Written Communication Skills

Level	Number of students	%
Advanced	-	
Intermediate	13	52
Emerging	8	32
Basic	4	16

Table 4 shows that the majority of students are in the intermediate category, with thirteen students (52%) in the intermediate category, eight students (32%) in the emerging category, four students (16%) in the Basic category, and no students in the advanced category. This indicates that, while the majority of students are already in the Intermediate category, there is still room for them to improve their written communication skills through STEM-based natural science online learning in order to advance to the Advanced category.

A. Tujuan
Menemukan solusi permasalahan dengan membuat suatu alat yang dapat membantu menyelesaikan masalah tersebut

Figure 2: Example of Students' Response of a question on Purposes of Making a Product which earns a score of 1. In English, it equals as "Making a tool to solve the problem in order to find a solution"

Figure 2 shows an example of a student's response to the 'Objectives' section with a score of one, indicating that the student is at the Emerging level. The explanation receives a score of one because it does not meet the criteria. Meanwhile, Figure 3 depicts an example of a student's response for the 'Objectives' section with a score of two points at the Intermediate level.

A. Tujuan
Menemukan solusi agar desa tersebut mendapat energi tambahan berupa energi listrik karena sebelumnya masih menggunakan lampu dengan bahan bakar minyak tanah

Figure 3: Example of Students' Response of a question on Purposes of Making a Product which earns a score of 1. In English, it equals as "find a solution to provide the village with additional energy in the form of electricity, as it previously relied solely on kerosene as a fuel source"

"Being able to make simple power generation technology using the principle of energy change through the use of natural energy sources based on problem analysis," is the answer to the 'Objectives' section that students are expected to write. Keywords such as energy crisis, alternative energy, natural energy, and power generation are also likely. It is also possible to write it directly by mentioning windmills or watermills. Figure 2 only states that the purpose of making the product is "making a tool to solve the problem in order to find a solution," without elaborating on what problems are encountered, what tools will be made, and what the conditions and situations that are occurring.

Meanwhile, in Figure 3, the response appears brief, but the explanation includes several keywords, such as "additional energy." The student then mentioned the village's previous conditions, implying that the students already knew what problems the village was facing. Despite the fact that the answers to the students' explanations were incomplete, the explanation indicated that students could write down the product's objectives based on problem analysis.

The data were found to be normally distributed and not homogeneous based on the results of the normality and homogeneity tests, so the mean similarity test could be continued using the Mann-Whitney U-test as an alternative to the free sample t-test through the SPSS 20 program with a significance level of 0.05. Table 3 displays the Mann-Whitney U-Test results.

Table 5. The Mann-Whitney U-Test

Test Statistics[a]	
	Pos - Pre
Z	-4.512[b]
Asymp. Sig. (2-tailed)	.001
a. Mann-Whitney Signed Ranks Test	
b. Based on negative ranks.	

Only the two-party (2-tailed) test meets the test criteria based on the Mann-Whitney test of the student report scores. The null hypothesis is rejected in Table 3 because Asmp. Sig. (tailed) has a significance of 0.001 and 0.001 is smaller than 0.05. This means that the application of STEM-based online science learning has an impact on ETE students' communication skills.

DISCUSSION

According to Table 3, more than half of the students are unable to communicate verbally. They do not meet the requirements, as evidenced by the findings. This happened because students had not had enough opportunities to practice their oral communication skills in the past. When students have the opportunity to speak in front of an audience, they will feel nervous, and when asked to give a presentation, they will feel under pressure. (Saenab et al., 2017). This causes students to forget what they want to say when speaking in front of a group, even if they are in an online learning environment. Receiving and transmitting information, as well as gathering data, are all communication skills (Ilyas, 2013). Because STEM relies on a Project-Based Learning approach, students are frequently required to communicate ideas with colleagues, teachers, or other audiences to convey the result of the learning process, students' oral communication skills have been honed in STEM-based online science learning. Project-based learning in STEM, according to Priansa (2015) , always includes presentations or performances. This presentation process, like the

previous project design presentation stage, allows students to share tasks in providing information about their project results. Information is communicated communicatively via poster media, attracting other members to actively ask questions. The question-and-answer process also increases student knowledge of the concepts covered (Saenab et al., 2017). Based on this description, it is possible to conclude that by implementing STEM consistently in online learning, students' oral communication skills will be able to meet or exceed standards.

Meanwhile, according to Table 4, half of the students have intermediate written communication skills, while the other half have emerging or basic skills. The intermediate category indicates that some students can communicate in writing, as evidenced by the individual reports on project results. It is possible to see how students determine goals, background problems, idea generation, project creation process, trial process, analysis, results, and conclusions, as well as how they adhere to the predetermined format and style. Students will gain experience and basic concepts from STEM project activities that will help them understand problems and find solutions. Improved written communication skills as a result of positive treatment/values from STEM learning activities using a project-based learning model. According to Afriana et al. (2016), Project-Based Learning in STEM has several benefits, including: encouraging students to do meaningful work; able to encourage students to improve collaborative skills in communication; increasing motivation in learning; improving student skills to manage learning resources; making students more able to develop and practice communicating skills; providing students with experiential learning through practice and project organization; Students will understand the material and be able to communicate their understanding through writing as a result of thi.

Figure 2 depicts the responses, which show that students were unable to elaborate on the problems encountered, the tools that will be created, and the conditions and situations that occurred. One aspect of creative thinking skills is the ability to elaborate, which allows a person to develop, enrich, and detail ideas (Guilford, 1950; Guilford, 1967; Beck, 2011). Students can learn to elaborate in presentations where they present their work or products. The presentation process in STEM learning can consistently train students to think fluently and elaborately, which can be expressed verbally and in writing. (Nafiah & Suyanto, 2014; Nurcholis et al., 2013).

Furthermore, in Figure3, students were able to analyze the problems encountered and understand that these problems require solutions in one aspect but are unable to find the correct solution. Even though the answers to the students' explanations were incomplete, the explanation indicated that students could write down the product's objectives based on problem analysis.

The ability of students to critically review problems from various points of view is closely related to their ability to analyze problems (Yuniarti & Hadi, 2015). Project-based learning can help you develop the ability to analyze problems in stages (Maida, 2011). This is due to the fact that in project-based learning, students must be able to develop their knowledge and skills through a process of problem analysis and investigation with structured open questions in order to be able to apply knowledge to produce a product (Kelana & Wardani, 2021).

CONCLUSION

Previous research on communication skills was limited to face-to-face learning dimensions and primarily focused on one aspect of oral communication. The current study revealed the implementation of STEM-based online science learning that is conducted online. The current study's findings would be critical for all elementary education parties to develop an effective solution to this problem.

There are several limitations to the study. Initially, it is only conducted on ETE students in a single batch at a single university, so it cannot be generalized completely to all ETE students. Second, because the study lasted less than a year, the data was not entirely comprehensive. Future studies on implementing social attitudes assessment would benefit from more representative informants (from various universities) over the course of a year. Three recommendations are made by this study. First, ETE lecturers in Indonesia must broaden their knowledge and insights into STEM-based learning and communication management. Second, ETE lecturers in Indonesia must take communication skills assessment more seriously. Finally, the government, with the help of researchers, must create an excellent assessment system to address time constraints.

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Development of E-Comic Teaching Materials for Social Studies Learning in Elementary Schools

Hana Dinah Fadilah
Universitas Negeri Jakarta, Jakarta, Indonesia
*Email: hanadinahf@gmail.com

INTRODUCTION

Background

Education is one of the most fundamental processes in adjusting to one's surroundings in order to achieve a goal or achieve success. Education can be defined as educators' efforts to develop knowledge and skills for the benefit of humanity. Learning objectives, students, educators, curriculum, materials or subject matter, approaches, methods, media, learning resources, and evaluation are all components of education (Ratnasari, 2017). Social studies learning allows students to gain in-depth knowledge related to the environment, including those that cover the four competencies in the 2013 curriculum objectives (Saputri &

Estiastuti, 2018). Social studies education is an adaptation of a series of social sciences and humanities that are combined into a single unit in a medium, as well as social studies learning, which is the implementation of education in schools (Hilmi, 2017). The purpose of social studies learning is to educate a community's life based on good moral and ethical values and can uphold the nation's cultural values and also aims to form students who have the knowledge, national insight, skills, social ethics, and high social character (Rosidah, 2017). The term social studies in elementary school are the name of a subject that combines a series of concepts from the social sciences, humanities, science, and various themes of life and social problems (Yuanta, 2019). Social studies in elementary schools aims to teach and guide students to become good citizens, have knowledge and perceptions, skills, and also social concerns that can be useful for students themselves, society, and the country (Rosmalina, 2019).

During the learning process, teaching materials become one of the components that can determine whether learning is exciting or not. The factors influencing whether or not the learning process is interesting are also influenced by the teaching materials used for learning (Rohmah, 2017). Teaching materials are media where teachers provide information or knowledge to students, and teaching materials are also learning materials that are systematically arranged for use by teachers and students in the learning process at school (Husada et al, 2020).

Problem of Study

The problem that often occurs in elementary school students, especially in social studies learning, is the use of learning media that are less attractive to students and do not always use media in the learning process (Sari, 2017). According to Adhaningrum (2020), the issues encountered during the implementation of social studies learning in the Indonesian thematic curriculum 2013 are ineffective learning materials used by students, resulting in an ineffective learning process.

Based on the aforementioned issues, several researchers concluded that comics teaching materials were appropriate for use in the elementary school social studies learning process. According to the findings of Prihanto & Yunianta (2018)'s study, the Mathematics comic learning media can assist students in learning, and the Mathematics comic media has been declared valid, effective, and practical to use for learning Mathematics in elementary schools. According to Indaryati & Jailani (2015)'s research, studying comics can boost students' motivation and achievement, and the findings show that comics are effective and practical for learning mathematics. Sari (2017) discovered that using comic books as learning materials in elementary schools is successful.

An e-comic based on mobile learning was developed in social studies learning in elementary schools to aid in the resolution of the problems described. It is possible to increase students' imagination and interest in learning in a lesson by reading comic books or books with pictures and storylines. When combined with a variety of teaching methods, comics can help students become more engaged in the learning process (Nugraheni, 2017).

State of the Art

Comics are collections of images arranged in sequence and using characters in the story to increase the imagination of the reader (Hardiyanti et al, 2019). The comic itself contains the text that can be found in the conversation bubble, which serves to clarify the story in it, and comics are also pictured books that are liked by children. The comic itself comes from the French "comique", which is an adjective that means funny or ridiculous. "Comique" itself comes from the Greek, namely comicos (Aeni & Yusupa, 2018). According to Sudjana & Rivai (Subroto et al, 2020), comics have several characteristics, including comics that consist of various serialized stories are entertaining, have other characteristics in them so

that the power of comics can be well understood and can also focus attention. In the surrounding environment, readers can identify themselves with the feelings and behaviour of the characters because the stories in comics can be about themselves, and stories that are packaged into concise comics and attract the reader's attention are also usually equipped with action stories and the making is more alive because with the free use of primary colors in comics. In addition, learning media that uses comics as a medium of learning will make it easier for teachers when providing subject matter, and this can help educators understand or accept material (Subroto et al., 2020).

Comics can now be created digitally without the need for printing in today's world. Electronic comics are a type of technological media that aims to improve understanding of the concept of early childhood knowledge while also serving as a learning medium that appeals to children's interests (Syarah et al, 2018). Electronic comics are also known as digital comics, and technological advancements have an impact on comics in today's digital world (Ruiyat et al, 2019). The use of electronic comics teaching materials that combine pictures and text can help children understand some concepts while they are learning.

This study differs from previous research in that it created an E-Comic teaching material for social studies learning for fifth-grade elementary schools. And the E-Comic that will be developed is in the form of a strip. The developed E-Comic is in the form of a strip. A comic strip is a comic that has only a few panels of pictures but can express a complete and clear idea in terms of content. The E-Comic can be used as a media tool in fifth-grade social studies lessons in elementary schools. The author prefers E-Comic teaching materials because they have several advantages, including: increasing student interest in learning, making the material more appealing to students, assisting students in understanding abstract concepts, and providing storylines that cover the material Kanti et al, 2018). Students benefit from using this E-Comic teaching material because it does not require an internet connection, allowing them to learn independently without having to wait for instructions from the teacher. To draw students' attention to the content of this E-Comic, it will be packaged into an illustrated storyline.

Gap Study & Objective

Comic books are typically packaged in a book, but with the advancement of technology in the modern era, comics are now also available in electronic form, referred to as mobile comics (Anesia et al, 2018). Social studies comics were created on a mobile platform, allowing users to take them with them wherever they go. Comics in the form of mobile apps can also help to reduce paper consumption (Hadi & Dwijananti, 2015). Subroto et al (2020), conducted previous research on comics and concluded that comics are effective for use in learning because they contain many colors and images, making the material easier to understand. Styaningsih et al (2016), found that using digital comics teaching materials in Civics learning increased student interest in learning. Another study was conducted by (Muliani, 2020) who discovered that comic books could be used to support learning activities in elementary schools to improve student learning outcomes in social studies classes.

Based on the foregoing, the researcher conducted this study with the goal of developing an engaging, efficient, and effective e-comic teaching material for the fifth grade in elementary schools based on mobile learning in social studies subjects that can help increase student interest in social studies learning in the fifth grade.

METHOD

The research design that will be carried out is Research and Development (R&D) research to develop teaching materials in the form of Mobile Learning-based E-Comic using the ADDIE model. The ADDIE model emerged in the 1990s, which was developed by Reiser and Mollenda. The researcher uses the ADDIE development model because it has a procedure that refers to the Research and Development (R&D) stage, which has simple stages so that effective products can be developed. The ADDIE model has 5 stages, namely Analyze, Design, Development, Implementation, and Evaluation. However, due to conditions that did not allow using the 5 stages of the ADDIE model, this research was not continued until Implementation and Evaluation. The following is an explanation of each ADDIE stage in making Mobile Learning-based E-Comic teaching materials.

Analyze

This analysis stage aims to obtain and collect information for the required needs. At this stage, the researcher will first analyze the material and also analyze the needs (needs analysis). The subjects in this study were fifth-grade elementary school students.

Design

In the design, the researcher designed and developed an E-Comic based on Mobile Learning Social Sciences on the material of the Indonesian Nation's Resistance Against Invaders in the fifth grade of elementary school based on the results of the analysis in the previous stage.

Development

The development stage is the step where E-Comic is made based on an existing design. Then the teaching materials are validated by experts, which will be continued at the revision stage. Experts who will validate these teaching materials are material experts, media experts and language experts. After the product has been made, it enters the product testing stage which will be carried out by teachers and students.

Instruments and Data Processing

The instruments that will be used for data collection in this study are interviews with teachers, students and expert test assessment questionnaires. The data analysis technique that will be used in this research is descriptive quantitative and also descriptive qualitative. The quantitative descriptive method is used to process expert data and student response questionnaires, while the qualitative descriptive method is used to describe corrective comments and validators' inputs.

Data for the study is collected using custom-made instruments that will be distributed to teachers, students, and experts. For data analysis, this study employs a Likert scale of 1-5. The formula for calculating the ideal percentage is as follows:

$$P = \frac{S}{N} \times 100\ \%$$

Source : (Arikunto, 2012)

P = ideal percentage
S = Number of components of research results
N = Total maximum score

The questionnaire response to the use of e-comic contained 5 criteria according to the questions asked. Changes from the results of the assessment of media experts, linguists, material experts from letters to scores that have been determined in table 1:

Table 1. Likert Scale of Validity Sheet

Interval	Criteria
5	Very Good
4	Good
3	Sufficient
2	Poor
1	Very Poor

Source : (Ulfah, 2014)

The purpose of using an expert questionnaire is to determine the feasibility of the under-development product so that the questionnaire's feasibility value can be obtained for each aspect. The conversion of scores into a statement of assessment criteria is shown in Table 2:

Table 2. Interpretation of Media Eligibilit Score

Percentage (%)	Criteria
0 - 20	Very Weak
20< - $\leq$40	Weak
40< - $\leq$60	Sufficient
60< - $\leq$80	Worthy
80< - $\leq$100	Very Worthy

Source : (Anesia et al, 2018)

Based on the criteria showed in Table 2, the media is said to be feasible if the percentage is > 60% of all aspects.

RESULT

As a result of this development research, an E-Comic based on Mobile Learning has been created. Using the ADDIE development model, but only up to the development stage due to unforeseen circumstances. The stages that researchers have completed are detailed below:

Analyze

Researchers gather and analyze the needs for e-comic teaching materials in the analysis phase by analyzing core competencies and basic competencies, as well as the learning objectives of fifth-grade elementary school students in the 2013 Indonesian national curriculum, and determining the materials to be used in e-comic teaching materials.

Students must be able to identify the important factors that lead to Indonesian colonialism and the Indonesian people's efforts to maintain their sovereignty, according to the curriculum's basic competency 3.4. The goal of studying this basic competency is for students to be able to recognize the background of European arrival in Indonesia and to be able to explain the events surrounding the arrival of European expeditions in Indonesia. The researcher decided to create an e-comic teaching materials based on the material of

European colonization in Indonesia based on the competency analysis. The author also conducted a needs analysis by observing and interviewing teachers and fifth-grade students at the Riyadh El Jannah Islamic School. According to the results of the interview, there is still a shortage of social studies teaching materials, as students struggle to comprehend the history of European colonization in Indonesia.

Design

Researchers worked on determining the comic's title and theme, collecting references, determining the material, compiling the comic's framework, designing the e-writing comic's format, and designing the e-display comic's or panel at this stage.

Drafting the e-comic

The research moves on to the stage of drafting the e-comic material after the researcher determines the content of the lesson. Microsoft Word is used to create scripts and e-comic materials. The source material has been adjusted to the Basic Competency that was determined during the analysis stage, as well as combining several resources and making adjustments to make it understandable for students.

This e-comic is divided into four parts, each explaining why Europeans colonized Indonesia, as well as explaining Portuguese, Spanish, and Dutch colonization. The material is organized into easy-to-follow stories with appealing illustrations to keep students interested in reading the e-comic.

E-comic creation tools and applications

Computers, laptops, and the Cintiq Pro 13 pen were used to create the e-comic. Clip Studio Paint Ex and Adobe Photoshop are the media editing applications used. Freepik, a image resources website, is used to find suitable imaging materials..

Illustration design

Interesting illustrations are required to draw students' attention to this e-comic and encourage them to read it. The author establishes two main characters, Mr. Girdan as a teacher and Kido as a student, based on the previous stage's draft. To make it more interesting, the surrounding background of this e-comic cover has been adjusted to the colonial theme.
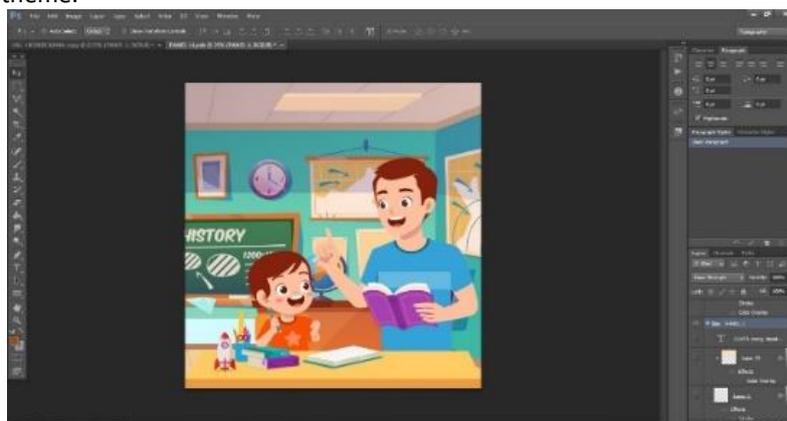
Figure 1. Illustration design display

Figure 2. Illustration design display

Development

The e-comic is created based on a predetermined design during the development stage. Starting with the canvas, creating panels, locating the source of the illustration components, designing and combining the illustrations, and, if necessary, redrawing the illustrations. Following the completion of the teaching materials, they will be validated by material, media, and language experts.

Canvas and panel making

The canvas and panel must be created first. Adobe Photoshop CS6 is used for both of these projects. The canvas has a resolution of 4000 x 5000 pixels and a 300 dpi. The panels are sized to fit the size of the canvas..
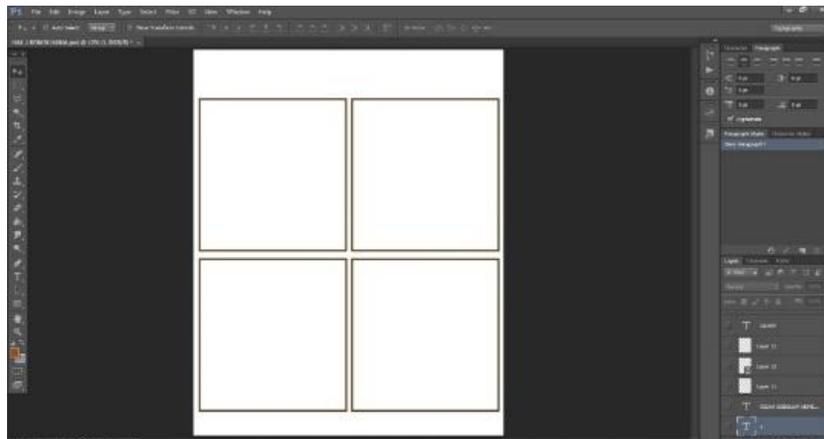
Figure 3. Canvas display and e-comic panels

E-comic editing and illustration creation

After the canvas and panels have been created, the e-development comic's team moves on to editing the rest of the e-components. book's Making panel boxes, word balloons, and adding extra designs like ancient effects, as well as making illustrations as needed, is the

first step. The next step is to decide on the language for the e-story comic's and tailor it to the script. This procedure is repeated until the desired outcome has been achieved. Figure 4 shows the subsequent outcomes of the development.
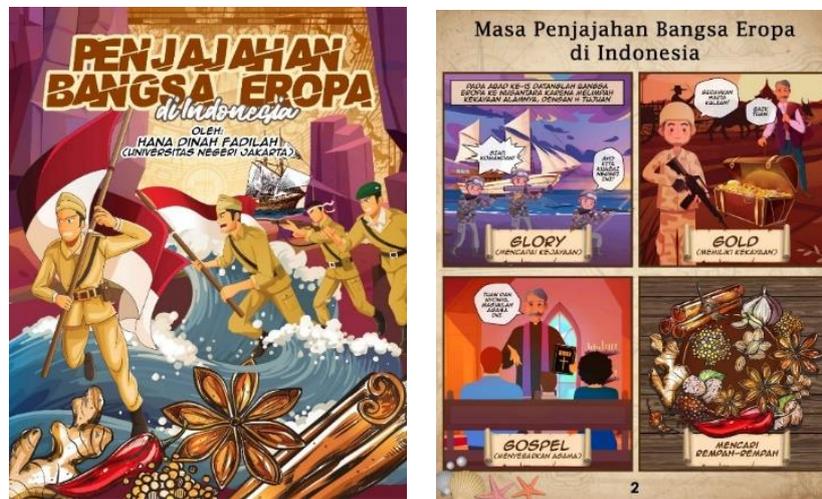
Figure 4. Cover and story display in e-comic

E-comic Validation Test

A validation test is a developed product assessment process that will be evaluated by the validator. A questionnaire with three aspects, namely the material aspect, the language aspect, and the media aspect, is used in the validation process. The goal of the validation is to see if the e-comic is suitable for research purposes.

Table 3. E-comic Validation Test

Expert Validator	*Percentage* (%)	Criteria
Material	90,76%	Very Worthy
Language	78,66%	Very Worthy
Media	98,46%	Very Worthy
Mean	89,29%	

The product revision is carried out based on the validator's feedback and suggestions after it has been assessed by the validator in every aspect. The Figure 5 displays the e-comic after changes have been made.

Figure 5. The display of e-comic after revision

DISCUSSION

This research creates an e-comic-style teaching plan for distance learning in social studies subjects for elementary school students. Using the ADDIE development model, but due to unforeseen circumstances, this study was not completed until the Implementation and Evaluation stage. Social Studies E-comic Teaching Materials Based on Mobile Learning Learning that has been developed is said to be excellent because it meets all of the requirements. The e-teaching comic's materials include information about the beginnings of European colonization in Indonesia. Teaching materials are accompanied by supporting illustrations that correspond to the material described, as well as stories that serve as material explanations, so that students can understand the material while reading. Illustrations are useful as supporting descriptions in clarifying the contents of an article because they provide a concrete and clear picture.

Furthermore, the e-comic teaching materials, based on the quality of the design of the teaching materials developed, contain detailed content and language that is easy to understand for students to understand the material. The attractiveness of illustrations varies and is interesting based on the characteristics that students possess. This media is thought to help students by attracting their attention and engaging them in self-directed learning.

The three validators' evaluations were obtained from the research that was conducted. On the basis of this evaluation, criticism and suggestions were obtained, which were used as a guide for improving the e-comic. By meeting assessment criteria such as the suitability of competence or learning objectives, the material presented is easy to understand, and the material's suitability with the image is very good, the above validation results obtained a percentage of 90.76 percent for the material aspect. The language aspect received 78.66 percent due to criteria such as the sentences used in the e-comic can represent the content of the message or information to be conveyed and the sentences used are communicative. Meeting the criteria for the accuracy of color selection on the e-comic character, the character design of the e-comic characters is attractive, and the presentation of the e-comic illustration has led to an understanding of the concept resulted in a 98.46 percent score for

the media aspect. The overall average for these three elements is 89.29 percent. It can be concluded that this e-comic can be used effectively in social studies classes.

After expert product validation, product trials were given to teachers and students to see how they reacted to the e-comic based on the questionnaire that had been created. The teacher's response received a final score of 92 percent, while the average student response received a score of 94.57 percent. Based on the results of the survey, it can be concluded that e-comic teaching materials are ideal for use in social studies classes.

The findings are similar to those of Wicaksana et al (2019), who created an e-comic about the struggle for Indonesian independence, which received an average rating of 93.78 percent, indicating that it is suitable for classroom use and can increase students' interest in learning about the struggle of Indonesian independence preparations.

Another study conducted by Laksmi & Suniasih (2021), on the development of e-comic in fifth-grade elementary school students was also found to be suitable for use in elementary school, with a percentage result of 90% on individual test subjects and a validator assessment average of 98 percent from content experts, learning experts, learning design experts, and learning media experts.

CONCLUSION

This study develops e-comic teaching materials for distance learning in social studies in elementary schools, focusing on European colonization of Indonesia. Several validators reviewed the e-comic for material, language, and media. The average percentage for teacher responses was 92 percent, and the average score for student responses was 94.57 percent, according to the validator's assessment. This e-comic teaching material can be concluded to be appropriate for learning.

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Connecting Spatial Reasoning Process to Geometric Problem

Lingga Nico Pradana[*] & Octarina Hidayatus Sholikhah
Universitas PGRI Madiun, Madiun, Indonesia
*Email: nicopgsd@unipma.ac.id

Keywords:	Abstract
spatial reasoning; geometric problem; spatial skill	The field of spatial reasoning has seen a lot of research. The process of spatial reasoning, on the other hand, needs to be investigated further. The goal of this study was to capture an elementary school student's spatial reasoning process when solving geometric problems. The spatial skills used in solving geometric problems were also identified in this study. A geometric test was given to seventeen elementary school students. Three participants were chosen as the study's subjects based on their written responses. According to the findings, the subject's spatial reasoning process always begins with the processing of information in mental visualization. Mental visualization is used to help with orientation and selecting the appropriate visual perspective. The spatial skills of spatial visualization and spatial orientation are critical in spatial reasoning. Furthermore, this research initiated the emphasis on the focus of spatial reasoning in the process.

INTRODUCTION

Background

Spatial reasoning is an ability related to representing and using objects and relationships geometrically in two and three dimensions (Williams et al., 2010; Yüksel, 2017). Spatial reasoning has three main properties (NCTM, 2006). First, awareness of space such as distance, coordinates and dimensions. Some of these skills are explicitly discussed in the mathematics curriculum. Second, the interrelationship of spatial information representation, graphic coding and decoding such as diagrams and maps. Third, interpreting spatial information and making decisions.

When someone does spatial reasoning, then there are spatial skills that are used. Spatial skills are classified into five components, namely spatial perception, spatial visualization, mental rotation, spatial relations, and spatial orientation (Yüksel, 2017). Spatial perception is the ability to determine vertical and horizontal directions based on information. Spatial

visualization is the ability to describe situations based on information (Lowrie et al., 2017; Moore-Russo et al., 2013). Mental rotation is the ability to rotate two- or three-dimensional objects and imagine their position when rotated. Spatial relation is the ability to recognize relationships between parts of objects (Lowrie & Jorgensen, 2017; Yüksel, 2017). Spatial orientation is the ability to enter a given spatial situation (Peng & Sollervall, 2014).

Problem of Study

In this article, we carried out the student' spatial reasoning process in geometric problems. In previous research, spatial reasoning was stated as one of the factors that made someone successful in the field of mathematics (Kovačevi´c, 2017; Mulligan et al., 2017; Newcombe, 2013). Then it becomes another trigger for research to design spatial reasoning activities (Cheng & Mix, 2014; Hartatiana et al., 2017; Lowrie et al., 2017). These activities designed to improve spatial reasoning and mathematics performance of elementary school students. However, research was mostly done on elementary school students. The research still hasn't highlighted the elementary school student' process of reasoning. In the measurement of spatial reasoning, the instruments used by previous studies are in the form of multiple choices. For example, Spatial Reasoning Instrument (SRI) (Ramful et al., 2017), paper folding tests (Akayuure et al., 2016; Williams et al., 2010), mental rotation test (Yoon & Mann, 2017) etc. However, the spatial reasoning instrument has not described the spatial reasoning process itself.

State of the Art

In previous studies, not all components were used in measuring spatial reasoning. Lowrie et al (2017) using three components of spatial reasoning, namely spatial visualization, mental rotation and spatial orientation to design spatial reasoning activities. While Cheng & Mix designing spatial training uses two components, mental rotation and spatial relation (Cheng & Mix, 2014). It states that in spatial reasoning, not all spatial skills are used. But it is more directed to the problem presented can be solved using the appropriate spatial skills.

The research that has been done, on the other hand, has been more focused on quantifying spatial reasoning. There are still few studies that show how a person's spatial reasoning works. This inspires the researcher to investigate the process of spatial reasoning as it relates to the elements of spatial skills. As a result, the findings of this study can be applied to the spatial reasoning process itself.

Gap Study & Objective

Spatial reasoning deals with geometric problems (Kovačevi´c, 2017). Geometric problems have the potential to make someone use spatial skills (Lane et al., 2018). Geometric problems have the potential to make someone use spatial skills (Yüksel, 2017). This provides an opportunity to obtain a spatial reasoning process that involves spatial skills on geometric problems. Studies on geometry are concentrated mainly on individual abilities and on processes. This ability includes manipulating various modes of object representation, recognizing and constructing nets, structuring object structures, recognizing object properties and comparing object shapes, and determining the volume and area of objects (Pittalis & Christou, 2010). The scope of a geometrical problem is a two-dimensional and three-dimensional object. Thus, the purpose of this study was to describe the elementary school students' spatial reasoning process in solving geometric problems. In the process, spatial skills are often used which are often used in solving problems and how much the spatial skills function for a solver.

METHOD

Type and Design

This research is a qualitative case study research. The research focuses on spatial reasoning and the use of aspects of spatial reasoning in solving geometric problems. By describing the process of spatial reasoning, the explanation related to the process and the spatial abilities used can be identified as related.

Data and Data Sources

Participants in this study were 17 elementary school student in Madiun. More specifically, participants consisted of 6 male and 11 female and had an average age of 10,43 years. Participants are upper class of elementary school (8 students are grade four and 9 students are grade five). From the seventeen participants, 3 participants were taken as the research subjects (Subject A: grade five – Female; Subject B: grade five – Female; Subject C: grade four – Male). The research subjects were chosen based on the answers of participants who have the potential to provide data on the spatial reasoning process.

Table 1. Student Characteristic

Source	Grade	N (by Grade)	Gender	N (by Gender)	Average Age
Participant	Four	8	Male	6	10,43
	Five	9	Female	11	
Subject	Four	2	Male	1	10,78
	Five	1	Female	2	

Data Collection Technique

The study began by giving geometric problems to the subjects (sample presented in Figure 1). The problem involved manipulating different two- or three-dimensional objects. The results of the participants' answers were analyzed to determine the research subjects. The selected research subjects were then interviewed to find out the spatial reasoning process carried out and identify the spatial skills used.

Interviews were conducted with participants who could potentially provide data on the spatial reasoning process. The selection criteria are based on participants' written performance on geometric problems that have been resolved. There were three subjects (1 male; 2 female) interviewed to identify the spatial reasoning process and the spatial skills used. The interview procedure is carried out in an unstructured and flexible manner for all indicators of geometry problems. If the subject does not write an explanation, then the question given leads to the subject's thoughts about the answer he wrote.

Findings were analyzed with two tools. First is the process of spatial reasoning based on the primary nature of spatial reasoning. The main properties in spatial reasoning are: (1) awareness of space, (2) the association of spatial information representation, (3) interpretation of spatial information and making decisions. The second is identifying spatial skills that are components of the subject in doing spatial reasoning for students. Spatial skills identified include (1) spatial perception, (2) spatial visualization, (3) mental rotation, (4) spatial relations, and (5) spatial orientation.

Data Analysis

The spatial reasoning process of the subject required several analyzes. Interview transcripts are read and analyzed by researchers using the nature of spatial reasoning and the components of spatial skills. The researcher identifies each process carried out by the subject and maps the appropriate spatial skills components. Next, by adapting the nature of spatial reasoning, the researcher makes a cycle of the spatial reasoning process based on the spatial skills used in solving geometric problems.
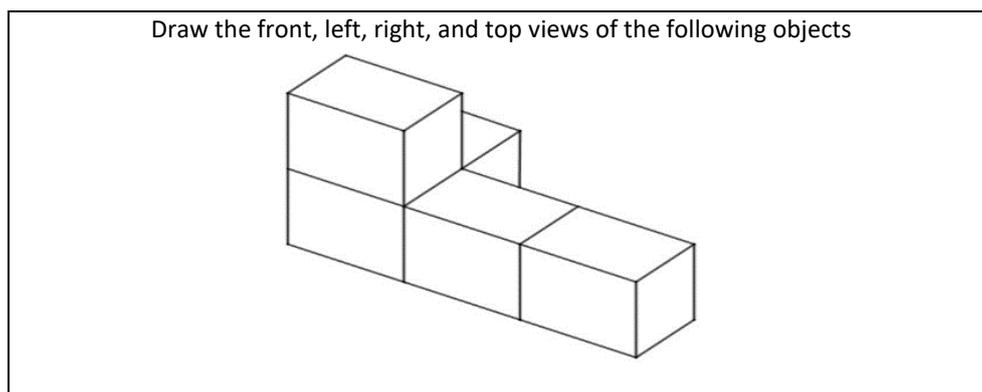
Figure 1: Geometric problem

RESULT

The results of this study are presented based on indicators of geometric problems. The data presented is the answer of the subject who has solved the geometrical problem given and the results of the interview that support the findings. The process of spatial reasoning and identification of spatial skills are presented based on the type of geometric problem. The problem of manipulating two- or three-dimensional objects is presented with the problem of moving isometric views to orthogonal views.

Based on Figure 2, the answers written by subject A are drawn on a flat plane. The depiction of the front, left, and right sides in accordance with the orientation of the view given is orthogonal. However, the upper side of the image presented does not match the orientation. Then an interview was conducted to confirm the thoughts the subject carried out in solving the problem. From the results of the interview, the subject drew the front side by positioning itself in front of the object. The same thing is done for the left, right and top sides by positioning themselves on the left, right and top. When determining the left side, subject A rotates the question paper so that the subject can see the left side can be seen clearly so that the subject gets a picture of the left side in accordance with his view. However, that also applies in determining the upper side. This changes the orientation of the upper side and makes the image rotate 90 degrees. So, the subject A make spatial visualization which included the spatial orientation process. The spatial orientation itself make subject A reason about rotation and use mental rotation skill.

Jawab: / answer
Depan / front

Atas / upon

Kiri /left

Kanan /right
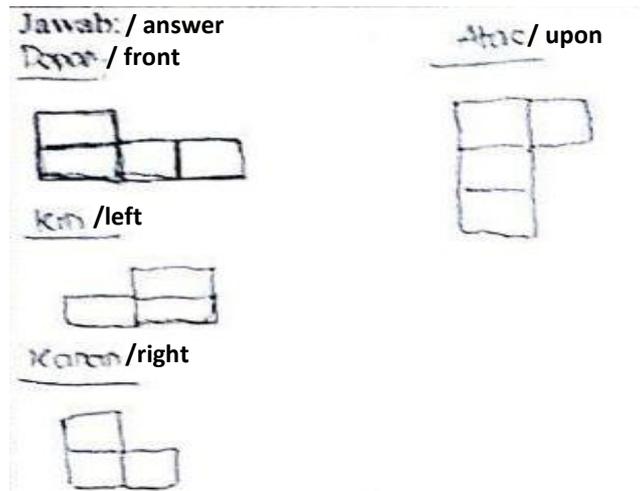
Figure 2: Answer of subject A

Depan / front

Kiri / left

Kanan / right

Atas / top
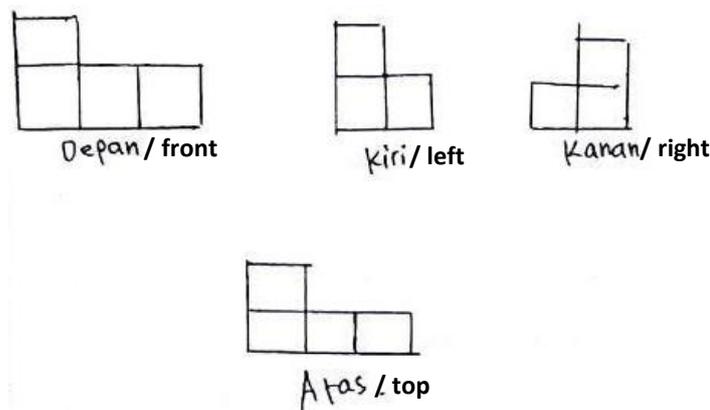
Figure 3: Answer of subject B

In Figure 3, Subject B can solve the problem correctly based on the answers provided. We inquired about the strategies employed in resolving these issues during the interview. Subject B completes the task by counting the numerous cubes first. The subject then confirms the placement of each cube in the arrangement and positions itself on the front, left, right, and top sides. The process of obtaining a side view by drawing the sides of the cube that are visible when positioning themselves in each direction was also confirmed. As a result of the spatial visualization process, subject B presents the figure. In addition, the subject does so without turning the question paper. As a result, the subject's spatial visualization revealed a mental rotation process.

In Figure 4, Subject C draws a side view based on the cubes' arrangement in the problem. This can be seen in the images on the left, right, and top, which are still in isometric view. The subject views the image based on the colors available on the problem, according to the results of interviews conducted on subject C. Subject C is then required to draw one side in accordance with the cube arrangement's shape. Subject C then notices that the image on the left is incorrect. According to Subject C, there should be three boxes. The shape of the left-hand view on subject C was then confirmed. The cubes were arranged in the same way, and the results were the same. In the process of solving the geometric problem, the subject C defines the perspective of spatial orientation.
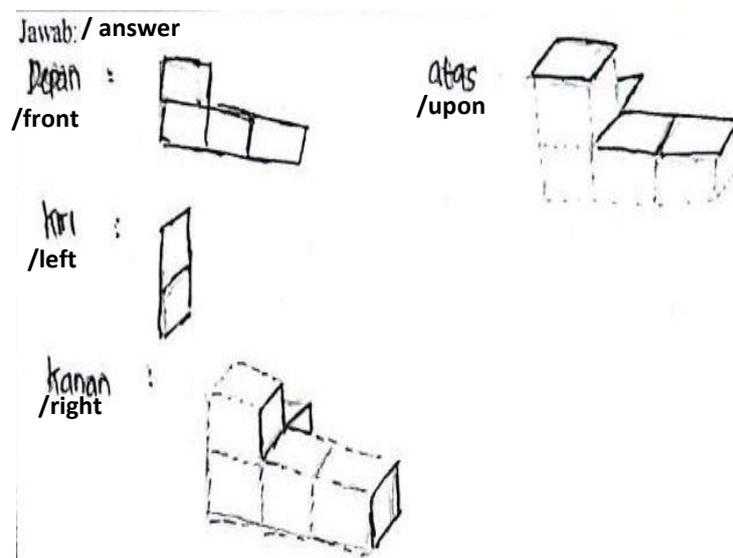
Figure 4: Answer of subject C

The research then identify the components of spatial skills that are used in the subject's spatial reasoning process. Subject A and subject B position their gaze to obtain a side view on the arrangement of the cubes. It proves that the subject uses spatial orientation in solving given problems. Then we asked why the left-hand side image was not skewed and the right-hand side image was unbroken. Each subject gives the same meaningful answer that is because it is viewed from the left side then what is seen is the front side of the 3 cubes so that the picture is not tilted. Then the explanation about the right side is because all the yellow sides are visible and only represent the yellow ones. We further asked whether the blue side was visible when viewed from the right direction. The subject responses were hidden by the blue side, which was horizontal and therefore not visible. The subject is able to recognize vertical and horizontal positions, so the spatial skills component used is spatial perceptions, according to the description.

DISCUSSION

According to research findings, the subject's spatial reasoning process always begins with the processing of information in mental visualization. The mental visualization then serves as the foundation for orienting yourself and selecting the appropriate visual perspective. Previous theories that support this finding state that visualization is very important in solving geometric problems (Jones et al., 2011; Moore-Russo et al., 2013). Then the process proceeds with forming a perspective to construct a solution. This is done to determine the views and orientation of the given object. This orientation serves as a benchmark to see objects from both an isometric and orthogonal view (Peng & Sollervall, 2014; Pittalis & Christou, 2010). After that there is a decision. This decision making refers to the possibility of a variety of perspectives in the spatial orientation process carried out in the spatial reasoning process (NCTM, 2006; van der Henst, 1999). Thus, the determination of new visualizations based on information and construction can be done in accordance with the problems given.

In the process of spatial reasoning, the influence of gender in this study is very pronounced. Yüksel (2017) states that gender is one of the factors that influence spatial

reasoning. Male subjects in this study have a more flexible spatial orientation and can view objects from various angles. Previous research backs up the findings of this study, indicating that men as a group have better spatial reasoning abilities as a result of biological factors. (Gilligan et al., 2017; Smith, 2009; Tariq et al., 2013; Yoon & Mann, 2017).

The use of spatial skills in solving geometric problems uses more spatial visualization and spatial orientation. Previous research has shown that visualization is frequently used in the solution of geometric problems. (Clements & Battista, 1992; Tepylo, 2017; Walker et al., 2011). This demonstrates that paying attention to the process of spatial visualization and spatial orientation will increase the likelihood of success in solving geometric problems.

CONCLUSION

According to the findings of this study, spatial reasoning begins with the processing of information into mental visualization forms, the formation of perspectives to construct solutions, the making of decisions, and the determination of new visualizations and perspectives based on the current construction. The spatial skills of spatial visualization and spatial orientation are critical in spatial reasoning. In addition, this research establishes the importance of spatial reasoning in the process. The geometric problems used in this study have a limitation in that they do not force the subject to use spatial relation skills. As a result, previous research should first focus on issues involving spatial relationships. This research examines how students use spatial reasoning to solve geometric problems. Further research is needed to explore the constraints of spatial reasoning and provide assistance by detecting difficulties in the spatial reasoning process using the sequence of processes discovered.

Paying attention to the process of spatial reasoning is crucial in spatial reasoning. Spatial reasoning has a unique combination of the five spatial skills. Furthermore, all spatial abilities aid students in solving the geometric problem. As a result, teachers should think about paying attention to spatial reasoning, or at the very least, teachers should be able to create an activity, task, or problem based on spatial reasoning.

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STEAM Oriented Science Learning Management During The COVID-19 Pandemic

Mimin Vera Dwi Priyantini*, Bambang Sumardjoko, Choiriyah Widyasari, Yulia Maftuhah Hidayati
Universitas Muhammadiyah Surakarta, Surakarta, Indonesia
*Email: q200200004@student.ums.ac.id

Keywords:	Abstract
pandemic; steam; science learning; management; tolerance assessment; online learning	*This research was motivated by the importance of experimentation in science learning which cannot be done directly in online learning during the pandemic. The application of STEAM is one solution to problems that arise in the management of science learning in elementary schools during the pandemic. The subjects of this study were 20 grade 6 students in an elementary school in Surakarta. The method used in this study was descriptive qualitative with a case study design. The recruited informants consisted of students and their parents. The techniques used in this research are interviews, observation and documentation. Data analysis using data collection techniques, data reduction, presentation of power and drawing conclusions. The data validity technique is technique triangulation and source triangulation. The results of this study indicate that (1) the application of online learning changes the way students learn (2) In online learning experiments cannot be done directly (3) During the pandemic, teachers are required to innovate in the teaching and learning process (4) The STEAM approach can provide a meaningful experience for students (5) STEAM can encourage student development for the better. The implications of this research are: First, more and more teachers are implementing the STEAM approach in the teaching and learning process as an alternative so that students can learn optimally. Both parents are willing to take the time to observe and assist their daughter's online learning process. This study describes the application of the STEAM approach in online learning during a pandemic.*

INTRODUCTION

Background

In 2020, the outbreak of Coronavirus Disease-2019 (covid 19) has not shown any signs of slowing down. Recently, a new variant of the COVID-19 virus was discovered, namely the delta variant. This new variant of the virus has killed hundreds of thousands of people around the world. On Wednesday, July 14, 2021, at 07.00 WIB, Worldometer reported that there were 188,563,150 cases of Covid 19 worldwide. A total of 4,065,129 people were declared dead and 172,396,201 people were declared cured(Muhamad, 2021). The skyrocketing spread of COVID-19 cases has prompted the government to immediately take action to contain the spread of the COVID-19 virus, one of which is the determination of a joint decision (SKB) of 4 ministers regarding the Guidelines for the Implementation of Learning in the Covid-19 Pandemic Period (Kemdikbud RI, 2020). In the joint decision, it is explained that the implementation of learning in 2021/2022 must pay attention to the respective regional zones. For Surakarta, entering the 2021/2022 school year, it is stated that it is still at level 4, the implementation of the teaching and learning process is carried out online, such as the implementation of learning in the 2020/2021 school year.

June 12, 2021 is the first day of school in the year 2021/2022. According to the instructions in the SKB 4 ministers in 2021, the learning activities that take place are still using the online system considering the risk of the spread of the COVID-19 virus is still very high. Learning is carried out synchronously or asynchronously. In Indonesia, synchronous learning still relies on the use of proprietary video teleconferencing software program (Busa et al., 2020). For asynchronous WhatsApp groups are still a mainstay for most teachers and parents (Daheri et al., 2020). A small number have also used the Microsoft 365 application or Google Class because of the limited abilities and facilities owned by students. Students are prohibited from coming to school and must study independently from home. This is a new phenomenon that poses new challenges in the world of education. If under normal conditions the world of education is filled with face-to-face activities between students and teachers, this cannot be done during this pandemic. Learning and teaching activities are filled with virtual face-to-face activities. Teachers and students meet in cyberspace.

During this pandemic, teachers are required to designing media for teaching and learning activities that encourage innovative and creative power so that students can continue to receive maximum learning. All efforts made by all parties for the implementation of online learning have the aim of providing learning facilities so that students can learn meaningfully that is not bound by space and time during the pandemic (Handayani et al., 2020; Kurniasari, 2020; Shah, 2020)(Suswandari et al., 2021). It is a challenge for elementary school teachers with limited facilities owned by students considering that the majority of elementary school age children do not have their own gadgets / cellphones and rely on their parents' cellphones. Electronic equipment facilities (HP, laptops, etc.) are the main factors in the online PJJ process, this will facilitate the delivery of material to students for the smooth teaching and learning process (Purwanto et al, 2020: 7)(Bahri & Budiyono, 2020). So that teachers are required to hold a learning process that can touch the whole of their students. Especially for logic subjects such as mathematics and science.

Science learning would be better to apply experimental methods that can develop the competence of students. Good science learning encourages students to get used to using scientific methods or process skills in studying science (Suriasumantri in Patta Bundu, 2006: 3). Because the implementation of science learning based on the 2013 curriculum should apply a scientific approach. In accordance with the Minister of Education and Culture

Regulation Number 81A of 2013 regarding the implementation of the 2013 curriculum in Appendix IV, it is explained that the approach that is in accordance with the 2013 curriculum is a scientific approach in collaboration with a problem-based and project-based approach. Good science content should encourage students to develop 4C Skills (critical thinking, creative, communication,(Khaira, 2018). Koballa and Chiapetta (2010: 105) define science as a science that demands investigation in obtaining new knowledge, and interaction with technological sophistication and society. It can be interpreted that in Natural Sciences has the dimension of thinking patterns, demanding investigation and building science and its relationship with technological sophistication and society.(Peserta & Smp, 2016).

Problem of Study

Science learning activities should be able to improve the competence of students by providing meaningful experiences for students, one of which is by conducting direct experiments. However, at this time science learning cannot be carried out optimally because we are in the time of the covid 19 pandemic. This requires the teaching and learning process to be carried out online from home. This is in line with the Circular of the Minister of Education and Culture no. 35492/A.A5/HK/2020 which was set on March 2, 2020 related to stemming the spread of Covid-19 transmission. Online learning must remain meaningful for students. Science learning should facilitate students to gain meaningful personal experiences for students, therefore students do not only understand theory, but an even greater hope is that students can apply newly acquired insights to find solutions to real-life problems. However, due to conditions that do not support conventional learning, these expectations cannot be realized optimally. This phenomenon is also faced by students at SDN Kepatihan in learning Natural Sciences (IPA) with the sub-material of simple electrical circuits. If under normal conditions this material is in great demand by students because they will be invited to experiment directly with friends in class with the guidance of the teacher and if they face difficulties will immediately get help from the teacher and friends. However, during the pandemic, all of these activities cannot be carried out because the teaching and learning process is carried out online. Teachers are required to design innovative teaching and learning processes in dealing with these conditions.

Current conditions encourage teachers to be smart in looking for techniques so that students can still learn meaningfully but still carry out recommendations from the government to continue to carry out the teaching and learning process with an online system. Therefore, the application of STEAM in the teaching and learning process is seen as a way that is able to overcome these problems. The STEAM approach is a way that can be a solution to answer the challenges of education during a pandemic with various limitations of current conditions. Irmani.L, et al.(2019) explained that STEAM is an approach in learning that can stimulate curiosity and be able to increase the curiosity of students so that they have skills in finding solutions in dealing with problems, cooperation, individual learning by applying a project-based learning process, research-based learning process and challenges. Henceforth, the selection and implementation of a STEAM-based curriculum (Science, Technology, Engineering, Art, and Math) has a very important role in increasing the creative ability of students which focuses on cooperation, creativity, developing communication skills both verbal and non-verbal research. , problem solving and critical thinking. With the STEAM approach, it is expected that students have good intelligence in academic aspects but are also intelligent in social and emotional aspects and Math has a very important role for increasing the creative ability of students which focuses on cooperation, creativity, developing communication skills both verbal and non-verbal research, problem solving and critical thinking. With the STEAM approach, it is expected that students have good intelligence in academic aspects but are also intelligent in social and emotional aspects and

Math has a very important role for increasing the creative ability of students which focuses on cooperation, creativity, developing communication skills both verbal and non-verbal research, problem solving and critical thinking. With the STEAM approach, it is expected that students have good intelligence in academic aspects but are also intelligent in social and emotional aspects (Kumar, 2016).

State of the Art

Some researchers who have researched the application of STEAM one of them are(Billiark et al., 2014)describes STEAM as a space that invites, encourages, and provides a safe learning environment where students have more freedom to explore and gain a deeper understanding of the arts and other disciplines. STEAM is also able to encourage good children's growth and development so that they grow into children who develop according to the demands of development according to their phases(Daugherty et al., 2014). The application of STEAM in learning is able to encourage the growth of creativity, critical thinking and can help gain a strong understanding of the material(Farwati et al., 2017). In early childhood the STEAM approach also significantly shapes students into children who have skills in problem solving and are able to socialize with the surrounding environment and are able to come up with creative ideas based on science and technology.(Melati et al., 2019), (Nurhikmayati, 2019) and (Susanti et al., 2020). The application of STEAM is able to develop genius talents in students and encourage students to think critically and have good scientific literacy skills(Adriyawati et al., 2020).(Kim & Park, 2012) The use of the STEAM approach in the teaching and learning process helps students to analyze the problems they are facing by involving 5 disciplines including science, technology, engineering, art and mathematics so that it will create strong resilience in the face of globalization. (Iolanessa et al., 2020)(Purnamasari et al., 2020). In addition to the advantages of the STEAM approach that have been described by several researchers above, the STEAM approach indicates that the application of STEAM has not been fully integrated in the teaching and learning process so far, so it requires assistance from experts and has not utilized comprehensive learning media.(Munawar et al., 2019).

Gap Study & Objective

Based on the background described above, this study aims to describe the management of the application of STEAM in the subject matter of Natural Sciences (IPA) in grade 6 SDN Kepatihan for the academic year 2020/2021 with the material "Simple Electrical Circuits". The contribution of this research is that more and more fellow teachers are implementing this STEAM approach in learning so that students learn more meaningfully and learning objectives can be achieved. In previous studies, the application of STEAM was not carried out by online learning and was carried out face-to-face in the classroom. In this study, the application of STEAM was carried out during the pandemic and by implementing online learning as recommended by the government.

METHOD

Type and Design

The method applied in this research is descriptive qualitative with a case study research design, an inductive research perspective, which is centered on exploring and understanding individual meanings and translating the complexity of a problem (Creswell, 2010:5). The research will draw/photograph the application of the STEAM approach by observing each stage of STEAM implementation in science subjects with the material "Simple electrical circuit". Cresswel (2012) explains that this research can examine the status of a group of people related to objects, conditions or events that are happening right now (Yanuarto, 2018: 15).

The subjects in this study were grade 6 students for the 2020/2021 academic year, totaling 20 students. This class was chosen as the research subject because this class as a whole has facilities in the form of gadgets for the application of STEAM in online learning. The data taken is not only taken from students but also involves parents because parents who directly accompany the learning process during the online system are implemented.

Table 1. Indicators of Learning Management by Implementing STEAM

Stage	Teacher's Role	Role Learners	Method
Exploration	Provide opportunities for students to explore interesting things from the material "Simple Electrical Circuits"	Actively submit proposals/opinions on activities or materials to be studied related to the material "Simple Electrical Circuits"	Discussion by using zoom meeting
Generating new ideas (New Idea)	Offer a learning design to accommodate all suggestions and opinions from the exploration stage	Students provide suggestions from the learning design proposed by the teacher so that the design is more interesting and meaningful	Discussion by using zoom meeting
Creating and developing models (Innonation) Steps of creation (Creativity)	The teacher encourages students to explain what things must be done to the agreed design. The teacher gives instructions for students to design simple circuits (parallel and series)	Students actively describe the things that will be done against the agreed design Students design simple circuits (parallel and series)	Discussion by using zoom meeting Independently working in their respective homes.
Drafting plans	The teacher provides instructions and opportunities for students to prepare the planned design	Students design simple electrical circuits	Independently done in their respective homes and discussed in the wa group
Communication and reflection (communication and reflection)	The teacher asks students to communicate/present their work and provide input from the student's presentation.	Students present their work.	Presentation using zoom meeting

Data and Data Sources

The data in this study were obtained from interviews with students and interviews with parents of grade 6 students at SDN Kepatihan in 2021 and data obtained by researchers from observations and documentation during the research process. Data collection techniques used in this study were interviews and documentation.

Data collection technique

Observation

The observations used in this study were non-participatory observations. Researchers asked parents for help to make observations because conditions did not allow researchers to make direct observations of students.

The aspects observed from the informants (students) are as follows: (1) Observing the preparation phase (2) Observing the implementation of STEAM-oriented learning (3) Observing the stage of making electrical circuit designs in STEAM-oriented online learning

Interview

Data collection techniques through interviews were carried out to explore information related to the development of students during online learning. This interview was conducted by utilizing video call media as a means of conducting interviews. Interviews conducted with students were used to obtain information related to the application of STEAM in online learning. Interviews conducted with parents of students were used to obtain information about the support and obstacles faced during the implementation of STEAM in online learning. Documentation is used to capture every stage of the implementation of STEAM in online learning with the material "Simple electrical circuits".

The grid of interviews with students conducted by researchers is as follows:

Table 2. Interview Grid With Students

Aspect	Research Questions	Indicator	Informant
Implementation of PJJ in the science learning process from the point of view of students	What do you think about the implementation of online learning?	Opinion, experience	Learners
	Which is more comfortable for you to study face to face or online? Why?		
Application of STEAM in the online learning process	What tools have you prepared in participating in the online learning process?		
	Are you able to operate all the applications found on the gadget?		
	What applications are often used in online learning?		
Inhibiting factors in the application of STEAM in online learning	Is the network at your place smooth or does it		

Aspect	Research Questions	Indicator	Informant
	often experience problems?		
	What problems have you experienced in the online learning process?		
Supporting factors in implementing STEAM in online learning	Do you have your own HP?		
Suggestions from students for implementing STEAM in online learning	What do you find interesting online learning during this pandemic?		

The lattice of interviews with parents of students conducted by researchers are as follows:

Table 3. Interviews with parents of students

Aspect	Research Questions	Indicator	Informant
Implementation of online learning in the science learning process from the point of view of students	What do you think about the implementation of online learning?	Opinion, experience	student Guardian
	In your opinion, which one is more effective, online or face-to-face learning?		
Application of STEAM in the online learning process	What tools have you prepared for your son/daughter to take part in the online learning process?		
	Do you know what applications have been installed on your son/daughter's cellphone?		
	According to your observations, does the application of STEAM have a positive impact on the development of your son/daughter?		
Inhibiting factors in the application of STEAM in online learning	Is the network at your place smooth or does it often experience problems?		
	How much internet quota capacity do you provide each week for your son/daughter?		
Supporting factors in implementing STEAM in online learning	Do you always accompany your son/daughter in online learning?		

Aspect	Research Questions	Indicator	Informant
Suggestions from parents for implementing STEAM in online learning	In your opinion, what are the interesting things about online learning during this pandemic?		
Suggestions from students for the application of STEAM in online learning	In your opinion, what are the interesting things about online learning during this pandemic?		

Data Validity

Test the validity of the data used in this study is to use triangulation of sources. The interviewees in this study were students and parents of participants. In addition, the data will be strengthened by the implementation of documentation during the process of implementing STEAM in online learning. Triangulation has the meaning of comparing and re-checking the level of trust in data generated through different times and tools (Patton 1987:331) as well as peer-checking through discussion to enrich information.

Data Analysis

The data analysis technique used in this study is a qualitative research data analysis technique with the type of Flow model (flow). In the flow data analysis technique, there are two main phases, namely the data collection phase and the post phase(Miles, 1994). At the data collection stage, researchers can directly reduce data, display data, group data from data obtained from interviews and documentation and then make initial conclusions from the research conducted. After that stage, the researcher wrote the results of his research on the management of STEAM-oriented learning in grade 6 SDN Kepatihan.

RESULT

The Results of The Observation of The Preparation Stage

At this stage, there are several components that need to be prepared, namely: (1) the teacher sends a summary of the material in the form of a printout containing a summary of the material that has been prepared and distributed to parents when the schedule for collecting assignments is as usual. (2) the teacher shares a youtube link containing the material "simple electrical circuits, (3) the teacher sends a zoom meeting link for the implementation of STEM-oriented learning, (4) the teacher shares a google form link as a means of observation that must be filled in by parents (5) Stage Next, the teacher sends a quizz link which contains 15 questions that students have to do

The Results of Observations of The Implementation of STEAM-Oriented Learning

The implementation of STEAM-oriented science learning is divided into several stages, namely:

(1) The implementation of science learning activities in grade 6 at SDN Kepatihan as long as STEAM is implemented is a student activity schedule made by the teacher once a week. The schedule explains in detail what will be done, as well as the activities that will be done by students for one week. The learning resources used are student thematic books borrowed from schools. In addition, in addition, the teacher makes a summary of the material that will be duplicated by as many as students. According to the agreement, every Monday the student's guardian will come to school to pick up the schedule of activities and additional materials that have been prepared. In

addition to taking the schedule, this opportunity is used to collect the results of student work for one week in the form of a spreadsheet.

Figure 1: Example of class 6 PJJ schedule

(2) This research begins with conducting interviews on the implementation of distance learning (PJJ) which has been carried out by utilizing the google form application.

Figure 2: Observation using google form

(3) The next stage carried out by the researchers was to apply the STEAM approach in teaching and learning activities. This activity begins by dividing students into groups because most students still use their parents' cellphones, which in the morning they have to work and it is not possible to take part in online activities in the morning. So the researcher grouped the students into 2 groups, namely the group in the morning and the group at night. The morning group is students who in the morning do not have problems participating in online activities in the morning. The night group is students who experience problems if they have to take part in online activities in the morning because students don't always carry cellphones.

(4) Make an agreement with parents that online learning activities in the morning start at 08.00 - 09.30 WIB and the afternoon group starts at 18.30 - 20.00 WIB by using the zoom meeting application.
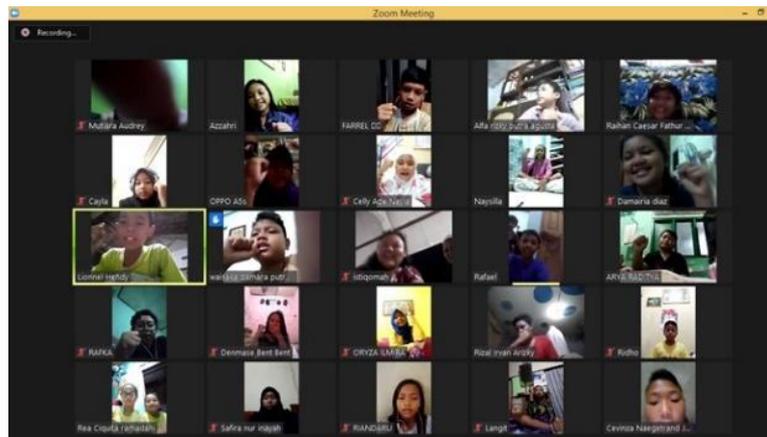
Figure 3: Implementation of class 6 zoom meeting

(5) In addition, researchers also made science learning videos with simple electrical circuit material by using the AZ Screen Recorder application. By utilizing this application in addition to making learning videos, researchers also combine powerpoint slides in the video. Furthermore, this learning video is uploaded to the researcher's YouTube channel. Students are asked to listen to this learning video through the youtube application.

Figure 4: Learning video with electrical circuit material

(1) The results of observations of the stage of making electrical circuit designs in STEAM-oriented online learning
Students are asked to draw a simple electrical circuit design that will be photographed and sent to the WhatsApp (WA) group to be given input by the teacher or by other friends.
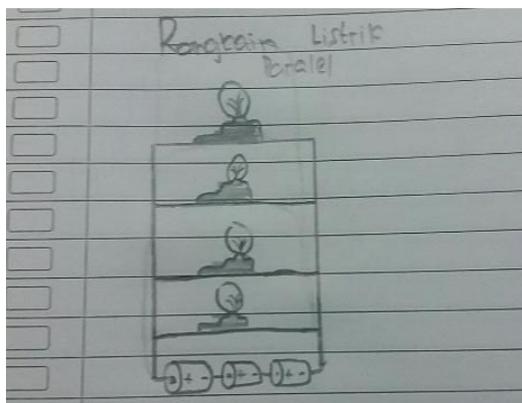
Figure 5: One example of an image designed by students

Students begin to start making designs from designs that have been drawn. At this stage, students work alone with parental guidance at home and if they have difficulty, they can consult with the teacher via WA or telephone. Students present their work by sending videos of the designs that have been made and students doing trials of the designs. the video is sent via wa to the teacher. The teacher appreciates and provides input via WA.

Figure 6: Students design a simple electric circuit

DISCUSSION

Science learning which is usually done in the classroom, which is identical to practice during the current pandemic, must be done online. As a classroom teacher, you must be extra innovative in designing interesting learning methods that students can do at home. During the learning process from home by utilizing various technological media, parents play a very important role as role models in assisting children's learning. Many parents complain about the implementation of distance learning (PJJ) through online. Because they have to play a double role every day, namely working and accompanying their children to study, especially their children who are still small in elementary school age. Considering that not all parents of students are accustomed to using technology for learning media, such as not being accustomed to operating laptops, gadgets, etc. The teacher's accuracy in determining the learning method or approach has a very important

role for the success of learning to actualize the learning outcomes that have been formulated. The presentation method was developed by referring to the learning outcomes to be actualized. The learning management that is made is expected to encourage students to be able to find solutions to real-life problems, both individually and in groups, by implementing knowledge and using technological sophistication as a form of concern and contribution in order to improve the quality of the environment responsibly. For this reason, one approach that can be used to bridge this is a STEAM-oriented approach model.

Based on the research findings, the application of STEAM can be supported by various learning methods. STEAM which has an integrative nature provides opportunities for various methods in the world of education to be used to encourage their application in learning. Therefore, educators must be careful in interpreting any existing material. For this reason, a teacher must first create a conceptual framework for the STEAM approach. At the elementary school level, the application of the STEAM approach raises and stimulates students' curiosity through activities that support the process of developing scientific literacy. In addition, activities that apply observation and investigation as one of the most important science skills can also be integrated.(Adriyawati et al., 2020,)(Susanti et al., 2020)(Laforce et al., 2017). The application of STEAM has also been shown to increase creativity.

Online learning by implementing STEAM requires teachers to be able to explore and design interesting and meaningful activities, this encourages teachers to develop into creative teachers. Besides teachers who are required to be creative, students are also indirectly required to be creative individuals to be able to answer challenges and complete tasks in STEAM-oriented online learning (Kim & Park, 2012)(Nurhikmayati, 2019). The implementation of STEAM raises new challenges in its implementation.

The implementation has a tremendous positive impact, but there are several things that must be considered to implement the STEAM approach in online learning, especially for elementary school students. The application of STEAM requires equipment that must be prepared before implementing STEAM, this requires good cooperation between students, parents and teachers as mentors. However, in online learning, parents inevitably become substitute teachers as long as students study at home. However, not all of them have the capacity and ability needed to implement STEAM. It takes an easy and comprehensive learning media that can help the role of parents in online learning (Munawar et al., 2019).

CONCLUSION

Previous research related to STEAM was carried out using a face-to-face system so that there was direct interaction between students and teachers. In this study, the application of STEAM was carried out during a pandemic with an online learning system. The findings in this study are expected that many more teachers will apply the STEAM approach in their classrooms. This research has some limitations. The informants selected in this study were students in one class of 27 students, this made the resulting data less diverse and incomplete. Second, the limited ability of both students and parents in operating gadget applications as online learning media. This causes the research to run less smoothly. Further research on the application of STEAM in online learning will be better with more informants and informants who have better mastery of technology so that research can run smoothly. This research has three suggestions. First, during the pandemic, all teachers in Indonesia must innovate in designing learning so that students can still learn meaningfully even with online learning. Second, the role of parents in online learning is very important to accompany their children as a substitute for a teacher at home. The three roles of experts

in the application of STEAM are needed to create/find learning media that can encourage the implementation of STEAM.

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Development of Length Measurement Materials using Adobe After Effects

Uswatun Chasanah[1]*, **Aninditya Sri Nugraheni[1] & Mazarul Hasan Mohamad Hanapi[2]**
[1]Universitas Islam Negeri Sunan Kalijaga Yogyakarta, Yogyakarta, Indonesia
[2]University Pendidikan Sultan Idris, Tanjung Malim, Perak, Malaysia
*Email: 20204081015@student.uin-suka.ac.id

Keywords:	Abstract
mathematics material length measurement Adobe After Effects	*This study aimed to (1) produce a video of length measurement material through Adobe After Effects software, (2) determine the validity and feasibility of the developed video, (3) knowing the student's response to the video length measurement material. This study used the Research and Development (R&D) method, which was modified from the 4D model, data collection techniques by observation, interviews, questionnaires, and documentation. The data analysis technique was done by converting qualitative data into quantitative data. The quality of the video development of length measurement material based on the assessment of mathematicians scored 5.0 with a good predicate, learning media experts got a score of 4.7 with a good predicate, and linguists got a score of 4.75 with an appropriate predicate. The teacher's assessment obtained a score of 5.0 with a felicitous predicate. The results of the limited video trial obtained a percentage of 100%, meaning that the average student gave a positive response to the material developed in the video.*

INTRODUCTION
Background

Mathematics subjects are one of the exact subjects that learners often fear, not infrequently learners feel difficulty understanding mathematical materials, low grades. Maloney and Beilock's research from the department of psychology explained that elementary school-age children tend to experience mathematics anxiety; this anxiety can harm the cognitive aspects of learners (Maloney & Beilock, 2012). Material objects in mathematics are still abstract; this can trigger difficulties experienced by low-class learners when learning or understanding mathematical materials (Mashuri, 2019, p. 1). The most prominent problem factors are differences in the level of understanding and the level of independence of learners. Teachers have difficulty explaining mathematical materials to

learners due to a lack of props or learning media. Learners also find it challenging to understand the mathematical material being studied, so they have not been able to solve mathematical problems appropriately, such as learners' accuracy in answering math problems (*Hasil Analisis Kebutuhan*, 2020). Though math learning is currently more inclined to learning critical thinking and creative thinking, the reality is that not all learning devices contain stimuli so that learners can think critically and creatively (Siswono, 2018, p. 5).

Problem of Study

Mathematical learning is identical to learning implementation to support learners in developing and improving the creative thinking process and the ability to process new knowledge so that mathematical learning materials can be mastered easily (Susanto, 2019, p. 194). The study results showed that as many as 42.2% of learners think critically, 44.3% can think, and 10.3% cannot think critically. However, these results certainly do not represent all indicators of critical thinking (Azizah et al., 2018). So For the objectives of learning mathematics, teachers can provide memorable experiences for students during the learning process in class through building learning activities that can encourage and provide problem-based challenges for students. Mathematics material is identical to the analysis of a problem Educate (Novita & Putra, 2016). For this reason, developing mathematical materials through a variety of strategies, props, or learning media is very important to do.

State of the Art

This research will utilize learning media in interactive multimedia to overcome these problems. The learning media acts as a container to serve or explain a learning material clearly so that learning goals can be fulfilled following expected (Kustandi & Darmawan, 2020, p. 6). Previous research revealed that learners could easily understand mathematical concepts by utilizing interactive multimedia than conventionally (Novitasari, 2016). Previous research has proven that developing *Powtoon* animations in mathematics can improve students' understanding (Awalia et al., 2019), develop appropriate interactive multimedia in mathematics learning (Istiqlal, 2017), and develop mathematics learning video*s through the Sparkill video* clerk application. Furthermore, it can be applied in learning (Fadillah & Bilda, 2019). The use of video in learning impacts learners, and learners get new experiences or new experiences. Video can affect the minds and emotions of students. (Yudianto, 2017).

In addition, Hikmah and Purnamasariconducted research by developing an animated video "Bang Dasi" flat build material class V using the *Camtasia* application. The study received a percentage from media experts of 93.3% and 96.86% of material experts. Therefore, the resulting video deserves to be used as a learning medium (Hikmah & Purnamasari, 2017). Wisada et al. have also developed a character education-oriented learning video. Using the ADDIE model, the results of the validity of material experts are 98.3%, learning design experts 93.3%, learning media experts 96.5%, trials on each 94.53%, limited trials 92.32%, and trials 91% area. So that can be stated that the video can improve the ability of 10th-grade learners B (Wisada et al., 2019). Students will get direct experience with learning media; direct experience can provide special meaning (Rusman, 2018, p. 168). Thus, mathematical materials will be more easily conveyed, and learners can digest them properly and precisely.

The explanation is in line with Piaget's theory that learners with the age range of 7-11 years can already think systematically through objects or a concrete event (Syah, 2019, p. 72). Therefore, these characteristics become an essential foundation for learning media to explain mathematical materials. Kurniawan et al. revealed in the results of his research that the application of video in learning was considered adequate, proven *posttest* results of learners obtained a percentage of 94.4% with previous *pretest* results obtained a

percentage of 75% (Kurniawan et al., 2018). Agree with the theory in his book Prastowo (Prastowo, 2015, p. 302); Mell Silberman argues that affixing visuals in learning can increase the memory of learners from 14% to 38%; the time used to explain is reduced by up to 40% to increase effectiveness and time efficiency during learning. However, several points must be considered in developing learning videos, Smaldino, Lowther, and Russell suggest there are two aspects: elements in visuals and elements in the text. Visual elements include the setting, balance, color, easy-to-read, and attractiveness. At the same time, text elements are more inclined to the characteristics of letters used, such as text style, letter size, spacing, color in the text, and uppercase and lowercase letters (Smaldino et al., 2014, p. 78).

Gap Study & Objective

The development of mathematical materials *utilizes Adobe After Effects Software*. The material developed is measurement material in math class 2 SD / MI to overcome the problems at hand. *Adobe After Effects* is commonly used for Motion Graphic *Design* (Maharani & Hotami, 2017). *Adobe After Effects* can manipulate text, images, audio, or video. *Adobe After Effects* can also be combined with other *Adobe* products such as *Photoshop, Illustrator,* and Premiere *Pro* (Smith & AGI Creative Team, 2012, p. 1). Students learning contributions gain a significant influence when using learning media during the learning process; 90.1% of learning media affect learners' learning outcomes (Mujiani, 2016). The results of Busyaeri's research et al. also showed that learning outcomes increased if teachers often used learning videos (Busyaeri et al., 2016). Based on this explanation, this study aimed to produce a video-based mathematical material development product through *Adobe After Effects*, determine the feasibility of developing video-based mathematics material through *Adobe After Effects*, and determine the responses given by students to the learning videos that have been developed.

METHOD

The research method used is *Research and Development* (R&D) (Saputro, 2017, p. 8), namely developing math materials in grade 2 SD/MI through *Adobe After Effects software* in the form of video learning materials. Development process adapting 4D models (*Define, Design, Development, and Desiminate*) (Mulyatiningsih, 2013, p. 195). This research is limited to finding out the feasibility of the product development of math materials grade 2 SD/MI through *Adobe After Effects,* so this development only reaches the third stage (*Define*, *Design*, dan *Development*). The population and sample of this study were randomly presented, namely students of the 2nd grade of elementary school and madrasah ibtidaiyah, taken ten people for a limited trial. At *the define* stage, researchers conduct needs analysis, teachers, learners, and curriculum analysis through observation and interviews. For the *design* stage, researchers began to determine and design interactive multimedia learning media in the form of videos containing mathematical materials about long measurements. Lastly, researchers began to conduct validates on videos developed in the development stage. Valid tests are conducted by mathematicians, learning media experts, and Indonesian experts. Researchers use input or criticism from experts as material to revise products that have been developed to be better. In addition, this video product is also assessed by peer *reviewers,* namely teacher class. Product trials are conducted on a limited basis with the target of 2nd grade SD/MI learners.
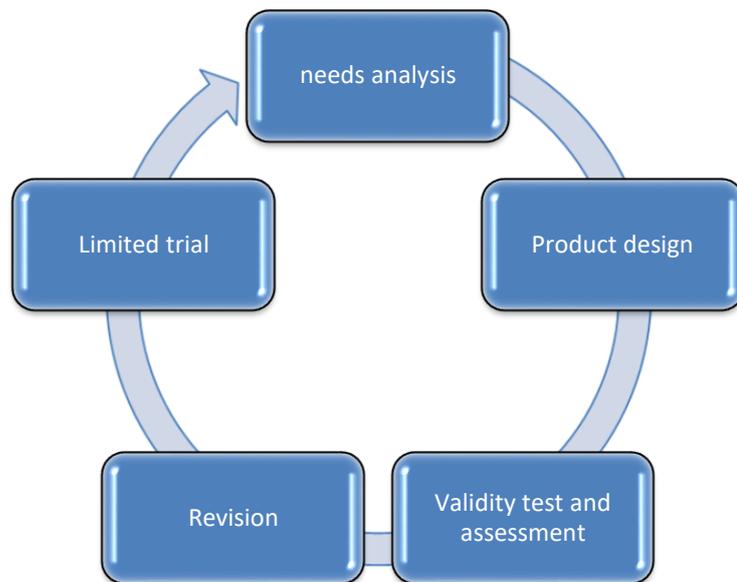
Figure 1. Product Development Process Scheme

Product eligibility is determined by the results of validation tests and assessments conducted by mathematicians, learning media experts, and linguists, at least obtaining a Good (B) score with an average score of > 3.4 to 4.2. Because the learning was done online, the study took random populations and samples, where limited trials were not conducted at one point. Researchers developed the instrument used for validating and assessing video products from the theoretical foundation used in this development, guided by the theory in his book Smaldino et al. (Smaldino et al., 2014, pp. 78–90). Research instruments use questionnaire sheets using *Likert scales and Guttman scales. The Likert scale* used for mathematical material experts, learning media experts, and peer reviewer assessment instruments combines material expert assessment instruments in mathematics, learning media experts, and linguists. Meanwhile, the response of learners using the *Guttman scale.* After that, the instrument is validated by the instrument expert.

Data collection techniques through observation, interviews, questionnaires, and documentation. Teknik data analysis by converting qualitative data into quantitative data. They were obtained from a questionnaire assessment of media experts, mathematicians, linguists, and peer reviewers. After converting into quantitative data, find the average score (Sudjana, 2014, p. 109) and convert it into qualitative assessment form by calculating the interval distance between the highest and lowest scores according to the Likert scale score suitable. Likewise, data analysis techniques for student responses are not much different, namely by changing or converting them into numerical (quantitative) and calculating positive-negative percentages according to the formula and percentage guidelines of learners' scores.

RESULT

The development of 2nd-grade math materials through *Adobe After Effects* resulted in a learning animation video containing math material theme 5 grade 2 SD/MI. This video was developed through adobe after effects software version 2020*,* then the results are uploaded in *Udemy Courses* and shared with the teacher of math subjects 2nd SD/MI. In addition to containing mathematical material about measuring the length of the theme of 5 grades 2 SD/ MI, this video product also contains problem exercises that learners can use to practice

and hone their skills. The resulting video takes the form of a learning animation accompanied by instrumental music and introductory sounds from researchers.

Figure 2. Material view

The material developed in this video is based on the teacher's book and the theme of the 5th grade SD/MI grade 2 SD/MI student book, as well as the Minister of Education and Culture Regulation Number 22 of 2016 concerning Standards for Primary and Secondary Education in order to keep it in line with the needs of students. In 5th grade 2 SD/MI, mathematical material describes the length measurement material. In addition to containing material about length measurements, problem examples, and problem exercises, this learning animation video also has a unique mascot named "Bubu." Bubu is a genius and clever monkey in solving problems and solving mathematical problems. The mascot is not just a picture but can move. Starting from Bubu came, Bubu spoke, until Bubu Returned. The hope is that Bubu can provide inspiration and motivation to students to be more passionate about learning mathematics because learners' level of learning motivation can impact the learning outcomes of learners (Lestari, 2017, p. 81).

Figure 3. "Bubu the Genius" Video Mascot

Figure 4. Bubu and Long Measurement Ladder

The duration of the video product resulting from this study did not reach 10 minutes to avoid saturation and boredom from learners because the nature of the video can be played repeatedly so that the duration of the video can be shortened, dense, and straightforward. The statement is reinforced by the opinion of Batubara and Ariani, preferably the video duration of about 3 to 5 minutes so that it is not too long (Husain & Ariani, 2016). The flexibility of size and settings of video utilization is one of the video's strengths. Other than that, learners are more accessible to absorb material from video than directly from printed teaching materials such as package books in general. The development of mathematical materials through Adobe After *Effects* has been validated and assessed by materials experts in mathematics, learning media experts, and linguists. The feasibility of the product in the form of animated videos containing long measurement materials is determined based on the results of the assessment of experts, namely material experts in the field of mathematics, learning media experts, and linguists who have been *experts* in each field (mathematics, learning media, and Indonesian language). Then, it is assessed by the classroom teacher *(peer reviewer)* and learners' responses. Experts' criticism and suggestions are used to revise the video of the long measurement material. Mathematicians get a score of 5.0 (excellent), a learning media expert gets a score of 4.7 (excellent), a linguist 4.75 (excellent), a classroom teacher gets a score of 5.0 (excellent), and a response from learners is worth 100% (positive).

DISCUSSION

This research only came to a limited trial, that is, the *development* stage, because of time constraints, so that it did not arrive at the product effectiveness test. All the data that has been collected is analyzed to find out and get a quality product and worth using. The following table guides average score conversion:

Table 1. Product Rating Category

Average Score	Rating Category
> 4,2 s/d 5,0	Excellent
> 3,4 s/d 4,2	Good
> 2,6 s/d 3,4	Enough
> 1,8 s/d 2,6	Less
1,0 s/d 1,8	Very lacking

Source: (Widiyoko, 2018, p. 112)

Material expert instruments have two aspects: aspects of the 2013 curriculum and material characteristics. Aspects of the 2013 curriculum obtained a score of 5.0, and the distinctive aspect of the material obtained a score of 5.0.

Table 2. Score Results Per Aspect of Mathematical Materials Expert

Aspects	Score	Rating Category
Curriculum 2013	5,0	Excellent
Characteristics of matter	5,0	Excellent

Based on the acquisition of data, it can be known that the results of validation of material experts obtained an average score of 5.0, namely the predicate "very good." The material's validation and expert assessment results indicate that the material presented in the video follows the core competency standards, essential competencies, and learning objectives in the theme of 5th grade 2 SD/MI. The material developed in the video also contains material based on facts, concepts, procedures, and principles. Lukman et al. argue that learning animation videos will be interesting if they are in the barrel with the material to be studied because it can add to the appeal and help learners understand the material easily (Lukman et al., 2019).

The instrument used in the product assessment results of "Development of Mathematical Materials Grade 2 SD/MI through *Adobe After Effect"* from the perspective of learning media experts has six aspects with details of score acquisition in the following table:

Table 3. Score Results Per Expert Aspect Mehe Learning

Aspects	Score	Rating Category
Characteristics of learners	4,0	Good
Compatible	5,0	Excellent
Safety and Resilience	5,0	Excellent
Display	4,75	Excellent
Text	5,0	Excellent
Audio	4,5	Excellent

The conclusion of table 3 is that all aspects of getting the predicate or category "excellent," except the characteristic aspects of learners. Where the characteristic aspects of learners are "good." So that overall validation results from learning media experts get a score with an average of 4.7 predicated"very good." Learning media experts assess the distinctive aspects of learners are following the character of elementary school age, which is not dull and can support learners learning independently. However, the video will be more fun if the image on the material can move like a person talking. Learning videos are considered very compatible, meaning that learning videos are easy to use, easy to obtain, not expensive. Learning becomes effective and efficient because it can be played anytime and anywhere and accelerated or slowed down. The duration of learning is not wasteful time. If viewed in the specs of resilience and security, the learning video is safe to use because the content used does not deviate from the learning norm, is not easily damaged even though later the form of a CD, and can be utilized for an extended period.

As for the appearance aspect, learning media experts state that video design is creative, simple, modern (contemporary), and can arouse the interest of learning learners. Images and writing can be seen and read clearly, because the typefaces used to follow the sans serif

style, consistently, upright, and standard letter size. Selain that the impression of asymmetrical and balanced video display design can attract learners' attention. The reason is that the *background* colors do not interfere with the color of other components and the harmonization of colors in the background. In the video, the audio aspect also needs attention. Media experts assess the music of the intrusion, and the introductory sound can be heard clearly. The use of music in learning activities is considered to provide benefits such as providing calmness for learners, helping learners think clearly and develop creativity, and stimulating the efficiency of right-brain balance and left brain. (Halimah, 2010). Roffiq et al. also explained that music could affect aspects of learners' cognitive development and emotional intelligence (Roffiq et al., 2017). Therefore, researchers facilitated instrumental music in developing the video.

The assessment of linguists has two aspects: aspects of language style and authorship. Each aspect gets a different total score, as stated in the following table:

Table 4. Score Results Per Linguist Aspect

Aspects	Score	Rating Category
Language style	4,5	Excellent
Authorship	5,0	Excellent

Table 4 shows the validation of linguists getting an average of 4.75 "excellent" categories. Regarding aspects of language style, the vocabulary used is appropriate and reflects the meaning to be conveyed. It follows the rules of Indonesian but is not appropriate. The shortcomings became the material of researchers to revise grammar in the video and the selection of sentences used in the video language used, which is standard, clear, straightforward, and communicative. So that learners can easily absorb the messages contained in the video. At the same time, the authorship aspect shows that the writing of upper and lowercase letters is by the enhanced spelling (EYD). Linguists in this study aim to know the quality of grammar used so that the meaning contained in the video can be appropriately conveyed and precisely.

Validation results from all experts can be described in the following graph:
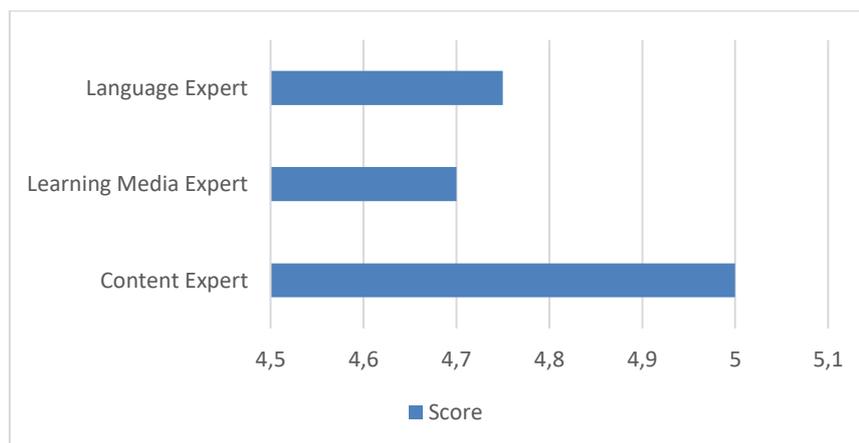

Figure 5. Validation Results Graph

The graph in figure 5 is an overview of product validation results based on experts' assessments. The graph shows that the video product is feasible and can be applied or tested to learners in learning.

According to the teacher's assessment results, the assessment of video material development using Adobe *After Effects software* can be tested on students. The teacher's assessment got an average score of r 5.0 with the perfect predicate.

Table 5. Score Results Per Aspect of Classroom Teacher

Aspects	Score	Rating Category
Curriculum 2013	5,0	Excellent
Characteristics of matter	5,0	Excellent
Characteristics of learners	5,0	Excellent
Compatible	5,0	Excellent
Safety and resilience	5,0	Excellent
Display	5,0	Excellent
Text	5.0	Excellent
Audio	5,0	Excellent
Language style	5,0	Excellent
Authorship	5,0	Excellent

It can be concluded from the results in table 5 that the video development of the material can be applied and tested to students in grade 2 SD / MI. The video production results of the development of mathematical materials were tested on a limited basis to learners: as much as 100% of learners gave a positive response. Thus, it can be said that learners receive videos of mathematical material development and can be applied in learning, both online and offline learning. The video can affect learners' attention and make it easier for learners to learn long measurement materials. In line with what was revealed in the Raisa et al. study results, overall, learners gave an excellent response of 81%. According to media, learners positively create attraction, interest and help learners understand the material (Raisa et al., 2017). The statement is also in line with the results of Pasko et al.'s research that audiovisual methods in the video can increase children's knowledge by 60% after extension with audiovisual methods in the form of video (Prasko et al., 2016). In addition, the application of video in learning is considered more effective by 48.14% than not using video because using the senses of sight and hearing during learning can be beneficial for students in learning the material during the learning process. (Agustiningsih, 2015). As explained by *Dale's cove of experience* and *Brunner*'s theory, learning will be more meaningful if the teacher can create a learning environment that can activate students' five senses simultaneously during the learning process. Thus students will have no difficulty absorbing the studied material (Hadi, 2017).

CONCLUSION

Difficulty understanding the material is commonplace and is often faced by students from time to time. The reason is that mathematics material is still abstract and challenging for students to understand. This research seeks to produce video material development products through *Adobe After Effects.* The validity and feasibility of the product are determined from the assessment of experts, namely material experts in mathematics, learning media experts, and linguists. Overall of all experts members obtained a score with an excellent category. Mathematicians score a score of 5.0 categories very well; learning media experts score 4.7 categories very well; linguists 4.75 categories are excellent. The validation results conclude that the product of this research is said to be feasible to be tested and applied by students in the learning process. In addition to experts, teachers also assessed the video and got a perfect score of 5.0. Learners showed a positive response to the video, which was 100%. The student's response can be evidence video development of

mathematical materials can attract attention and provide new experiences for learners. Learners become excited and helped when studying long measurement materials. Researchers are aware of limitations in this study, and the development stage has not reached the dissemination stage (spread). In addition, the video has not been widely tested or tested for its effectiveness to learners. The hope is that the following study has reached the disseminated stage and tested the effectiveness of the video content of mathematical material that has been developed. Therefore, all teachers in Indonesia can make good use of it. This research has several things that need to be given a bottom line; First, teachers should always be creative and innovate to support the smooth learning process, constructing an effective learning atmosphere for learners. Second, schools can provide facilities to teachers by holding training or seminars on developing learning media to enrich the knowledge.

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Readiness of Elementary Teachers in Minimum Competency Assessment: Teachers' Competence in Arranging Literature and Numeration Tests

Titis Angga Rini[1*], Puri Selfi Cholifah[1], Ni Luh Sakinah Nuraini[1] & Kay Margetts[2]
[1] Universitas Negeri Malang, Malang, Indonesia
[2] The University of Melbourne, Australia
*Email: angga.rini.fip@um.ac.id

Keywords:	Abstract
literacy and numeracy; national assessment in Indonesia; elementary school; teacher readiness	Minimum competency assessment is a new challenge for classroom teachers in implementing and integrating it in learning to maximize its diagnostic and curative function on the quality of Indonesian education. This is the background of this research to analyze the readiness of teachers in arranging literacy and numeracy tests in elementary schools. This study used a content analysis design to reveal a test prepared by elementary school teachers for minimum competency assessment involving 30 elementary school teachers. Data analysis results are presented in the form of percentage accuracy of items with quantitative descriptive and examples of items that are described qualitatively. The results showed that the competence of school teachers in compiling literacy and numeracy assessment questions in elementary schools was still not optimal in terms of form, content, context, and cognitive level, especially for reflect and evaluate levels for literacy assessments and reasoning levels for required numeracy assessments. Especially for literary content on literacy, scientific context on literacy and numeracy, and third-level literacy and numeracy. Based on the results of the study, it can be concluded that the competency of elementary school teachers in implementing a minimum competency assessment needs to be carried out to meet the standards and functions of the Indonesian national assessment. This study provides an overview of teacher readiness in carrying out minimum competency assessments in elementary schools related to their role as learning evaluators.

INTRODUCTION

Background

Learning assessment occupies a trend of educational topics that are widely discussed, studied, and developed through the latest research results. The results of the study still

show the existence of learning assessment needs both in mastery and products from year to year (Dasmalinda & Hasrul, 2020; Mundia Sari & Setiawan, 2020; Rini & Cahyanto, 2020). If previously traditional assessments were more in the form of written tests in a summative framework, now assessments have developed with various types and formats offline and online in a formative framework for various functions. This development is a great opportunity for educational practitioners to determine and design the best assessment used according to learning needs.

In Indonesia, the latest topic in the development of an assessment is the abolition of the national exam to become a national assessment. Previously, the National Examination was a summative assessment carried out for the grading and selecting process in the graduation and acceptance of students (Nehru, 2019). After being evaluated and followed by the implementation of Merdeka Belajar policy, this assessment process is considered inappropriate because the assessment should be a step to improve the quality of education through its results. Based on the improvement in the quality of education, the National Assessment consists of a minimum competency assessment, a character survey, and an environmental survey which is planned to be implemented in 2021 (Muta'ali, 2020). In contrast to the previous assessment to evaluate student achievement individually, the national assessment is aimed at evaluating the mapping of inputs, processes, and learning outcomes (Sugiri & Priatmoko, 2020).

Specifically related to learning, the Competency Assessment carried out includes two competencies, namely literacy and numeration. These two competencies have an important role in improving qualifications and preparing students for the 21st-century generation (Grotlüschen et al., 2020). This fact is supported by the existence of various national and international surveys to measure the literacy level of students, such as PIRLS, PISA, TIMSS, or Alibaca (Wulandari & Azka, 2018). The survey results from PISA 2018 for example, show that the literacy level of Indonesian students is still low, reading ability is ranked 371 while mathematical ability is ranked 379 (Azizah, 2019). This condition underlies the implementation of a minimum competency assessment to measure, improve and increase the literacy level of Indonesian students.

Improvements can be made if the teacher also has good competence in the minimum competency assessment. Moreover, preparing literacy and numeracy tests related to the implementation of the minimum class competency assessment that is integrated with learning. In addition, the urgency of teacher competence in literacy and numeracy assessment is also related to their professionalism as an evaluator of student learning (Daud et al., 2020; Sulistyaningrum et al., 2021). As evaluators, teachers must have skills in the tests, measurements, and assessments that are included in them (Archana & Usha Rani, 2017; Megawati & Sutarto, 2021). Moreover, the assessment paradigm for diagnostics is implemented in a minimum competency assessment. To carry out diagnostics, the teacher must know the students' abilities correctly through test results from levels that have been achieved or have not been achieved. After that, the teacher must also follow up on the diagnostic results by integrating them into learning for example with training, strengthening, or enrichment to improve student competence in literacy and numeracy in elementary schools according to the objectives of the national assessment (Nurhikmah et al., 2021).

Problem of Study

The main problem that will be discussed in this study focuses on teacher readiness in minimum competency assessment as a new policy in the implementation of learning assessment in Indonesia. Furthermore, it was also revealed how the preparation of higher order thinking-based questions is still a challenge for elementary school teachers. In addition, generally, the questions that are arranged are also in the form of multiple-choice,

brief descriptions, and essays, as well as the lack of visual stimuli or contextual illustrations. The difference between the form and process of the test in the minimum competency assessment from the previous form and process of the test is what we want to reveal how the teacher's readiness to face and apply it in terms of competence in compiling literacy and numeracy tests in elementary schools.

State of the Art

As has been discussed in the background of the research, the minimum competency assessment is a new policy in the implementation of the national assessment which has been discussed since 2020 and will began to be implemented in 2021. Although new in education in Indonesia, the implementation of minimum competency assessment has been implemented in several countries despite differences in the process (Birenbaum et al., 2015; Nortvedt et al., 2016). As the results are widely revealed through international surveys such as PISA, PIRLS, or TIMSS which show the low ranking of Indonesian students when compared to other countries involved in the survey (Chamisah, 2017; Sukmayadi & Yahya, 2020). Based on this fact, the topic of teacher readiness as a learning evaluator in minimum competency assessment is interesting for discussion. Several research results that discuss minimum competency assessments starting from students' initial abilities, teacher competency development, and policy implementation have become new topics that are widely studied (Anas et al., 2021; Fauziah et al., 2021; Rohim, 2021). Digging further into the national assessment in Indonesia, especially the minimum competency assessment, will provide an opportunity to prepare, implement, and evaluate its best practices in the future.

Gap Study & Objective

Minimum competency assessment is a challenge for teachers for their readiness and competence in carrying out literacy and numeracy assessments in learning. Teachers as reform agents certainly need to have qualified knowledge and skills to implement these changes in learning assessments. The intended change relates to the difference between the minimum competency assessment and the previous assessment, both in terms of planning, form and application in learning. As stated in the problem of study, it is important to explore how the teacher's readiness in dealing with changes in learning assessments is related to the contribution of the results as a basis for the practice of minimum competency assessment in terms of teacher competence. Regarding the urgency of the importance of teacher competence in minimum competency assessments, this study aims to analyze teacher competencies in preparing literacy and numeracy tests for minimum competency assessments in learning in elementary schools.

METHOD

Type and Design

Following its objectives, this study uses content analysis to reveal the readiness of teachers in the assessment of minimum competencies in terms of their ability to prepare and analyze literacy and numeracy tests in elementary schools. Complementing the data, data on perceptions of teacher readiness and difficulties in dealing with minimum competency assessments were also explored. In more detail, the research procedure taken is described in Figure 1.

Data Source

In this study, the data sources obtained were 30 teachers who were involved in AKM in their schools from representatives of 7 elementary schools in Klojen District, Malang City. Klojen Subdistrict was chosen with the background of the school area in the city center so that several schools became model schools in the regulation of educational policies in

Malang City. . In addition, this number was obtained based on the willingness of teachers and principal referrals to be involved in this study who taught third and fifth grades in their schools who were indeed involved in the preparation of the 2021 National Assessment in their schools.

[1]formulated goals

[2]determine data source

[3]data categorize

[4]analyze data and coding

[5]interpret and conclude the data
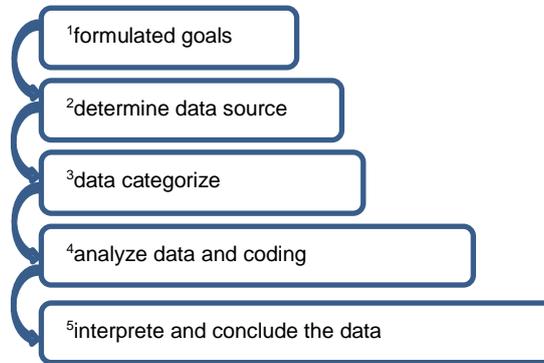
Figure 1: Research procedure

Data Collection Technique

The data was extracted based on test instruments for literacy and literacy assessments in elementary schools that had been compiled in August 2021 as outputs in AKM training activities. The data was also extracted using a questionnaire technique with an online form format which was distributed to participants to explore data on perceptions and difficulties of teachers in conducting literacy and numeracy assessments in elementary schools. The following is a grid of instruments for preparing literacy and numeracy tests according to the composition of the minimum competency assessment for elementary schools in Table 1. In addition to the grid in literacy and numeracy, an analysis is also carried out on the form of questions based on the minimum competency assessment standards for classes in elementary schools which are more diverse in proportion 20% multiple-choice, 40% complex multiple-choice, 10% matchmaking, 5% short fill, and 25% essay.

Table 1. Grid of Literacy and Numeration Tests in Elementary School

N	Content		Cognitive			Context	
	Sum	Description	Sum	Code	Description	Sum	Description
Literacy							
10	5	information text	5	L1	retrieve and access	6	personal
			4	L2	interpret and integrate	3	sosio-cultural
	5	literary text	1	L3	reflect and evaluate	1	scientific
Numeracy							
10	4	numeral	3	N1	knowing	6	personal
	3	measurement & geometry	5	N2	applying	3	sosio-cultural
	2	data and uncertainty	2	N3	reasoning	1	scientific
	1	algebra					

Data Analysis Technique

All data were analyzed descriptively both quantitatively and qualitatively. The results were validated by involving two research colleagues through a peer debriefing process. In the quantitative descriptive technique, the assessment criteria and qualifications are determined by referring to Arikunto (2013: 68) with the consideration that the score range is quite high for the categorization of teacher mastery levels in literacy and numeracy assessments with the information in Table 2 as follows.

Table 2. Criteria for Mastery Level

Scale	Percentage	Qualification
4	86-100	very good/skilled
3	71-85	good/skilled
2	56-70	good/skillful enough
1	<56	not good/unskilled

RESULT

Forms of Literacy and Numeracy Questions for Elementary Schools

From a total of 520 questions that were successfully compiled by 30 elementary school teachers, an analysis of the form of the questions was carried out according to the proportions required in the minimum competency assessment. The results of this analysis also show the form of questions that are widely used and mastered by teachers in preparing tests in elementary schools.
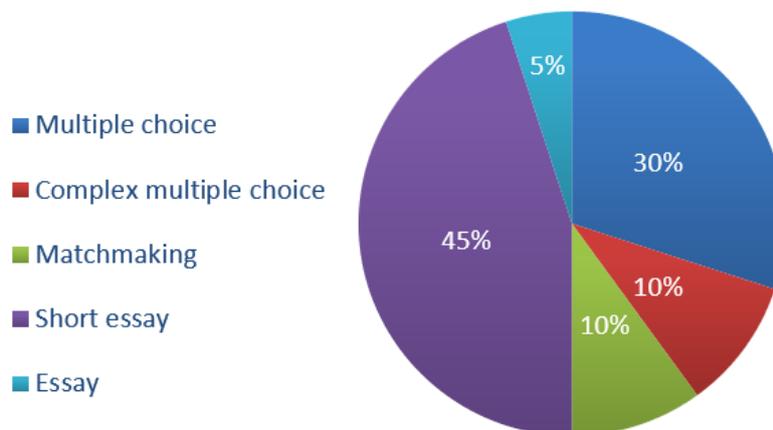
Figure 2: Percentage of question forms compiled for literacy and numeracy

In Figure 2, it can be observed that short essay questions are most widely used by teachers in the form of questions to determine true or false as in the examples in Figures 2, 5, and 3 before. From the results of this analysis, of course, the required proportions in the form of questions in the minimum competency assessment have not been met. Especially for complex multiple-choice which should occupy the largest portion of the number of questions among the others.

Analysis of Test Items for Literacy Assessment in Elementary Schools

The results of the analysis show that the readiness of teachers in the AKM in the classroom for the preparation of literacy tests is quite good or quite skilled with the achievement of a score scale at 42%-89%. In more detail, the mastery of each aspect in the literacy test for minimum competency assessment in elementary schools is described in Table 3. There's can be observed that in the content section of the literacy test, participants

used more informational texts than literary texts. The information text used is predominantly exposition, procedure, and explanatory texts, while in literary texts only story texts are used. This shows that the mastery of content from the literacy test itself is still not optimal in the type of literary text. In the cognitive aspect, it can be observed that the teacher's mastery in compiling questions at the retrieve and access (L1) level is very good, questions in the form of what, where, who, when are widely used appropriately in written and visual texts. Likewise, at the second level for interpret and integrate (L2), the accuracy of the preparation of questions on the criteria is quite good.

Table 3. Level of Accuracy of Preparation of Literacy Test for Each Aspect

Aspect	Criteria	Accuracy (%)	Qualification
Content	Information text	89%	very good
	Literary text	42%	not good
Cognitive	L1	80%	good
	L2	65%	good enough
	L3	45%	not good
Context	Personal	84%	very good
	Sosio-cultural	75%	good
	Scientific	58%	good enough

Based on the test grid, there were participants' misconceptions between the questions for each level. At level one, participants should be able to retrieve and access information that is explicit in a written or visual text. This level was mastered well by participants using what, where, when, who, or why questions extracted from the text. Although some participants still showed misconceptions from levels one and two in the literacy assessment, especially in the preparation of the test questions.

Take a look at the poster below!

Based on the information from the text, is the following statement true or false? Put a check mark in the true or false column for each appropriate statement.

Statement	True	False
1) Comparison of the third highest Omega 3 content, namely shrimp.		
2) Fish is high in vitamin D.		
3) The difference in Omega 3 content between shrimp and goat is 102.		
4) Unsaturated fats contained in fish are not very beneficial for the body		

Figure 3: Sample question of retrieve and access level

Figure 3 is an example of a question made by the teacher for the interpretation and integration level which should be at the retrieve and access level because the question that must be determined is in the form of explicit information in the poster. On the other hand, in the example questions in Figure 4, examples of questions made by participants for the interpret and integrate level in literacy are shown, namely interpreting how the characters in the story feel, which are shown through their attitudes or implicitly. This example is also one of the questions that use literary texts as its content, namely narrative. The narrative is a literary text that is widely used in the preparation of literacy tests, which should occupy a portion of 50% of the number of literacy tests using literary content.

Siti and Udin

Siti and Udin's names. Their faces were full of dust. Dressed in rags, they sing in the midst of the noise. From morning to night, they smiled in sweat, greeted uncle and aunt, hoping for some small change. n Thousands of Siti and Udin wandered the streets, hoarse and breathless with pollution. If you can eat today, thank God. Siti and Udin continue to pray that they can go to school and have a house with windows.

Which condition is in accordance with the content of the reading? Put a tick (√) in the column "True" or "False" for each statement.

Statement	True	False
Siti and Udin are always happy when they sing		
Uncle and Aunt were upset when Siti and Udin arrived		

Figure 4: Sample question of interpreting and integrating level

At the level of reflection and evaluation (L3), the level of accuracy of the compiled tests is still low. The majority of test questions that should be arranged at this level are at the interpret and integrate level, for example about converting text information into posters or using "how" questions but the answers are already in the text or explicit, for example, "how do I make banana chips last longer crispy?" through the text of the procedure for making banana chips. Here it can be seen that the use of "how" questions are considered to have represented literacy test questions at level 3. Even so, there were test questions that were appropriate and arranged both from the instructions and illustrations as in Figure 5.

Read the following text!

Amir is doing community service. The work is carried out in Amir's home environment. Residents help each other clean the environment. Some sweep, take out the trash, and clean the gutters. Cleaning the environment is beneficial for maintaining public health.

Put a cross (x) on the answer you think is correct! You can choose more than one answer. Attitudes that show social care include….

Figure 5: Sample question of evaluation level

In the example questions in Figure 5, reflection and evaluation of the content of the text about community service carried out by Amir is shown by assessing the illustration of similar behavior in the picture which also shows social concern. Illustrations are also important to support this problem as a characteristic in AKM as a form of visual text and the suitability of this illustration with real conditions from facial images, height, behavior, and others.

Furthermore, in terms of context, it can be observed that the majority of personal context accuracy is used very well in literacy tests in elementary schools. Likewise in the socio-cultural context, the average is used appropriately in the preparation of literacy tests such as about cultural diversity, social events, and others. However, in a scientific context, almost 50% of the participants did not use it even though it had been described in the grid. The personal context is more used than the socio-cultural or scientific context in the matter, even though the accuracy or accuracy is quite good.

Preparation of Tests for Numerical Assessment in Elementary Schools

The results of the analysis show that the readiness of teachers in the AKM in the classroom for the numeracy test shows the criteria are quite good or quite skilled with the achievement of a score scale of 32%-100%. In detail, the mastery of each aspect in the numeracy test for elementary schools is described in Table 4.

Table 4. Test accuracy levels for numeracy in elementary schools for each aspect

Aspect	Criteria	Accuracy (%)	Qualification
Content	numeral	90%	very good
	measurement & geometry	85%	very good
	data and uncertainty	68%	good enough
	algebra	45%	not good
Cognitif	N1	80%	good
	N2	58%	good enough
	N3	32%	not good
Context	Personal	100%	very good
	Sosio-cultural	40%	not good
	Scientific	38%	not good

Table 4 shows that in terms of content, the numeracy test is more diverse than literacy and the average is well mastered in the preparation of the questions, especially for numbers, measurements, and geometry. Counting operations questions, both integers, and fractions are arranged in questions with very good accuracy, as well as measurements and geometry such as calculating area, circumference, length, or weight which tend to be associated with personal contexts such as the example questions in Figure 6.

Figure 6: Sample question of knowing the level

At the level of knowing (N1) in numeracy assessment in elementary schools, they are well mastered in preparing questions as exemplified in Figure 6. The content used at this level is generally numbers and measurements such as counting the number of objects, the area of objects, identifying the size of objects, and others with personal contexts. A quite striking difference from the questions that are arranged lies in the stimulus in the form of visual texts and contexts that are associated with everyday life, in contrast to the form of math test questions that directly present operations, for example in addition to fractions.

At the level of applying (N2) in numeracy assessment in elementary schools, they are mastered quite well in the preparation of questions, one of which is exemplified in Figure 7. At this level, the questions compiled should require students to apply mathematical concepts in real situations that are routine. The majority of the questions compiled are still in the form of counting, classifying, identifying various materials related to daily life such as the example questions in Figure 6. Here, misconceptions were found in the preparation for level applying, not only related to daily life such as calculating the price of goods sold. purchased or measured the area of the park but rather a question to measure students' ability to apply their knowledge (N1) in everyday life.

Look at the picture below!
We often encounter the following objects in our daily life. We can use these objects to measure length, weight, and time.

To measure our weight we use a measuring instrument!

Figure 7: Sample question of applying level

The example questions in Figure 7 show the application of mathematical concepts related to the use of tools in everyday life. This question is intended for low grades in measurement material. However, the inaccuracy lies in the questions that are not well structured. Notice the last sentence in the picture which should be edited as "*From the selection of these various tools, which one is used to measuring body weight?*". Similar errors were also found in almost 55% of the questions compiled. In addition to editorial errors, the selection of illustrations is also often not under real conditions as in Figure 8.

Edo, Ani, Dita and Rado are waiting at the elevator door to go up to the fifth floor. The elevator position is on the second floor leading to the third floor. In the elevator there are 5 people with a total chest weight of 340 kg. The weights of Edo, Ani, Dita and Rado are as follows:

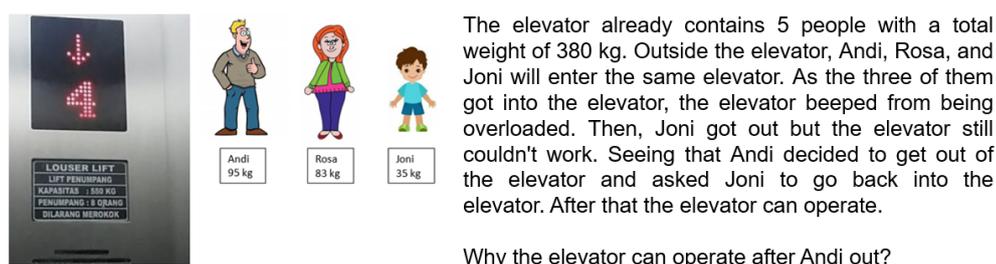Edo 30 kg

Ani 47 kg

Dita 55 kg

Rado 70 kg

While waiting for the lift to move, they read the information on the button next to the lift door, that the lift has a maximum capacity of 450 kg and can be climbed by 7 people. The total lift capacity is kg

a. 450   c. 400
b. 340   d. 600

Figure 8: Other sample question of applying level

The inaccuracy of the illustration shown in Figure 8 lies in the selection of figures and their weight. Edo is described as a child but weighs 30 kilograms, as well as Ani, who is described as a child but weighs 47 kg, which is only 8 kg apart from Dita, who is described as an adult woman weighing 55 kg. On the other hand, Rado weighing 70 kg is described as having a growth that is not too fat. Although only as a stimulus, this illustration shows a poor application of the concept in measurement. Especially for students who are critical so that the selection of illustrations needs special attention in preparing questions.

Next, at the N3 level, it is known that the accuracy of the questions compiled at the reasoning level is still low. Of the 30 participants, only 9 of them correctly arranged the numeration questions at this level. An example can be seen in Figure 9 which uses evaluation questions to reveal students' ability in reasoning based on the illustrations provided. In this problem, students may not have to include the results of their calculations in answering questions, but in the process, they still have to calculate to find solutions to the questions as evidence of their answers.

The elevator already contains 5 people with a total weight of 380 kg. Outside the elevator, Andi, Rosa, and Joni will enter the same elevator. As the three of them got into the elevator, the elevator beeped from being overloaded. Then, Joni got out but the elevator still couldn't work. Seeing that Andi decided to get out of the elevator and asked Joni to go back into the elevator. After that the elevator can operate.

Why the elevator can operate after Andi out?

Andi 95 kg

Rosa 83 kg

Joni 35 kg

LOUSER LIFT
LIFT PENUMPANG
KAPASITAS : 550 KG
PENUMPANG : 8 ORANG
DILARANG MEROKOK

Figure 9: Sample question for reasoning level

Common errors that are known from the preparation of this question are misconceptions with questions for level N2, applying. The majority of questions are used in the form of questions as shown in Figure 3 or 4, but the answers requested only require students to solve arithmetic operations in real life. The form of the question was also the majority using true and false questions, for example determining which statements are true and false without asking students to express their rationalization.

DISCUSSION

As has been revealed in the background of the research that the minimum competency assessment is different from the assessment practices that have been carried out so far in learning. This change demands the readiness of the government, teachers, students, and parents of students who are certainly involved in the process (Nehru, 2019). Of course, this change is aimed at increasing the competence of students as the nation's generation in the 21st century that is superior and competitive in the midst of the rapid development of science and technology (Sukmayadi & Yahya, 2020). More precisely, it is from this minimum competency that improvements should be made based on the diagnostic results of students' thinking and learning in literacy and numeracy. These two competencies were previously known as "*calistung*" or reading and writing arithmetic as a basic ability that must be mastered by students (Muliastrini, 2020). The importance of "*calistung*" is the same as the importance of literacy and numeracy for students in solving problems in their daily lives.

Teacher competence plays an important role so that the objectives and functions of this minimum competency assessment are achieved. The intended competence is included in the preparation of test questions for the literacy assessment and numeracy itself in the class assessment. The illustration from the results of the assessment carried out nationally will be mapped on how the ability of students in elementary schools will be (Novita et al., 2021). The teacher's task is to follow up on the results in learning starting from determining the competencies to be improved, preparing learning designs and learning instruments, providing treatment or further development, and evaluating through classroom assessments (DeLuca et al., 2018). This process certainly requires different literacy and numeracy test instruments at each grade level with the same proportions according to the specified standards.

According to the results of the analysis in this study, the competence of teachers in preparing literacy and numeracy tests still needs to be improved. From the form of the questions, it can be seen that the teacher's skills in preparing questions still need to be addressed, namely in complex multiple-choice questions and matchmaking. The form of this question is indeed very different from the previous question form used in learning assessments which tend to be multiple choice or essay (Osnal et al., 2016). However, it can be observed that from a large number of true-false short essay questions and the stimulus questions used, the teachers made good progress in following the changes in the assessment itself. Although in some of the contexts that have been discussed, such as the use of illustrations, editorials, and the appearance of questions, it needs to be improved again to meet the test criteria as a measurement tool, namely having good readability (content, font size, color), not depending on previous questions, logical answer choices and homogeneous, the test stimulus (text, pictures, graphics, tables) is clear and functional and does not have multiple and negative meanings (Rust et al., 2003).

In terms of mastery of content, context, and cognitive level, the literacy tests that were prepared also did not meet the specified standards. In terms of literacy content, information texts are more widely used in learning than literary texts. Literary texts themselves need to be varied according to the scope of the material in each class, such as poetry, rhymes, historical fiction, fables, or other types of literary texts (Khair, 2018; Machromah, 2021). As with numeracy content, general materials such as numbers, measurements, geometry, and data have better accuracy than other materials. Furthermore, in terms of context, the personal context is indeed more dominantly used, especially for the lower class who are still focused on recognizing themselves according to the specified proportions, but the use of this context does need to be explored again, especially for science (Rohim, 2021).

The misconceptions of each cognitive level, in particular, need to be clarified so that the function of the minimum competency assessment can run ideally even though it does reflect on previous changes, for example, the 2013 Curriculum in Indonesia in the past few years requires a long journey until these changes can be implemented ideally. In this

condition, the findings of this study should be able to provide an overview to evaluate the next step in improving the competence of teachers as learning evaluators. Efforts were initiated and documented in this early year through training, development, and other efforts in preparing qualified teacher competencies to conduct assessments (Anas et al., 2021; Andikayana et al., 2021; Handayani et al., 2015).

In line with literacy, the numeration tests that are prepared also still need to be improved in terms of content, context, and cognitive level. In numeration itself, it is considered more difficult to compile contextual math problems in everyday life, considering that so far math tests tend to be in the form of numbers and formulas only. This fact is also reflected in the findings of this study how the accuracy of the preparation of reasoning questions is low. Students are accustomed to learning mathematics in the form of numbers and often do not know how to apply it in everyday life such as algebraic material for example (Maulidina & Hartatik, 2019). Questions like "what do we study fractions for, ma'am?" or "why do we need to learn to count when we can use a calculator?", are examples of questions that have the potential to stimulate students to think critically and creatively in solving mathematical problems in everyday life (Kong, 2014).

CONCLUSION

In this study, it can be concluded that the readiness of teachers in minimum competency assessment in terms of their competence in compiling literacy and numeracy assessment questions in elementary schools still needs to be improved, especially for literacy assessment at the reflect and evaluate level and for numeracy assessment at the reasoning level. In terms of the accuracy of the form of the question, it can also be seen that the form of the questions that have been prepared does not meet the proportion of forms required in the minimum competency assessment so that it is also necessary to improve the competence of teachers in compiling the form of questions such as in the form of complex multiple choice.

Based on the results of this study, the improvement and development of teacher competencies in minimum competency assessments in elementary schools is urgently needed. Teachers have an important role in implementing, using and following up on the results of the minimum competency assessment in the National Assessment in improving the quality of Indonesian education in the future. This research is limited to the analysis of the minimum competency assessment questions compiled by elementary school teachers according to the research location. Differences in teacher competencies may be different in other locations that deserve to be investigated in preparing good teacher competencies for minimum competency assessments. Furthermore, the results of this study also open up opportunities to conduct research that can improve and develop teacher competence in the assessment.

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Teacher's Use of WhatsApp Application to Solve Elementary School Students' Online Learning Difficulties

Eko Kuntarto[*], Faizal Chan, & Nurul Qalbi Eka Pratiwi
Universitas Jambi, Jambi, Indonesia
*Email**: nurulqalbiekapratiwi.pgsd@gmail.com

Keywords:	Abstract
Whatsapp; learning difficulties; online learning	This research aimed to describe the types of difficulties encountered by students when conducting online learning through WhatsApp, as well as how teachers address students' learning difficulties. The method used in this research was qualitative research method using case study design. Data were gathered through online observation and interviews. Data analysis was carried out by collecting data, analyzing data, and drawing conclusions. To check the validity of the data, sources and technique triangulations were used. The results of this research showed that there were several difficulties experienced by the students during online learning through WhatsApp group, such as lack of support facilities because students did not have their own mobile phones, unstable internet network, and insufficient internet quota. Regarding the use of WhatsApp in learning activities, students had difficulty discussing in the group or using WhatsApp features. The teacher overcame the obstacles for students who did not have their own mobile phones by asking their classmates or neighbors who lived nearby to provide information related to learning activities. To address challenges such as an unstable internet network, the teacher instructed students to find a location with a good network while learning. Then, regarding students who did not have an internet quota, the teacher recorded the student's WhatsApp numbers so they could get free internet assistance from the Ministry of Education and Culture. To solve problems related to the difficulty of students discussing in groups and difficulties using the WhatsApp feature, the teacher always guided and assisted students on how to use the WhatsApp features in the learning process.

INTRODUCTION

Background

According to the Minister of Education and Culture Regulation Number 81A Year 2013, learning is a method for students to master what is taught. Learning activity, in general, is an educational process that allows students to develop their potential and abilities, as well as the attitudes, knowledge, and skills required to live and socialize as a nation and contribute to human welfare.

The world is currently experiencing the COVID -19 pandemic, which has claimed many lives and represented a massive challenge for Indonesia and the rest of the world. The COVID-19 outbreak causes an impact on education as well. Based on Circular Letter No 3 Year 2020, in the context of preventing the development and spread of coronavirus disease (COVID -19), education units are directed to focus on several issues concerning the prevention and the transmission of coronavirus disease. Following the policies issued by the Minister of Education and Culture, namely Circular Letter Number 4 Year 2020 regarding the implementation of education during the coronavirus disease emergency, there are some changes in the learning process, in which teaching and learning activities are conducted remotely (from home) or online.

Problem of Study

This necessitates a shift in the learning process from face-to-face (offline) to online learning. A social media platform is a type of media where users can find information, communicate with one another, and make new friends online. As is well known, there are various types of social media, such as Facebook, Twitter, Line, BBM, WhatsApp, Instagram, Path, LinkedIn, Snapchat, and others (Trisnani, 2017). WhatsApp is one type of online social media platform that is simple to use and operate for students. WhatsApp, as a social media platform, enables its users to deliver specific announcements, various ideas, and learning resources, as well as to support online discussions (Amry, 2014). There are several advantages to using Whatsapp Messenger Group for learning: 1) It can easily be downloaded and free, 2) It allows the transmission of comments, writings, images, videos, sounds, and documents. 3) It can be used as a medium for publishing works or disseminating information. 4) It has a variety of features for disseminating information and knowledge, and 5) It makes online learning more convenient (Indaryani & Suliworo, 2018).

Teachers must be creative in using WhatsApp, including the use of application features for delivering material, appointing assignments, collecting assignments, and conducting online learning assessments in order to produce effective learning outcomes. This needs to be a teacher's attention so that students do not have difficulty to participate in online learning. Learning difficulties occur when a person's learning process is disrupted by the emergence of conflicting responses or a person's inability to learn (Mulyadi, 2010). So, if there are problems or learning difficulties encountered by the students during online learning, teachers must be able to address the issues in various ways.

The teacher's role is critical in effectively utilizing WhatsApp in the learning process so that students do not find it difficult to participate in learning activities. Teachers can use WhatsApp to give assignments, interact with students, and collect assignments in order to prevent gatherings during the current pandemic and prevent the spread of COVID-19. Furthermore, the teacher's role is vital in providing solutions or ways to overcome learning difficulties experienced by students during the learning process. The researchers selected SD N 160/IX Simpang Tuan as the subject of the research. According to the results of the observations and interviews with the homeroom teacher, there were still some students at the school, particularly the fifth-grade students, who had difficulty participating in online learning using WhatsApp.

State of The Art

Several studies have been conducted to investigate the use of WhatsApp in online learning. First, Alaby (2020) carried out research on the use of WhatsApp as a medium of information and learning. This study found that WhatsApp plays an important role in the lecture process. It is also used to improve the method of sending assignments. Second, Shodiq and Zainiyati (2020) discovered that using WhatsApp as a learning tool in the midst of the COVID-19 pandemic is very appropriate because this application is simpler, easier to use, and has more features than another online application. Third, research by Afnibar and Fajhriani (2020) revealed that students generally use WhatsApp to communicate and learn. WhatsApp also makes communication easier, supports learning activities, and assists students in learning activities. Fourth, Dewi's (2020) study discovered that using WhatsApp helps reduce the impact of COVID-19 on the implementation of online learning in elementary schools.

Gap Study & Objective

COVID-19 has had such a large impact on education as it can be seen on the shifting of face-to-face learning into online learning through the use of different applications such as WhatsApp, Zoom, Google Classrooms, and others. This online learning can be quite effective if teachers, students, and parents work together. Fifth, a study by Wiguna et al. (2020), informed that the use of WhatsApp is a factor that significantly influences the learning process when it is conducted online. In this case, students in elementary school face a number of challenges when participating in the online learning process via WhatsApp application. Based on this context, the purpose of this research is to describe the students' difficulties in online learning using WhatsApp application, as well as the methods that teachers have used to help these students overcome their learning difficulties.

METHOD
Type & Design

This is qualitative research using a case study design. The research was conducted at SD Negeri 160/IX Simpang Tuan, particularly in the fifth grade. This research was carried out during the even semester of the 2020/2021 academic year.

Data & Data Source

The data were qualitative in the form of words gathered through observations and interviews. The participants of this research were fifth-grade students and the homeroom teacher. The first set of data focused on students' difficulties with online learning. These data were gathered from four students who struggled with online learning. The second set of data came from the fifth-grade students' homeroom teacher, and it was about how the teacher overcame students' difficulties. The data for this research were collected through observation and interviews.

Data Collection Technique

The observation technique was used to determine how the teacher used the WhatsApp social media platform to help students overcome learning difficulties. The researchers joined the WhatsApp group of the class, did the observations, and paid attention to the teacher and students' activities during the online teaching and learning process. The observations were done based on the observation guide.

Table 1. Observation Guide

No	Aspects observed	Indicator
1	Supporting facilities in the form of WhatsApp application	1. Have a mobile phone 2. Have joined the WhatsApp group 3. Have a stable internet connection 4. Have an internet quota
2	The use of the WhatsApp application	1. WhatsApp group is used to facilitate discussion during the online learning process. 2. The class in WhatsApp group is used to deliver information about learning activities. 3. All students actively participate in discussion activities through WhatsApp group chats. 4. WhatsApp is active during the teaching and learning process. 5. WhatsApp is used every day. 6. WhatsApp features are used in the online learning process. 7. There are obstacles in using WhatsApp for online learning. 8. The teacher provides a solution when students encounter a problem during the learning process.

The researchers also employed semi-structured interviews. Data collection from interviews began by preparing an interview guide sheet. Interviews were conducted with the homeroom teacher and the fifth-grade students who had difficulty following online learning by complying with health protocols by wearing masks, washing hands, and using hand sanitizers. During the interview, the teacher and students were asked to respond to questions based on the actual situation.

Table 2. Interview Guide

Data Sources	Aspects observed	Indicator
Teacher	Supporting facilities in the form of WhatsApp application	1. Have a mobile phone 2. Have WhatsApp application on the phone 3. Have a stable internet connection 4. Have an internet quota
	The use of the WhatsApp application	1. Have joined the class WhatsApp group 2. WhatsApp group is used to facilitate students with discussions. 3. WhatsApp group is used to notify students about upcoming learning activities. 4. WhatsApp is active during the teaching and learning process.

| Students | Supporting facilities in the form of WhatsApp application | 5. WhatsApp is used every day.
6. The teacher knows and is able to use WhatsApp's features.
7. Obstacles to online learning with WhatsApp
8. Solutions to overcome obstacles in using WhatsApp
1. Own a mobile phone
2. Have a WhatsApp application on the phone
3. Have a stable internet connection
4. Have an internet quota
5. WhatsApp is more user-friendly for online learning than other social media platforms.
6. Students use the class in WhatsApp group to ask questions related to online learning problems. |
| | The use of the WhatsApp application | 7. Students use class WhatsApp group to discuss online learning materials.
8. Students use WhatsApp more frequently than textbooks
9. Students use WhatsApp every day.
10. Students know and are able to use WhatsApp's features. |

Data Analysis

Several triangulation techniques were employed in this research. First, source triangulation was used to test the validity of the data by cross-referencing the data from various sources. Second, technique triangulation was used to test the validity of the data by comparing it to the same source but using different techniques. The data analysis technique was carried out continuously until it was completed, causing the data to become saturated. The stages in data analysis include data collection, data analysis, and conclusion drawing.

RESULTS

This research aims to describe the students' difficulties in learning online using the WhatsApp application, as well as the methods that teachers have used to help these students overcome their learning difficulties. Data were gathered through observations conducted during the research period through the WhatsApp group. In addition, to enrich the data, interviews with the participants were also conducted. The followings are the findings from interviews with the teacher and fifth-grade students at SD Negeri 160/IX Simpang Tuan who had difficulty in learning online using WhatsApp.

Forms of Students' Online Learning Difficulties Using WhatsApp

According to the research findings, the form of students' difficulties in online learning using WhatsApp was related to supporting facilities such as the WhatsApp application. It was found that the students did not own mobile phones, that the internet network was unstable, and that they did not have an internet quota. Then, the difficulties associated

with the use of the WhatsApp platform were that students did not understand how to use WhatsApp features, so they did not dare to ask questions in the group, and they became inactive in the WhatsApp group during learning. Further explanation is given below.

The researchers discovered several findings regarding the students' difficulties with online learning using WhatsApp. The findings of the observations and interviews revealed that the difficulties of the fifth-grade students were related to a lack of supporting facilities, in this case, the WhatsApp application. The following is a discussion of the problems encountered by students at SD Negeri 160/IX Simpang Tuan when using WhatsApp for online learning.

1. **Students did not have their own mobile phones**

One of the reasons students struggled with assignments was that they did not have their own mobile phones. In this case, they used their parents' mobile phones. As a result, when the teacher distributed assignments and learning materials, students were unable to join the WhatsApp group. They finished the assignments when their parents returned home from work. Under these conditions, learning did not run effectively.

It was mentioned by RJ, one of the fifth-graders at Sekolah Dasar Negeri 160/IX Simpang Tuan:

> "I don't have my own mobile phone; the one I use belongs to my father; as a result, I can't complete my assignments on time when the teacher posts them in the WhatsApp group. I didn't do it immediately. I'm going to have to wait for my father to get home from work. Then I'll check the group and finish my homework" (23/01/2021).

2. **Unstable internet connection**

Another issue was the limited internet network at the student's house due to its location in the garden. This resulted in students not receiving messages from the teacher in the WhatsApp group, which could impede the teaching and learning process in online learning.

As explained by student A in our interview:

> "I frequently missed lessons because the signal in my house was lost, and also, since my house is in the garden, it is difficult to find a good internet connection. Sometimes, I have to leave my house or go to a friend's house outside the garden to find an internet connection" (30/01/2021).

3. **Students do not have an internet quota**

Another challenge in online learning is the Internet quota or data limit. The difficulty discovered in this research was that students did not have an internet quota. The internet quota that students used was purchased independently. They did not receive free internet quota assistance from the Ministry of Education and Culture. Students were unable to purchase their quota at any time. Due to their parent's financial situation, students must first postpone the purchase of their internet quota. As a result, students missed out on online learning, which was done through a WhatsApp group.

This is supported by the results of interviews with a fifth-grade student of SD N 160/IX Simpang Tuan, initials AP:

> "In terms of assignments, I have difficulty accepting assignments from teachers who send them through the WhatsApp group because my brother and I share one mobile phone. When I want to do an assignment, my brother's internet quota runs out, so I can't check the assignments assigned by the teacher" (20/01/2021).

According to the findings of observations and interviews, the online learning difficulties encountered by students when studying using WhatsApp during the COVID-19 pandemic are students' lack of personal mobile phones, unstable internet connections, and limited internet quotas. Due to these difficulties, students are unable to follow the teacher's lessons. Learning through WhatsApp groups is one option for students to continue learning during the COVID-19 pandemic in order to prevent the virus's spread and transmission.

● **The Use of WhatsApp**

During the research, the researchers found that students encountered problems in online learning.

Based on the findings of observations and interviews, the difficulties of learning faced by fifth-grade students at SD Negeri 160/IX Simpang Tuan are as follows:

1. Students find it difficult to engage in a discussion in a WhatsApp group.

During online learning using WhatsApp, some students still had difficulty discussing the tasks assigned by the teacher through the WhatsApp group because the mobile phone belonged to their parents, as a result, students could not use WhatsApp during school hours. Students also did not dare to ask the teacher who assigned the tasks if they were confused about how to complete the assignment.

It is in accordance with the results of the interview with one of the respondents, initials MA:

> "When the teacher sends assignments to the group, I sometimes didn't understand the tasks. Furthermore, the WhatsApp account I use belongs to my parents, so I won't be able to participate in the lessons during school hours. I didn't even dare to ask questions in the WhatsApp group. When I didn't understand, I asked a friend via WhatsApp chat, and he sent me a video of how he completed the task" (06/02/2021).

2. Students find it difficult in using WhatsApp's features

The issue discovered was that students had difficulty using the WhatsApp feature, such as students could not download learning materials or send photos of their assignments to the teacher due to memory limitations, and students failed to play videos sent by the teacher. When the WhatsApp memory is full, the phone will undoubtedly become slow and WhatsApp will cease to function properly.

It was uttered by TA, a fifth-grade student at Sekolah Dasar Negeri 160/IX Simpang Tuan:

> "When the teacher started the lesson in the group and sent photos and learning videos, I couldn't download them because WhatsApp warned me that my WhatsApp memory was full, so I couldn't see what assignment announcements the teacher made. If we receive a notification that our WhatsApp memory is full, our phones will no longer receive message notifications or WhatsApp chat" (06/02/2021)

▪ **Teacher's Strategy to Overcome Students' Difficulty in Online Learning Through WhatsApp**

From the research findings, students' difficulties were related to learning support facilities, such as students' lack of personal mobile phones. The teacher provided a solution in which classmates or neighbors shared information about the lessons taught that day, and they could discuss it together through a WhatsApp group on their friend's mobile phone. The teacher also allowed students to submit their assignments when their parents came home from work.

This information was conveyed by AZ, one of the participants of this research:

> "As students do not have their own mobile phones but rather those of their parents or siblings, I sent messages via WhatsApp chat to friends or neighbors who are close to them so they can share the assignments I give on that day. I also allow the students to send their assignments late because the most important thing is that they want to complete the tasks. Personally, students' effort to finish their tasks is enough to make me grateful" (30/01/2021)

To overcome online learning difficulties caused by limited internet quotas and unstable internet signals in the area of residence, teachers provided a solution by registering student phone numbers with school operators, to be registered as the recipient of free internet quota assistance from the Ministry of Education and Culture, so that students can carry out learning without any obstacles.

This information was conveyed by the homeroom teacher of the fifth-grade students of SD Negeri 160/IX Simpang Tuan, initials AZ:

> "If a student is having trouble with internet quotas, I report it to the school operator so that the mobile phone number registered as a recipient of free quota assistance from the Ministry of Education and Culture, allowing students to participate in learning and do assignments without interruption. Similarly, if an internet signal is unstable, I advise students to find a location with a good network during learning hours"(30/01/2021)

The teacher managed the online learning process through WhatsApp by assigning tasks to the students. The teacher gave assignments once a day to prevent students from becoming lazy and having difficulty or confusion with multiple assignments. The teacher also provided clear instructions for the assignments and allowed students to ask and answer questions in the WhatsApp group or private chats, as well as through WhatsApp calls.

As mentioned by AZ, the homeroom teacher:

> "When submitting assignments, I took advantage of existing WhatsApp features to overcome online learning difficulties experienced by students. I sent a downloaded video about material that the students did not understand. Besides, I also provided students the opportunity to ask questions either in groups or through private chats. I shared sample photos of assignments that they did not understand, and in addition to using chat, I sent voice notes to explain the learning materials" (30/01/2021)

Then, it was also found that the teacher's method of dealing with students who had learning difficulties during online learning was that the teacher provided learning media using WhatsApp by sending learning videos to the group and providing an explanation of the learning material that was sent to the group. The teacher also offered a discussion session in the WhatsApp group so that students could ask questions to the teacher regarding learning material that has not been understood.

DISCUSSION

Based on the findings of this current research, several points regarding students' difficulties in online learning through WhatsApp group as well as teacher's strategies in addressing students' problems are discussed below.

During this research (18 January 2021-18 February 2021), online learning was carried out using WhatsApp. Teachers and students conducted teaching and learning activities in a WhatsApp group. During this Covid-19 pandemic, the teacher played an important role in online learning. Teachers guided and assisted students in overcoming online learning difficulties by sending learning materials and explaining tasks that students must complete while studying at home. Then, when students experienced learning difficulties, the teacher offered solutions so that students could continue to learn and did not miss out on the learning material.

In this case, the teacher followed a policy issued by the Minister of Education and Culture, Nadiem Anwar Makarim, who issued Circular Letter Number 3 Year 2020 through the letter Number 36962/MPK.A/HK/2020 concerning online Learning to prevent the spread of Corona Virus Diseases (COVID-19). This policy has compelled teachers and students to continue their learning at home through the use of distance learning media, one of which is the WhatsApp application, which was used by the fifth-grade teacher at SD Negeri 160/IX Simpang Tuan.

During the pandemic, learning was done online through WhatsApp. The teacher distributed assignments, and students were expected to complete them. However, some students were still late in submitting their assignments. This occurred as a result of some difficulties or obstacles encountered during online learning. The difficulty encountered was that students did not have their own mobile phones, but rather those of their parents or siblings. So, in order to complete school assignments, students had to wait for their parents to return home; in some cases, students submitted assignments at night when their parents were at home.

According to Indaryani and Suliworo, "Whatsapp is a messaging-based application for smartphones, with a basic interface similar to Blackberry Messenger" (Indaryani & Suliworo, 2018). As a result, smartphones are essential for using the WhatsApp application. When students did not have their own mobile phones, the teacher overcame online learning difficulties by sending private chats to students' parents, so that they left their mobile phones at home for their children to study, or by sending messages to classmates who were close to their homes. Suryani, (2017) argued, "the WhatsApp application also has a message status in the form of a sign that functions to find out the status of the message, so that teachers can monitor students whether they have opened the messages, read, or not at all". With the message's status, the teacher can more easily track which students have done the assigned tasks.

In online learning through the WhatsApp group, the assignments were distributed every day during class hours. Following the distribution of the assignment by the teacher, the student must submit the assignment via WhatsApp, and they must also send a photo of proof when they were working on the assignment, along with a photo of the completed task. However, some students did not know the task assigned by the teacher during class and did not complete it.

From the data, this happened due to students running out of their internet quota, preventing them from receiving messages from the teacher in the WhatsApp group. Hartono (2012) argued, "WhatsApp is a cross-platform messaging application that allows users to exchange messages without using SMS fees because WhatsApp uses the same internet network data package for email, web browsing, and others". Conforming to this explanation, the teacher's method of overcoming this problem was to register the students' mobile phone numbers with school operators so that they were recorded as recipients of free internet quota assistance from the Ministry of Education and Culture.

As stated in research data, one of the learning difficulties during online learning using WhatsApp was an unstable internet signal, which prevented students from sending assignments to the teacher on time. This is consistent with Nasrullah's (2015) opinion that "social media has a special character, namely the network, the infrastructure that connects computers with other hardware. Computers or mobile phones must be connected through a connection in order to communicate with other users." Purwanto et al. (2020) confirmed this by stating that "internet communication costs money". The factor causing difficulties in online learning is a less stable internet network because not all residences are covered by internet service. According to Indaryani and Suliworo (2018), "WhatsApp also uses 3G/4G or WiFi connections for data communication". Parents' limited abilities in using smartphones and internet fees, as well as other factors, have become obstacles in the learning process, resulting in online learning difficulties during the covid-19 pandemic. To overcome students who have difficulty in online learning, the teacher provided a solution by calling them directly using WhatsApp calls and instructing them to move to places where there is a good signal during learning hours or online discussions.

During the covid-19 pandemic, the teacher sent learning assignments every day, with one task per day. Although there was only one task, there were students who had difficulty understanding the material presented by the teacher, and as a result, students were lazy to complete the task. This is consistent with Dalyono's (2009) belief that "learning difficulties or learning disorders are situations in which a person's learning process is hampered due to the emergence of conflicting responses." It also refers to a person's inability to learn." Faced with these issues, the teacher attempted to use the features of the WhatsApp social media platform to provide learning videos that could be downloaded and sent to the class in WhatsApp group, and the teacher also shared photos of examples of how to finish the assignments.

According to Indaryani and Suliworo (2018), "there are several benefits of using Whatsapp Messenger Group in learning: 1) It is easily and freely obtained, 2) it allows the transmission of comments, writings, images, videos, sounds, and documents, 3) it can be used to publish works or disseminate information, 4) it has various features for disseminating information and knowledge, and 5) it facilitates online learning. With the current pandemic, teachers must be able to use WhatsApp features in the learning process to overcome online learning difficulties and to create meaningful learning for students.

Based on the discussion above, WhatsApp can provide benefits and serve as a solution to learning difficulties faced by students. By maximizing the use of WhatsApp for learning, students do not miss the material presented by the teacher. The use of this application also makes it easier for students to succeed in their learning when face-to-face learning is not possible. By using WhatsApp, students can still carry out learning, although it is not as effective as face-to-face learning.

CONCLUSION

The objective of this research is to describe the different types of online learning difficulties that students face when using WhatsApp, as well as how teachers can help students overcome these difficulties. Based on the result of the research and the discussion that has been presented, it is possible to conclude that the types of learning difficulties experienced by students are related to students' lack of support facilities because students did not have their own mobile phones, unstable network, and internet quota. Then, when it comes to WhatsApp features, students had trouble discussing in WhatsApp groups and using WhatsApp features. The teacher overcame the obstacles for students who did not have their own mobile phones by asking their classmates or neighbors who lived nearby to

provide information related to learning activities. To address challenges such as an unstable internet network, the teacher instructed students to find a location with a good network while learning. Then, regarding students who did not have an internet quota, the teacher recorded the student's WhatsApp numbers so they could get free internet assistance from the Ministry of Education and Culture. To solve problems related to the difficulty of students discussing in groups and difficulties using the WhatsApp feature, the teacher always guided and taught students on how to use the WhatsApp features in the learning process.

The findings of this research are expected to provide information and increase teacher understanding of how to use WhatsApp to help elementary school students overcome online learning difficulties during the COVID-19 pandemic. Furthermore, the results of this research can also be used to guide teachers in selecting effective media during the COVID-19 pandemic. For researchers, as prospective teachers, the results of this study increase researchers' understanding that teachers must have their own method or solution in overcoming students' difficulties in online learning using WhatsApp.

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Elementary Teachers' Perceptions of Online Learning During Covid-19 Restrictions

Meirza Nanda Faradita* **& Kunti Dian Ayu Afiani**
Universitas Muhammadiyah Surabaya, Surabaya, Indonesia
*Email: **meirzananda@fkip.um-surabaya.ac.id**

Keywords:	Abstract
teacher's perceptions; online learning; Covid-19 restrictions	*Learning activity during public activity restrictions at Muhammadiyah Elementary School, Taman Sub-district, Sidoarjo Regency, is carried out through online learning; however, teachers at SD Muhammadiyah Taman continue to face a number of challenges in this teaching and learning activity. This research aims to examine online learning implementation during the public activity restrictions. There are still many teachers who lack an understanding of science and technology, let alone old or traditional teachers who make online learning uninteresting. This research applied the survey research method. Data were collected using an open questionnaire accessible via Google Forms. The data was analyzed using descriptive statistics. There were 97 teachers at SD Muhammadiyah Taman who filled out the questionnaire. Based on the questionnaire responses, 70.1% had implemented online learning. The issue during online learning was that many students did not have their own mobile phones or laptops because their siblings were still using them for online learning or their parents were still using them for work, so teachers felt that the material presented could not be fully absorbed by the students. Meanwhile, parents struggled with not being able to control their children when learning at home, which differed from face-to-face learning at school.*

INTRODUCTION

Background

The Circular Letter of the Minister of Education and Culture No. 15 of 2020 mentions that the process of learning during the covid-19 pandemic is done through distance learning from home, and there is no face-to-face learning until the situation is declared green zone. The regulation was then extended for an undetermined period of time in the even semester of the 2020/2021 academic year. The government has also implemented public activity restrictions (PPKM), which was valid from 11-25 January 2021 applied in Java and Bali, was

extended from 25 January to 8 February 2021 to ensure that people are productive and safe from COVID-19 and that the Indonesian economy improves in the future.

Distance learning is learning that takes place online through the use of learning applications and social networks. Online learning is done without the use of face-to-face interaction, but rather through the use of a platform. This process of learning can be effective if it employs the appropriate media for the task at hand (Khusniyah & Hakim, 2019). According to Sadikin & Hamidah (2020), online learning is defined as learning that takes place over the internet network and provides accessibility, connectivity, flexibility, and the ability to initiate various types of learning interactions. The use of the internet and multimedia technology has the potential to change the way knowledge is conveyed and can be an alternative for remote learning during the PPKM period.

During this PPKM, the school is still implementing online learning on the basis of these regulations. Many teachers struggle with it because they frequently teach offline rather than online at school. Pratiwi (2013) argued teachers' perceptions include subject matter knowledge, work attitudes, and teaching skills. This perception will be influenced by the teacher's previous experience in online teaching. The perception of the teacher is closely related to the teacher's performance. The teacher is considered competent when he or she has implemented the competency standards such as pedagogic competence, personality competence, social competence, and professional competence (Ismail, 2010). If the teacher's competence is attained, learning will run effectively and the learning objectives will be met in both distance and face-to-face learning.

Problem of Study

As mentioned by Afiani, Muhari, & Siswono (2015), education is an effort to provide a person with the ability to deal with changes brought about by technological advances. Today's technological advancement is the result of the creative thinking ability. As a result, current conditions necessitate learning with technology for learning in order to continue adeptly, specifically through online learning. Online learning is an educational innovation in which there is an element of information technology in the learning method, as well as online learning systems such as distance education with a set of teaching methods carried out separately from the learning activity (Eliza & Fitria, 2021). Online learning is an option that teachers can use for distance learning. Teachers must apply different learning media, methods, and models that are appropriate for the current situation (Faradita, 2018). In the last six months, Muhammadiyah elementary school teachers in Taman sub-district, Sidoarjo Regency, have conducted online learning. The researchers intend to analyze teachers' perceptions of online learning implementation so that the challenges they face can be identified.

State of the Art

This research refers to a study by Anggianita et al. (2020), who contended that online learning causes learning objectives to be miscommunicated to students. There are still many teachers who lack an understanding of science and technology, let alone old or traditional teachers, making online learning not interesting. Online learning is also hampered by a lack of supporting facilities and infrastructure, such as android and internet quotas. As reported by Zhafira, et al. (2020), online learning can be mastered with the use

of an online platform such as Google Classroom, which has been implemented at Universitas Teuku Umar's Faculty of Economics.

Gap Study & Objective

This research explored teachers' perceptions of online learning implementation and the challenges they encountered during the teaching process. The findings of this research can be used as a reference for other researchers in conducting similar research.

METHOD

This research applied the survey research method. The data was analyzed using descriptive statistics. The survey method was used to investigate teachers' perceptions toward online learning. This research was conducted at SD Muhammadiyah in Taman sub-district, Sidoarjo Regency, involving SD Muhammadiyah 1 Taman, SD Muhammadiyah 2 Taman, and SD Muhammadiyah 3 Taman. Data were collected using a questionnaire and spread out through Google Form. The questionnaire was filled out by 97 teachers. Afiani & Faradita (2021) said an open questionnaire is a questionnaire that is presented in a simple form so that respondents can provide responses based on their preferences and circumstances.

The following is the blueprint of the open questionnaire used in this research.

Table 1. Blueprint of the Questionnaire of Online Learning during Public Activity Restriction

Aspects	Indicators	Number	
		+	**-**
Teaching and learning process	How did you find the learning process during PPKM?	2	
	During PPKM, what applications/platforms did you typically use for online learning?	3	
	Is wifi available at the school?	1	
Teaching and learning problem	What are your teaching challenges during PPKM?		4
	What is the student response toward learning during PPKM?		5
	How do the parents react to the learning process during PPKM?		6
Suggestion	What are your suggestions for learning during PPKM?	7	

Source: (Afiani & Faradita, 2021)

RESULTS

The diagram in Figure 1 shows the results of the questionnaire:
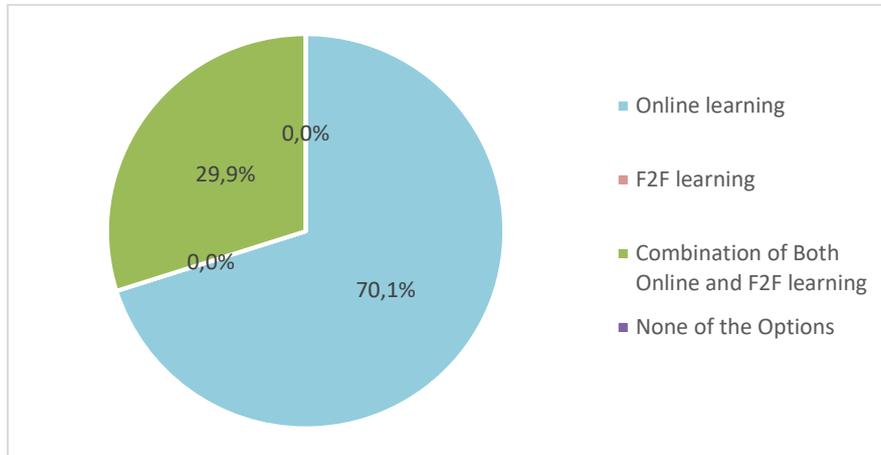

Figure 1. Diagram of the types of learning implemented by the teachers during the restrictions

Based on Figure 1, it was found that 29.9% of the respondents used the combination of online and face-to-face learning. This means that there were schools that used a method in which students studied at school once a week and learned online the other four days. Meanwhile, the teachers at SD Muhammadiyah in Taman Sub-district who used online learning during restrictions amounted to 70.1%.

The platforms frequently used by the teachers in online learning are shown in the Figure 2.
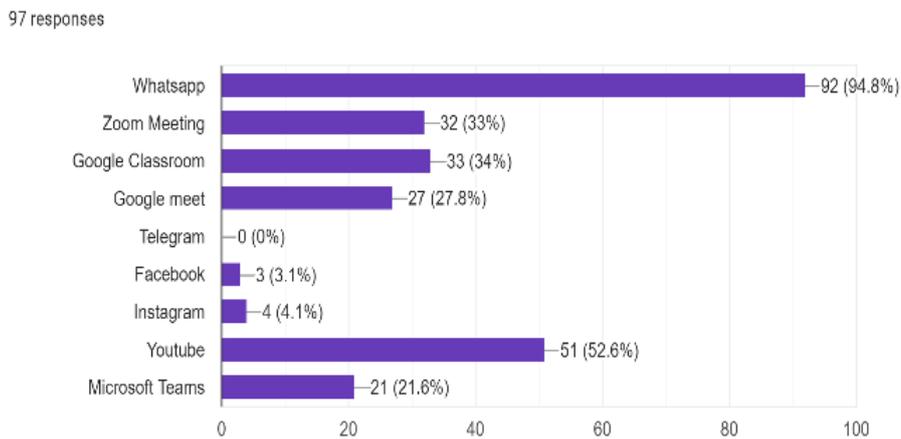

Figure 2. Platform used by the teachers

Figure 2 shows that WhatsApp, YouTube, and Google Classroom are the top three applications or platforms used by teachers during online learning.

DISCUSSION

According to the data, 70.1% of teachers at SD Muhammadiyah Taman conducted online learning during PPKM through the use of WhatsApp, YouTube, and Google Classroom platforms. The results of the questionnaire show that teachers used the school's Wi-fi in teaching. This is one of the facilities provided by the school to help the teachers to conduct online learning.

Concerning the challenges of online learning, some teachers complained about not having enough time to explain the material, difficulties to assessing students' understanding, communication with students that had to go through parents who were busy working, and that students were physically tired because they were sitting in front of a laptop screen.   According to the questionnaire results, some difficulties encountered by the students are that the students should take turns in using mobile phones with other siblings who also did online learning. Other challenges were unstable internet connection, limited internet quota, and mobile phones that did not support the Android system.

In agreement with the result of the research, parents' barriers to dealing with online learning include the fact that many parents complained about the facilities used in learning (mobile phones) that had not been able to meet the needs of their children because their mobile phones were used for work. Then, for parents who were at home, they complained about the fact that they had to accompany three children at the same time, which was stressful. Furthermore, when studying at home, their children were out of control, which was very different when they did face-to-face learning with teachers at school. Some parents also claimed that their children did not master the material even though they were in grade 5 or grade 6. Teachers at SD Muhammadiyah Taman hope for the learning process to soon return to normal, while still adhering to health protocols because students are happier and more active when they come to school.

From the discussion, the findings of this research are consistent with research by Arifin & Sukati (2020) who stated that online learning can be done if all needs are met in order for learning to run optimally. According to Riadil, et al. (2020)**,** in online learning, students must be more independent in their learning, and parents should not impose their wills because many parents are displeased with the implementation of online learning.

CONCLUSION

Online learning is possible if there is a lot of support from students, teacher skills, parents, and the fulfillment of learning infrastructure. There were 70.1% of teachers at SD Muhammadiyah in Taman Sub-district, Sidoarjo Regency that had done online learning during PPKM, while 29.9% had not. These 29.9% of teachers used a method in which once a week the teachers met with the parents to distribute students' worksheets and teaching materials for 6 meetings. The worksheet was then submitted to the teacher for correction in the following week, and the teacher also counseled parents if there were any difficulties with independent learning at home. The teachers did this because some students still did not have access to a mobile phone or a laptop for learning purposes. The majority of these facilities were used by other siblings to study or by their parents for work.

Online learning is feasible when all the prerequisites are met. Parental involvement is also important in online learning. To maximize online learning during this PPKM, teachers can use existing platforms such as social media (Facebook, Instagram), WhatsApp or telegram, or conferences such as Google Meet and Zoom Meeting, or teachers can also use Google Classroom, Moodle, or MS Team centered on one school.

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Which Factor Influences Environmental Care Characters More: Knowledge of Issue or Demographic Factors?

Azmi Al Bahij*, Nidar Yusuf, Lativa Qurrotaini, Khairadha Maharani*
Universitas Muhammadiyah Jakarta, Jakarta, Indonesia
*Email: khairadhamaharani@gmail.com

Keywords:	Abstract
knowledge of issue; demographic factors; character of environmental care	The background of this research was due to the lack of people's awareness to their environment. A report by Indonesian Central Statistics Agency in 2018 stated that the Indonesian Environmental Ignorance Behavior Index (IPKLH) in 2018 is 0.72. The number indicates a high level of ignorance on waste management. That being said, the character of environmental care in society is still low. Therefore, the researcher was moved to study the influence of knowledge issues and demographic factors on environmental care for elementary school students. A quantitative survey was utilized as a research methodology. In this study, 119 people were included as a sample. Of the questionnaire instrument for the character of environmental care, the researcher had adjusted to the life of elementary school students. The questionnaire instrument was then analyzed using SPSS version 22.0 with simple regression technique and multiple regression. The result showed that the significant value obtained by all variables is 0.001 or P < 0.05. That being said, Ha wa accepted, and Ho was rejected, or it displays that there was an influence between each of them. The percentage obtained respectively is 4.4% and 9.4%.

INTRODUCTION

Background

The environment is the things around us that can affect our lives. Our lives as humans will not be separated from interactions with the environment (Wiryono, 2013). The environment is an element that affects life because maintaining the environment will positively impact human life. Environmental quality depends on human attitudes and

behavior towards the environment itself (Palupi dan Sawitri, 2017: 214). Environmental issues are part of a severe global problem felt by humans, which is increasing day by day (Fua, 2014: 20). The lack of human awareness of environmental conditions is one of the causes. The environment is still not considered important, while environmental damage has occurred everywhere and was followed by natural disasters that caused many victims.

Environmental changes due to human activities will make our earth unfriendly, which is a threat to human life. Limited knowledge about environmental issues tends to be the reason humans continue to destroy the environment. One of the triggering factors for environmental damage is human ignorance in maintaining, managing and protecting the environment and ignorance about the consequences of their actions on the environment, such as throwing garbage in any place that can pollute the environment. This is often considered normal because there are no binding rules for this (Purba and Yunita, 2017).

From an Islamic perspective, humans and the environment have a close relationship because Allah created this world in balance and harmony, including humans and the environment. This balance and harmony must be maintained not to damage the environment. The continuity of life in nature is interrelated, and if one component is damaged, it will affect the other components (Harahap, 2015: 5).

Problem of Study

The waste management component has an index of 0.72 in the Index Value Based on the Dimensions of Compiling the Environmental Indifference Behavior Index in Indonesia, according to the 2018 Indonesia Environmental Ignorance Behavior Index study. The index number indicates that waste management is poorly understood in Indonesia. (Indonesian Central Statistics Agency, 2018). According to the above-mentioned article, World Bank estimates from 2012 suggest that Indonesia generates 85 thousand tons of garbage every day. This figure is expected to rise to 150 thousand tons per day by 2025. The landfill in Indonesia in 2016 is estimated to be 65.2 million tons per year based on garbage generated. Plastic trash accounts for 16% of that total, or around 10 million tons every year. (Ministry of Finance of the Republic of Indonesia, 2019).

State of the Art

These circumstances highlight the significance of instilling the value of environmental stewardship in the next generation. Concern for the environment must be instilled in primary school pupils at a young age in order for it to become a positive habit in the future (Narut and Nardi, 2019). This awareness for the environment can begin in school with students developing the habit of throwing garbage in its proper place, caring for plants, maintaining the cleanliness of the classroom and school environment, and a variety of other activities. If this is done repeatedly, students will develop a caring attitude toward the environment (Narut and Nardi, 2019).

Environmental awareness is influenced by environmental knowledge and understanding, as well as demographic factors. In line with this, demographic factors such as education, gender, age, income, and place of residence are directly related to the nature of environmental care (Pronityastuti, 2017: 23). Age, education, type of work, and gender are all demographic variables. Demographic variables such as age and gender have the most significant influence on changes in population composition (Aryogi & Wulansari, 2016). Researchers used two demographic variables in this study: age and gender.

Gap Study & Objective

These findings are consistent with what researchers discovered at the Lab School Elementary School, Faculty of Education, Universitas Muhammadiyah Jakarta, where students' environmental awareness is still low. Students' concern and self-awareness about the importance of environmental preservation can help to create a healthy and comfortable school environment. A healthy and comfortable school environment will make learning more enjoyable. School is a place to instill environmental stewardship in students. Based on the foregoing, the researcher believes that it is critical to investigate and demonstrate the existence of the influence of knowledge of issue and demographic factors on the character of students' environmental care.

METHODS

This study employs a quantitative approach, as well as a survey method. Because the study wants to test the hypothesis about how much knowledge of issues and demographic factors influence elementary school students' environmental care character, the researcher employs a quantitative approach with a survey method. The survey method was chosen by the researchers due to its cost-effectiveness and speed in presenting research findings. This study lasted one month, from July to August of 2020. 119 students in grades 4, 5, and 6 were used as subjects. The character of environmental care is the dependent variable in this study. Then there are independent variables such as knowledge of issue and demographic factors. In this study, data was gathered through the use of a questionnaire (questionnaire) and test methods. The research instrument used is a questionnaire to collect data on the character of environmental care, and the test instrument is multiple-choice questions to collect data on knowledge of issues or knowledge about environmental issues. The data analysis method used in this study is a simple regression technique using SPSS.

Table 1. Instrument of Environmental Care Character Measurement

Dimension	Indicators	Question Item	
		(+)	(-)
Waste management	Garbage Disposal	1,2,3	4,5,6
	Cleaning the school environment	7,8, 9,10,11	12
	Tidying up the classroom and school	13, 15,16	14, 17
Water saving efforts	Energy and water saving	18,19	-
Energy Saving	Energy and water saving	20,21,22	23, 24, 25
Caring for Surroundings Environment	Maintaining the school garden	26, 27	28, 29
	Participate in activities to keep the environment clean	30	-

Table 2. Instrument of Knowledge of Issue Measurement

Dimension	Indicators	Question Item	
		Question Number	Amount of Item
Factual (basic information)	Knowledge of Terminology	1,2, 3	3
	Knowledge of Special Elements	4, 5	2
Conceptual (the relationship between the parts of a structure)	Knowledge of classifications and categories	6,7, 8, 9,10	5
	Knowledge of principles and generalizations	11, 12, 13, 14	4
	Knowledge of various theories, models and structures	15, 16	2
Procedural (how to position oneself to do something)	Knowledge of various special skills	5, 22	2
Metacognitive (think in general and in particular)	Knowledge of various cognitive tasks, including contextual knowledge	23, 24, 25	3
	Self-Knowledge	26, 27, 28, 29, 30	5

Table 2 explains that the four dimensions of environmental care that are evaluated are: 1) waste management; 2) water conservation efforts; 3) energy conservation efforts; and 4) environmental maintenance. Students must respond to 30 statements on the questionnaire. Table 2 also explains that issue knowledge is evaluated on four dimensions: 1) factual (basic information); 2) conceptual (relationships between the parts of a structure); 3) procedural (how to position to do something); and 4) metacognitive (knowledge of how to position to do something) (thinking in general and specifically). A total of 30 items make up the test instrument used to assess knowledge of the topic.

RESULTS

In quantitative survey research, a prerequisite test is performed first to demonstrate that the data variance is the same or homogeneous, followed by a homogeneity test using the SPSS program. Using Levene Statistics, a homogeneity test was performed. A summary of the homogeneity test is provided in Table 3.

Table 3. Homogeneity Test Results

	Levene Statistic	df1	df2	Sig.
Knowledge of Issue	2.252	9	109	0,124
Gender	0,679	1	117	0,411
Age	2.003	2	116	0,140

Based on the output, the homogeneity test results are known to have a significance value of the knowledge of issue variable (X_1) on the environmental care character variable (Y) of 0.124 > 0.05, indicating that it is homogeneous. The test results on the variable ($X_{2.1}$) gender to the variable (Y) environmental care character, namely 0.411 > 0.05, suggest that it is homogeneous. The test results on the variable ($X_{2.2}$) age on the character of caring for the environment, namely 0.140 > 0.05, indicate that the data variance is homogeneous.

The normality test, which is used to determine whether or not the data in this study is normally distributed, is the second prerequisite test. The Kolmogorov-Smirnov test is used to determine normality. The following table shows the SPSS output results for the data normality test.

Table 4. Normality Test Result

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Predicted Value
N		119
Normal Parameters[a,b]	Mean	79.0756303
	Std. Deviation	1.25664500
Most Extreme Differences	Absolute	.067
	Positive	.052
	Negative	-.067
Test Statistic		.067
Asymp. Sig. (2-tailed)		.200[c,d]
a. Test distribution is Normal.		
b. Calculated from data.		
c. Lilliefors Significance Correction.		
d. This is a lower bound of the true significance.		

Based on the Table 4, the significance value is greater than 0.05, namely 0.200> 0.05, implying that the data in the study were normally distributed. After passing the prerequisite test, the data must be analyzed. Simple regression analysis was used to determine which factors have the greatest influence on the character of environmental care. The following is a summary of the data analysis results obtained using the SPSS program.

Table 5. Simple Regression Test Results X_1 and Y

Model Summaryb				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.209a	.044	.035	5.398
a. Predictors: (Constant), *Knowledge of Issue*				
b. Dependent Variable: Environmental Care				

According to the SPSS "Model Summary" output table above, the coefficient or R-value is 0.209, and the R square value or coefficient of determination obtained is 4.4 percent, indicating that the knowledge of variable X_1 has a 4.4 percent effect on the environmental care variable (Y).

Table 6. Simple Regression Test Results X_2 and Y

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.306a	.094	.078	5.530
a. Predictors: (Constant), Age, Gender				

The global coefficient value (R) in the output above is 0.306, indicating a sufficient and unidirectional relationship between the character of caring for the environment, gender, and age. Gender and age variables explain 9.4 percent of the variation in environmental care character variables.

DISCUSSION

The results of the analysis show that there is a significant influence between knowledge of issue variables and demographic factors on the character of environmental care. The data from the analysis of issue variables on the character of environmental care show a 4.4 percent influence between the two. It is understandable that there is a slight relationship between knowledge and the character of environmental care. This is in line with the opinion of Kaiser et al., (1999), that several previous studies found statistically less significant results, but that knowledge of issue played a role both directly and indirectly.

This is consistent with Molina et al (2018)'s belief that knowledge, attitudes, perceptions, and effectiveness all play a role in the character of environmental care. As a result, advanced knowledge is expected to foster the character of environmental stewardship. Other research has found that environmental knowledge has a significant positive effect on environmental attitudes, environmental attitudes have a significant positive effect on environmental, behavioral intentions, and pro-environmental behavior, and environmental behavior intentions have a significant positive effect on pro-environmental behavior (Liu et al., 2020).

Then, by 9.4 percent, for the influence of demographic factors (gender and age) on the character of caring for the environment. Gender influences a person's behavior in his environment, according to Pronityastuti (2017), There were also significant differences with

regard to specific factors influencing pro-environmental behavior, namely gender (Molina et al., 2018). According to the findings of this study, female students have higher environmental care character values than male students. This is consistent with the findings of Pronityastuti (2017), who claims that women have more pro-environmental attitudes, concerns, and behaviors than men. According to another study conducted by Pronityastuti (2017: 23), demographic factors such as education, gender, age, income, and place of residence have a significant direct correlation to the character of environmental stewardship. In line with this, Ifegbesan and Rampedi (2018) discovered that age and attitudes have a significant relationship with environmental sustainability problems.

Environmental attitudes and behaviors are at the heart of a sustainable future, but little is known about their early childhood developmental origins Otto et al (2019) is the first longitudinal study to look at how children's environmental attitudes and behaviors change throughout their childhood (ages 7 to 18). Around the age of seven, the form of environmental attitudes and behavior increased until the age of ten, leveled off until the age of fourteen, and then decreased again. Environmental behavior develops from childhood to early adolescence and begins to consolidate around the age of ten, whereas environmental attitudes continue to change until at least early adulthood.

Another finding shows that children who attend primary schools that are designed to engage them in sustainable design have significantly more pro-environmental attitudes and behaviors. As a result, it is proposed that an environmental education pedagogy be developed that involves children directly in learning sustainable design features such as solar panels, recycled water use, natural lighting, gardens, and outdoor classrooms. (Tucker & Izadpanahi, 2017). The findings of this study are also consistent with Azwar (2006)'s belief that age is one of the factors that determine a person's maturity in thinking and learning. Maturity of thought can influence knowledge, attitude, and practice.

CONCLUSION

Knowledge of issue has a significant influence on the environmental care character of students in Lab School Elementary School, Faculty of Education, Muhammadiyah University Jakarta by 4.4 percent, and demographic factors (gender and age) have a significant influence on the environmental care character of students in Lab School Elementary School, Faculty of Education, Muhammadiyah University Jakarta by 9.4 percent. As a result, demographic factors (gender and age) have a greater influence on the environmental care character of students at the school than knowledge of the issue. This study has limitations, such as the fact that the participants were only elementary school students. As a result, more research can be done to develop a variety of interesting media and teaching materials to help people understand the importance of environmental stewardship. The findings have an impact on public awareness of the importance of environmental stewardship.

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