



The Influence of The Quantum Teaching Model Assisted With Video Learning Media on The Motivation And Learning Outcomes of Social Sciences for Class V Elementary School Students in Gugus III Tallo District Makassar City

Yuli Astuti¹, Rosleny Babo², Sulfasyah³

Program Pascasarjana, Universitas Muhammadiyah Makassar, Indonesia

AstutiYuli638@gmail.com

Receive: 11/08/2024

Accepted: 10/09/2024

Published: 01/10/2024

Abstrak

Pemanfaatan teknologi dalam dunia Pendidikan menuntut profesionalisme dan sikap adaptif para pendidik abad 21 untuk berinovasi dan terus mengembangkan berbagai perangkat, alat, dan model pembelajaran yang sesuai dengan kebutuhan siswa. Penelitian ini berkontribusi pada upaya untuk menguji pengaruh model *Quantum Teaching* terhadap Motivasi dan Hasil Belajar siswa. Akurasi dan presisi statistik diandalkan dalam studi eksperimen terkontrol dengan desain – *Non equivalent control group* ini, dan sebanyak 50 orang siswa SD kelas V digunakan sebagai sampel (subjek) penelitian. Data dikumpulkan dengan teknik standar penelitian kuantitatif seperti: Observasi, Kuisisioner dan Tes tertulis dengan kriteria yang telah ditentukan, dan dianalisis dengan perangkat *Stastical Program for Social Science* (SPSS) 25. Hasil analisis deskriptif menunjukkan peningkatan terhadap Motivasi juga Hasil Belajar siswa pada kelas Eksperimen, di mana model diterapkan. Sementara pengujian hipotesis menegaskan pengaruh model *Quantum Teaching* terhadap Motivasi dan Hasil Belajar siswa, dengan nilai signifikansi sebesar 0,000 atau $< 0,05$.

Kata Kunci: Pengaruh Model Quantum Teaching, Motivasi, Hasil Belajar

Abstract

The using of technology in the world of education demands professionalism and an adaptive attitude from 21st century educators to innovate and continue to develop various devices, tools and learning models that suit students' needs. This research contributes to efforts to test the influence of the Quantum Teaching model on student motivation and learning outcomes. Statistical accuracy and precision were relied upon in a controlled experimental study with a non-equivalent control group design, and 50 fifth grade elementary school students were used as research samples (subjects). Data was collected using research quantitative standard techniques such as: Observation, Questionnaires and written tests with predetermined criteria, and analyzed using the Statistical Program for Social Science (SPSS) 25 tool. The results of the descriptive analysis showed an increase in motivation as well as student learning outcomes in the Experimental class, where the model is applying. Meanwhile, hypothesis testing confirms the influence of the Quantum Teaching model on student motivation and learning outcomes, with a significance value of 0.000 or < 0.05 .

Keyword: Influence of the Quantum Teaching Model, Motivation, Learning Outcomes

INTRODUCTION

Education is the most important element in human life. Every human being has the right to education and hopes to be able to develop in education. With education, everyone can gain broad knowledge that can influence physical, psychological, social and moral development.

Education in the current era of globalization plays an important role in helping people to obtain various kinds of information. Supported by the development of technology and science, it makes it easier for us to access a variety of information.

Apart from providing benefits to human life, globalization, on the other hand, must accept and respond wisely and one of the methods used is strengthening and instilling moral values. In this case education is the best method. The importance of education is instilled from an early age because through the educational process humans can gain an understanding of the moral values that apply in society, besides that, education will become capital for a child to reach his future.

The world of education today faces many problems related to the quality of education, both the process and the product. On the other hand, many people assume that this educational problem is limited to classroom learning, and explains the crisis in the world of education (Dantes, 2008).

Social studies education cannot be separated from the goals of national education, which is to form quality human beings who can develop themselves as Indonesian people who are physically and spiritually healthy, have knowledge and skills, are democratic and considerate, creative and responsible, have noble character, love others. and the nation based on Pancasila and the 1945 Constitution (Nursalam, 2016).

Social studies learning was previously considered very boring because the learning method used was lectures in delivery. Social studies learning is currently experiencing changes according to the demands of the times. The solution that can be applied to overcome social studies learning which tends to be monotonous is to use learning media that is fun and effective. In the learning process, the use of media can help make social studies material more interesting and easy to understand.

In implementing social studies learning in higher classes, special strategies are needed to teach social science material contextually. Therefore, educators must be able to prepare a variety of media to make it easier for students to receive and understand social studies material in higher classes given by educators (Prehanto, dkk 2021)

Learning social studies can be fun for students, of course, if it is done with lots of learning strategies. In the social studies learning process, students do not just sit quietly to listen to the teacher's delivery of material, but students must play an active role in the learning process. For students, learning social studies is very boring because students are required to memorize the material in social studies books. For students, there is a lot of memorization in social studies material which makes students feel bored learning. Apart from that, in the social studies learning process, students only sit quietly and involve student activity.

This condition is in accordance with the reality that occurs in several schools in Makassar. Based on the results of observations and interviews that researchers obtained, the average student learning outcomes in social studies subjects are still low, where the problem that arises is a lack of motivation in learning. This is indicated by when working on assignments given by the teacher, students answer carelessly, Apart from that, there are some students who rely

on answers from friends, this makes students less confident and responsible and the learning model used by the teacher is a conventional learning model (lecture) so that students are less active in learning, they tend to be the only teacher who is dominant. explain without any interaction between the teacher and students.

The solution to overcome this problem is to apply a learning model that can motivate students to learn actively in the learning process and provide opportunities for students to work together in doing assignments and studying lesson material.

One suitable learning model is to apply the Quantum Teaching model assisted by learning videos. The Quantum Teaching learning model is a fun learning model with good interaction between teachers and students (Hartati, 2021).

Quantum Teaching makes everything meaningful in the teaching and learning process such as words, actions, thoughts and the extent to which the presentation, teaching design and environment are changed. The quantum teaching learning model is a learning process by providing background and strategies to improve learning and make the process more enjoyable (Acat, 2014).

Based on research conducted by (Prasetya, R., 2019), he said that with the application of the quantum teaching model assisted by audio-visual media in the Social Sciences (Social Sciences) Class V subject at SDN Karangsambung III, there have been changes for the better. This can be seen from the increase in learning outcomes and from the observation sheets of teacher and student activities in cycle I and cycle II. This researcher believes that the use of the quantum teaching model assisted by audio-visual media in Class V Social Sciences (PS) learning can provide a new experience that is different from before, where in the learning

process students become more active and can collaborate well in the learning process.

Based on the thoughts above, the researcher is interested in conducting research on "The Influence of the Quantum Teaching Model Assisted by Video Learning Media on Motivation and Social Studies Learning Outcomes for Class V Elementary School Students in Gugus III Tallo District, Makassar City.

METHOD

a. Type and Research Design

The type of research carried out in this research is Quantitative Research. This research uses an experimental method, namely quasi-experiment, to find out the effect under controlled conditions.

The research design used in this experimental research is quasi experimental design non equivalent control group design. This research used two classes, one experimental class and one control class. The experimental class was given treatment using the Quantum Teaching model and the control class was given teaching without the Quantum Teaching model assisted by video learning media. The research design is depicted in the following table:

Tabel 3.1 Desain Penelitian

	<i>Pretes</i> <i>t</i>	<i>Treatmen</i> <i>t</i>	<i>Postes</i> <i>t</i>
<i>Eksperimen</i>	O ₁	X	O ₂
<i>t</i>			
<i>Kontrol</i>	O ₃		O ₄

Sumber Sugiyono (2015)

Information :

X₁ = experimental class taught by applying the Quantum Teaching model assisted by video learning media.

O₁ & O₃ = both classes are given a pretest to determine initial learning results.

O₂ = students' social studies learning outcomes in the material after participating in learning using the Quantum Teaching model assisted by learning videos.

O₄ = students' social studies learning outcomes in the material after participating in learning without using the Quantum Teaching model assisted by learning videos.

b. Research Location and Time

The location of this research was carried out at Class V Elementary School in Gugus III, Tallo District, Makassar City, South Sulawesi.

Taking into account that in this school there is still a lack of understanding of the use of learning models that are suitable for use in the teaching and learning process.

This research activity was carried out in class V from April to June 2023, 2022/2023 Academic Year, Even Semester.

c. Population and Sample

The population is all students who will be a source of data and information so that research is more focused on something related to what is needed in the research. The population in the research is all students of class V, Cluster III, Tallo District, Makassar City, which consists of 6 schools which will be presented in the following table:

Table 3.2 Number of class V students
Cluster III Tallo District

N o.	Nama Sekolah	Jumlah Kelas V		Jumlah Siswa
		Laki-laki	Perempuan	
1.	SD Negeri	29	40	69

	Kaluku Bodoa			
2.	SD Negeri Kaluku Bodoa	19	30	49
3.	SD Negeri Tallo Tua 69	43	46	89
4.	SD Inp. Tallo Tua 1	39	40	79
5.	SD Inp. Tallo Tua 2	31	17	46
6.	SD Islam Datuk Ribandang	23	18	41

Source of Administrative Data for Cluster III, Tallo District.

The sampling used in this research was sampling using a random sampling technique. Sampling in the population is carried out randomly without paying attention to the strata in the population. Random sampling technique in this research was used to determine the experimental class and control class by drawing lots, so that the experimental class was a state elementary school. Kaluku Bodoa with a total of 25 students and the control class is SD Islam Datuk Ribandang with a total of 25 students.

d. Data collection technique

1) Observation

Used to obtain the initial data needed in preparing this thesis by observing teachers during the teaching and learning process and observing student learning activities.

2) Test Technique

Implementation of teaching and learning activities is the core of conducting experiments. In the experimental class lessons were given using the quantum

teaching model assisted by video media and for the control class using conventional learning methods. The social studies learning test was given to each class, both the control class and the experimental class. The data collection techniques used in this research were initial tests and final tests

3) **Kuisisioner**

A questionnaire or questionnaire is a form of data collection that is carried out by giving written statements or questions to respondents in order to obtain the information needed for research. In this study, the aim of using questionnaires was to measure students' learning motivation.

e. **Operational Definition and Variable Measurement**

a) **Operational Definition**

1. The quantum teaching model is a fun learning model with good interaction between teachers and students. The quantum teaching model aims to make students more actively involved in learning.
2. Video media is a medium used by researchers to present audio and visual media containing learning messages to students.
3. Motivation is a visible change in students to do something to achieve goals. The indicators of learning motivation in this research are: perseverance in facing tasks; tenacious in facing difficulties; prefer to work independently; can defend his opinion and enjoys finding and solving problems.
4. Learning outcomes are achievements achieved by students academically, both through exams and assignments.

b) **Variable Measurement**

1. **Dependent variable (dependent variable)** this variable is a variable that is influenced by an independent variable (independent variable), the dependent variable in this research is motivation and learning outcomes.

2. **Independent variables (independent variables)** are variables that influence the dependent variable. The independent variable is the quantum teaching model assisted by video media.

f. **Data Analysis Techniques**

The data that has been obtained is then processed and analyzed using two types of analysis methods, namely descriptive statistical data analysis and inferential statistical data analysis. To help researchers carry out descriptive statistical data analysis calculations and inferential statistics using the SPSS application program version 25.0.

1. **Normality and Homogeneity Testing Criteria**

The normality test is used to test both motivation data and student learning outcomes with the assumption that if the significance value (Sig.) is > 0.05 then the research data is normally distributed. Conversely, if the significance value (Sig.) < 0.05 then the data is not normal. The same assumption also applies to the homogeneity test. If the significance value (Sig.) is > 0.05 then the research data is said to be homogeneous and vice versa.

2. **Hypothesis Testing Criteria**

The standard Paired Sample T-test technique is used to measure the influence of the independent variable on the dependent variable partially. While One Way Multivariate Analysis of Variance (One Way MANOVA) is used to test effects simultaneously and in general, this paper focuses on the second analysis. The next research hypothesis is denoted as follows:

- H0: There is no influence of the Quantum Teaching Learning Model;
- H1: There is an influence of the Quantum Teaching Learning Model;

While the Hypothesis testing criteria are:

- If the significance value (Sig.) > 0.05 , then H0 is accepted and H1 is rejected.
- If the significance value (Sig.) < 0.05 , then H1 is accepted and H0 is rejected.

RESULT AND DISCUSSION

Data on students' learning motivation in the Control class and Experiment class were obtained through the same Pretest and Posttest questionnaires. This is based on a design also used by Van Breukelen (2023) where the same instrument is used to obtain data from two different classes or groups. Technically, this design has been differentiated from the use previously practiced by Reime et al (2022), specifically, in the type and level of education that is the subject and the scientific discipline in which the research is carried out; also in different applications such as random data collection on the same sample (Stallasch et al., 2021) as well as at certain stages, from what is practiced by Ploj Virtič (2022). The results of statistical analysis comparing categories of learning motivation as well as inferential statistics then showed that there were differences in the levels of learning motivation of students in the experimental class who applied the Quantum Teaching model assisted by learning videos, with students in the control class who used conventional learning. Likewise with the Learning Results of Experiment class students.

In the Pretest of the Control class with generally less achievement in Learning Motivation, after being given a learning process that continued to use the conventional learning model and the Posttest was carried out, the questionnaire scores for student Learning Motivation were obtained with a percentage of 56% of students still in the 'Lack' category of having Motivation in learning. Meanwhile, in the Pretest for the Experimental class, for students who still had less motivation - then followed the learning process using the Quantum Teaching learning model assisted by learning videos, then given a Posttest to determine changes in

Learning Motivation, there was visible improvement. Where there are 32% of students in the 'Very Good' Learning Motivation category and 60% in the 'Good' category and only around 8% of students are still in the 'Medium' Learning Motivation category. However, even though these results have explicitly shown an improvement, previous research with a focus on the influence of the Quantum Teaching Model is still very lacking (especially for the Indonesian context). Except for Aritonang (2023) who is perhaps the only one who conducted experiments and focused on the influence of the Quantum Teaching learning model on the Learning Motivation variable.

Nevertheless, research on the influence of this learning model (Quantum Teaching) has quite a lot of intensity in terms of numbers - although, as has been said, only a few focus on the Learning Motivation aspect. Amalana & Latifah (2013) for example, focuses on the same aspect - namely Learning Outcomes; the same focus is also directed by Mohiddin (2016); including Lestari & Hudaya (2018); Dewi et al (2020) on knowledge competency; Nursalam et al (2020) on the effectiveness of the Quantum Teaching model; and Nurlaela et al (2021) on critical thinking skills and Jayantika & Yuliawati (2020) on learning activities and problem solving abilities. Very few have tested the influence of the Quantum Teaching learning model on Learning Motivation.

Technique - One-Sample Kolmogorov-Smirnov is used to test the normality of the data (see next: table 4), and based on the Unstandardized Residual results, a significance value or Asymp is obtained. Sig. (2-tailed) of 0.200 - where the value is greater than 0.05. So the research data can be said to be normally distributed. Likewise in the Homogeneity test for Motivation and Learning Outcomes data in

the Control and Experiment classes. Based on the results of Homogeneity testing for Motivation data (see: table 5) and Learning Results (see: table 6) for the Control and Experiment classes, a significance value for Learning Motivation (based on mean) was obtained at 0.408, greater than 0.05 with a statistical leverage of 0.696 – then it can be said that the data is homogeneous. Meanwhile, the significance value (based on mean) for Learning Outcomes was obtained at 0.654 - or greater than 0.05 with a statistical leverage of at least 0.204. Thus, it can be said that the data for these two variables is homogeneous.

Table 4. Normality Test for Control and Experimental Classes

		Kelas Kontrol	Kelas Eksperimen
N		25	25
Normal Parameters ^{a,b}	Mean	76.20	86.24
	Std. Deviation	4.291	5.294
Most Extreme Differences	Absolute	.176	.123
	Positive	.176	.123
	Negative	-.103	-.096
Test Statistic		.176	.123
Asymp. Sig. (2-tailed)		.045 ^c	.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.

Tabel 5. Uji Homogenitas Motivasi Belajar Kelas Kontrol dan Eksperimen

	Levene Statistic	df1	df2	Sig.
--	------------------	-----	-----	------

Motivasi	Based on Mean	.696	1	48	.408
	Based on Median	.682	1	48	.413
	Based on Median and with adjusted df	.682	1	45.317	.413
	Based on trimmed mean	.727	1	48	.398

Tabel 6. Uji Homogenitas Hasil Belajar Kelas Kontrol dan Eksperimen

	Levene Statistic	df1	df2	Sig.
Based on Mean	.204	1	48	.654
Based on Median	.225	1	48	.637
Based on Median and with adjusted df	.225	1	45.540	.637
Based on trimmed mean	.210	1	48	.649

The preference for normality tests is quite relative in almost all research, although according to Llordés et al (2020) in general quantitative variables will be summarized as 'Mean' and 'Standard Deviation' if they are normally distributed or 'Median' and 'Interquartile' if they are not. The strength of each normality test in the Ag-Yi & Aidoo (2022) analysis also varies and is potentially influenced by different sample sizes. According to Wang et al (2022) homogeneity

tests between populations play a very important role in many statistical analysis approaches. This is necessary to test performance in various fields including in the context of education (Aslam, 2020); or even Climatology (Gibbs et al., 2023). The same approach is applied in the analysis of this research to test the level of possibility of similarities or differences in the data variants that we have, where all test results for both Normality and Homogeneity ultimately show positive results. Hypothesis testing at the next stage is carried out, and the results can be seen in the following table.

Table 7. Hypothesis Testing Motivation and Learning Outcomes

Effect	Value	F	Hypothesis df	Error df	Significance	
Intercept	Pillai's Trace	.995	9688.975 ^b	2.000	95.000	.000
	Wilks' Lambda	.005	9688.975 ^b	2.000	95.000	.000
	Hotelling's Trace	203.978	9688.975 ^b	2.000	95.000	.000
	Roy's Largest Root	203.978	9688.975 ^b	2.000	95.000	.000
Kelas	Pillai's Trace	.733	18.503	6.000	192.000	.000
	Wilks' Lambda	.273	28.977 ^b	6.000	190.000	.000
	Hotelling's Trace	2.648	41.478	6.000	188.000	.000
	Roy's Largest Root	2.640	84.481 ^c	3.000	96.000	.000

a. Design: Intercept + kelas

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

Hypothesis test results (note: table 7) - to ensure the influence of the Quantum Teaching learning model assisted by video learning on student motivation and learning outcomes show quite positive results, where the significant value is 0.000 or <0.05, which means that Ho is rejected and H1 is accepted. Explicitly, these results then confirm that there is indeed an influence of the Quantum Teaching learning model assisted by learning

videos on students' motivation and social studies learning outcomes, especially - class V students at Gugus III Elementary School, Tallo District, Makassar City.

CONCLUSION

This paper ultimately produced several things that are important to note as findings. Descriptively, there was an increase in the learning motivation of experimental class students, where 32% of students had very good learning motivation; 60% are in the Good category, and; only 8% of students are still in the Medium category after the Quantum Teaching model is implemented. This is clearly different from the condition of students in the Control class, where improvements did not occur in either the Motivation or Learning Outcomes aspects. Apart from that, and the most important thing - is the result of the hypothesis test which shows quite positive results. Where the significant value is 0.000 or <0.05, thus - Ho is rejected and H1 is accepted. These results confirm the influence of the Quantum Teaching learning model assisted by learning videos on the Motivational aspects and Social Studies Learning Outcomes of students - class V at Gugus III Elementary School, Tallo District, Makassar City.

REFERENCES

- Acat, M. B. (2014). An Investigation the Effect of Quantum Learning Approach on Primary School 7th Grade students' Sciences Achievement, Retention and Attitude. Educational Research Association the International Journal of Research in Teacher Education , 5 (2), 11-23.
- Ag-Yi, D., & Aidoo, E. N. (2022). A comparison of normality tests towards convoluted probability distributions. *Research in Mathematics*, 9(1).

- <https://doi.org/10.1080/27684830.2022.2098568>
- Amalana, H., & Latifah, S. (2013). Pengaruh Model Pembelajaran Quantum Teaching Berbantuan Modul Qt-Bilingual Terhadap Hasil Belajar Siswa. *Jurnal Inovasi Pendidikan Kimia*, 7(2), 1145–1157.
<https://doi.org/10.15294/jipk.v7i2.4415>
- Aritonang, D. I. (2023). Pengaruh Model Pembelajaran Quantum Teaching Terhadap Motivasi Belajar Siswa Kelas VIII SMP Negeri 2 Siborongborong Kecamatan Siborongborong Kabupaten Tapanuli Utara Tahun Pembelajaran 2022 / 2023. *JCSR: Journal of Creative Student Research*, 1(5).
<https://doi.org/10.55606/jcsrpolitama.v1i5.2706>
- Aslam, M. (2020). Design of the Bartlett and Hartley tests for homogeneity of variances under indeterminacy environment. *Journal of Taibah University for Science*, 14(1), 6–10.
<https://doi.org/10.1080/16583655.2019.1700675>
- Dantes, Nyoman. (2008) “Pengembangan Bahan Ajar Berbasis Tematik Dalam Kaitan dengan Implementasi KTSP”, Makalah, Program Pascasarjana Universitas Pendidikan Ganesha Singaraja Dantes.
- Gibbs, M., Alcorn, M., & Vaze, J. (2023). The SWTools R package for SILO data acquisition, homogeneity testing and correction. *Australian Journal of Water Resources*, 00(00), 1–13.
<https://doi.org/10.1080/13241583.2023.2214989>
- Hartati, H. (2021). Peningkatan Aktivitas dan Hasil Belajar IPS Melalui Model Pembelajaran Quantum Teaching Berbasis Media Visual. *Journal of Education Action Research*, 5(1), 102–108.
- Jyantika, I. G. A. N. T., & Yuliawati, N. P. E. (2020). Pengaruh Model Pembelajaran Quantum Teaching Terhadap Aktivitas Belajar Dan Kemampuan Pemecahan Masalah Matematis Peserta Didik. *Transformasi: Jurnal Pendidikan Matematika Dan Matematika*, 4(2), 283–295.
<https://doi.org/10.36526/tr.v4i2.947>
- Lestari, P., & Hudaya, A. (2018). Penerapan Model Quantum Teaching Sebagai Upaya Meningkatkan Hasil Belajar Siswa Pada Mata Pelajaran Ips Kelas Viii Smp Pgri 3 Jakarta. *Research and Development Journal of Education*, 5(1), 45.
<https://doi.org/10.30998/rdje.v5i1.3387>
- Llordés, M., Jaen, A., Zurdo, E., Roca, M., Vazquez, I., & Almagro, P. (2020). Fixed ratio versus lower limit of normality for diagnosing copd in primary care: Long-term follow-up of egarpoc study. *International Journal of COPD*, 15, 1403–1413.
<https://doi.org/10.2147/COPD.S250720>
- Mohiddin, D. P. (2016). Pengaruh model pembelajaran quantum teaching dan kemampuan berpikir matematis terhadap hasil belajar siswa. *Jurnal Technopreneur (JTech)*, 4(2), 90–93.
<http://jurnal.poligon.ac.id/index.php/jtech/article/view/60>
- Nurlaela, N., Doyan, A., & Gunada, I. W. (2021). Pengaruh Model Pembelajaran Quantum Teaching Terhadap Kemampuan Berpikir Kreatif Dan Hasil Belajar Fisika Peserta Didik Kelas Xi Mia Sma Negeri 2 Labuapi. *ORBITA: Jurnal Kajian, Inovasi Dan Aplikasi Pendidikan Fisika*, 7(1), 199.
<https://doi.org/10.31764/orbita.v7i1.4363>
- Nursalam. (2016). Strategi Belajar Mengajar IPS. Situbondo: CV Garuda Mas Sejahtera.
- Ploj Vrtič, M. (2022). Teaching science &

- technology: components of scientific literacy and insight into the steps of research. *International Journal of Science Education*, 44(12), 1916–1931. <https://doi.org/10.1080/09500693.2022.2105414>
- Prasetya, R. (2019). Penerapan Model Quantum Teaching Berbantuan Media Audio-Visual Untuk Meningkatkan Hasil Belajar Siswa. Prosiding Seminar Nasional Pendidikan, 1350–1364. <https://prosiding.unma.ac.id/index.php/semnasfkip/article/view/198>
- Reime, M. H., Aarflot, M., & Kvam, F. I. (2022). Does Interprofessional Scenario-Based Simulation Training Change Attitudes Towards Interprofessional Learning – A Pretest-Posttest Study. *Journal of Multidisciplinary Healthcare*, 15, 1527–1532. <https://doi.org/10.2147/JMDH.S370100>
- Stallach, S. E., Lüdtke, O., Artelt, C., & Brunner, M. (2021). Multilevel Design Parameters to Plan Cluster-Randomized Intervention Studies on Student Achievement in Elementary and Secondary School. *Journal of Research on Educational Effectiveness*, 14(1), 172–206.
- Sugiyono. (2015). Metode Penelitian Kuantitatif, Kualitatif dan R&D. Alfabeta.
- Wang, J., Li, X., & Liang, H. (2022). A new exact p-value approach for testing variance homogeneity. *Statistical Theory and Related Fields*, 6(1), 81–86.