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Effectiveness of Google Maps and Flat Map on Fifth-Grade Elementary School Students' Ability to Determine Geographic Locations

By

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Abstract

Digitalization within the scope of the Independent Curriculum mandates the integration of technology in Natural and Social Sciences (IPAS) learning in Elementary Schools. This study aims to empirically compare the effectiveness of using Digital Maps (Google Maps) and Conventional Maps (Flat Map) on the accuracy of determining geographic locations of fifth-grade elementary school students. The research method used is a quantitative quasi-experimental design with a Nonequivalent Control Group Design. The research sample consisted of 60 fifth-grade students at SDN 102 Cikudayasa selected using purposive sampling technique, divided into an Experimental Class (n = 30) and a Control Class (n = 30). The data collection instrument was a geographic location cognitive ability test in the form of essays. Since the data distribution was not normally distributed based on the Shapiro-Wilk test (p < 0.05), the hypothesis testing was analyzed using non-parametric statistics. The Wilcoxon Signed Rank Test results showed that Google Maps was significantly effective (p < 0.001) with a high N-Gain increase (0.82). The Flat Map medium was also significantly effective (p < 0.001) with a moderate N-Gain increase (0.68). The Mann-Whitney U test results confirmed a significant difference in effectiveness (p = 0.015 < 0.05) where the Mean Rank of the experimental class outperformed the control class (35.97 > 25.03). Google Maps proved more effective because its interactivity and 3D visualization reduce students' cognitive load in conceptualizing abstract spatial data. Thus, Google Maps significantly outperforms flat maps in improving elementary students' ability to determine geographic locations.

Introduction

According to Cristiana (2021), in this era of 5.0, where the world of education is increasingly moving toward digitalization, students and parents who are accustomed to using digital technology are indirectly demanding that teachers provide digital learning experiences as well. This is evidenced by books that have transitioned into e-books or flip books, pop-up books which

are traditionally associated with paper-shifting to e-pop-ups, and so on, where every element of learning media now includes an "e" or electronic component. This view is supported by Aeni et al. (2022), who note that the rapid development of the digital era directly drives the integration of technology into classroom learning processes.

Nevertheless, the use of digital media still often sparks controversy, particularly in 3T regions, as cited by Benufinit et al. (2025), who note that apparent limitations in infrastructure, disparities in internet access, and even low digital literacy in 3T regions create new inequalities within the national education system. It is no wonder that teachers prefer to use conventional learning media that they have been accustomed to using for a long time, such as conventional maps (printed maps), to teach geographic location in the IPAS subject. The use of these conventional media continues to this day, where geography instruction within the social studies cluster in elementary schools is still perceived as severely lacking in the use of electronic media. The lack of adequate learning media results in students having low proficiency in spatial thinking and determining geographic locations. Students merely memorize the material without understanding the true essence of space and location. This situation remains a distinct challenge in practice, as evidenced by initial observations and preliminary studies conducted in Grade 5 at SDN 102 Cikudayasa; material regarding geographic location is indeed abstract for students. Based on classroom teachers' ongoing observations of students during learning activities, students are often seen struggling when asked to visualize regional boundaries or accurately determine compass directions if they rely solely on static two-dimensional images. Consequently, these conventional print materials are often insufficient to help elementary school students visualize spatial concepts in a tangible way. Therefore, more interactive learning media alternatives need to be introduced to aid students' spatial understanding from the very beginning of the lesson.

Research on the effectiveness of Google Maps and Flat Map has actually been conducted by previous researchers. For example, a study by Fadillah et al. (2023) showed that the use of Google Maps was proven effective in improving the spatial literacy of elementary school students. Similar results were found by Sari (2024), who stated that the Google Maps application is effective in improving students' critical thinking skills in identifying their place of residence. Meanwhile, regarding print media, Vitriana et al. (2024) explain that the use of conventional map media in social studies learning processes continues to have a tangible positive impact on students' conceptual understanding, provided it is implemented with appropriate strategies. This research is supported by Mustamin (2020), who demonstrated that the use of flat maps in geography

instruction can lead to a significant improvement in test scores. This implies that conventional media still hold potential for educational use. However, previous studies have generally evaluated these media in isolation. It is still very rare to find research that directly compares the effectiveness of Google Maps and flat maps in a single comparative study to measure the accuracy of fifth-grade elementary school students' ability to determine geographic locations. Most similar studies over the past five years, such as those conducted from 2021 to 2023, have focused more on the effectiveness of digital maps for high school students or geography majors in broad-scale spatial skills. Meanwhile, comparative research that directly pits these two media against each other to measure the spatial literacy skills of elementary school-aged children in IPAS learning has not yet been explored in depth. This is where the novelty (research gap) of this study lies in conducting a head-to-head test between digital and conventional media integrated into learning.

Based on the above issues, the hypotheses in this study are formulated as follows. The first hypothesis (H_0) states that there is no significant difference between the ability to determine geographic locations among students using Google Maps and those using a flat map. The second hypothesis (H_1) states that there is a significant difference between the ability to determine geographic locations among students using Google Maps and those using a flat map. The purpose of this journal article is to empirically test and compare the effectiveness of using Google Maps and Flat Map learning media on the ability to determine geographic locations among fifth-grade students at SDN 102 Cikudayasa.

Method

This study was conducted using a quantitative approach. According to Kurniawan & Puspitaningtyas (2016), quantitative research is a highly structured form of research designed to quantify data—that is, to convert it into numerical values—so that the results can be applied to a broader group or generalized. This aligns with the present study, which systematically examines the effect of media use on students' geographic location accuracy through data collection accompanied by measurable numerical analysis. This study is an experimental study designed to test the effectiveness of the instructional media used. The selection of this method is based on the principle that the researcher intentionally applies a specific treatment to the subjects and then examines the consequences or effects of that treatment (Fauzi et al., 2022). The core of experimental research lies in the manipulation and control of the independent variable, where the researcher then observes the variations or effects occurring on the dependent variable. The method used is a Quasi-Experiment with a Nonequivalent Control Group Design. This design was chosen because it allows for a comparison between two groups (Experimental and Control) whose

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samples were not selected randomly but still underwent pre-test and post-test procedures (Rukminingsih et al., 2020).

The population in this study consisted of 486 students from SDN 102 Cikudayasa. The sampling technique used was non-probability sampling, which is a sampling technique that does not give every member of the selected population an equal chance or opportunity to be reselected as a sample member (Sugiyono, 2024). This is also consistent with Santina et al. (2021), who noted that this sampling technique does not provide equal opportunity to every member of the population to be selected as a sample. This non-probability sampling technique is divided into several types, namely systematic sampling, quota sampling, incidental sampling, purposive sampling, saturation sampling, snowball sampling, and total sampling. The sampling method used in this study was purposive sampling, which according to Sugiyono (2024) is a sampling technique based on specific criteria. Sampling was not conducted through individual random assignment but was instead based on pre-existing class groups (intact classes), as reassigning students randomly was not feasible without disrupting the stability of the school's teaching and learning activities. The fundamental criteria for sample selection in this study include the level of parity in students' initial academic abilities, the homogeneity of teachers' capabilities, and the similarity in the implementation schedules of instruction between the two classes. Furthermore, the most important criterion is that the curriculum aligns with the geographic context as stipulated in the Head of BSKAP's Decision No. 032/H/KR/2024 regarding Learning Outcomes for Grade 5. Based on that criteria, the sample selected for this study consists of all 30 students in Class VA (the experimental class) and all 30 students in Class VB (the control class), for a total sample size of 60 students, drawn from the entire population. This study was piloted at SDN 102 Cikudayasa, located on Cikuda Street, Cibiru District, Bandung City, and was conducted from April 6–8, 2026. Instructions were delivered following the syntax of the Discovery Learning model, as outlined in the instructional module, over three sessions per class. The experimental class sessions were held in the morning, while the control class sessions took place after the first recess. Each session was allocated 4 x 35 minutes (140 minutes). Chronologically, the first session was used for the pre-test and steps 1–3 (providing stimuli through data collection), the second session for steps 4–5 (data processing and verification), and the third session for step 6 (conclusions) and the post-test. During this process, the experimental class utilized interactive Google Maps features such as coordinate determination, while the control class used conventional Flat Map worksheets.

As cited in Samsu (2017), data collection techniques can include questionnaires, tests, observations, and documentation; however, given the objective of this study—which is to measure the effectiveness of media on the accuracy of determining geographic locations—the primary instruments prepared are ability tests in the form of pre-tests and post-tests, consisting of short-answer or essay-type questions. Scoring will be based on a structured rubric to ensure objectivity and the quantification of results. The instrument's framework was designed based on the learning outcomes for the geographic location topic, aligned with Bloom's cognitive domains (C4 to C6), to assess students' spatial thinking and regional mapping abilities cumulatively. Before the instrument was used, an empirical validity test was first conducted; as cited from Sanaky et al. (2021), a validity test is a standard required to demonstrate or prove whether a measurement tool used in research truly performs its function accurately and appropriately. Subsequently, a reliability test was conducted to identify the consistency of relationships among items within the instrument. This pilot test was intentionally conducted outside the research sample, specifically with 30 fifth-grade students at SDN 166 Ciateul. The selection of this pilot test location was based on the consideration of avoiding experimental bias in the form of a testing effect or leakage of the test instrument to the original research subjects, while ensuring that SDN 166 Ciateul has demographic characteristics, accreditation levels, and implementation of the Merdeka Curriculum equivalent to those of SDN 102 Cikudayasa. Validity testing was conducted at a 5% significance level; thus, the table r value used with N=30 is 0.361. Based on the principle of validity, where an item is considered valid if the calculated r value is greater than the table r value, the statistical analysis using SPSS and Excel showed that out of all the items tested, 10 items were deemed valid and suitable for measuring the ability to determine geographic locations. For the reliability test, the internal consistency reliability approach was used, employing the Cronbach's Alpha formula via SPSS, which yielded a Cronbach's Alpha value of 0.808. Based on general criteria for determining reliability, an instrument is considered reliable if its coefficient exceeds the minimum standard of 0.60. Thus, a Cronbach's Alpha value of 0.808 (0.808 > 0.60) indicates that the designed measurement tool possesses a high level of reliability and is highly consistent for use in collecting research data.

The data analysis techniques used in this study involved assumption tests and hypothesis testing with the aid of SPSS statistical software. The first assumption test conducted was a normality test using the Shapiro-Wilk test; this was chosen because the sample size per class/group was less than 50 people. This test has a significance level (α) of 5%, with the criterion that if the p-value is > 0.05, the data are normally distributed, and if < 0.05, the data are not normally distributed. If the data are found to be non-normally distributed, the analysis will

proceed with non-parametric tests (such as the Wilcoxon or Mann-Whitney tests). Next, a test of homogeneity of variance was conducted to determine whether two or more samples from different populations have the same variance distribution or characteristics (Pradita et al., 2024). In this study, the test of homogeneity was performed using Levene's Test, where the data is considered homogeneous if the obtained significance value (Sig.) is greater than or equal to 0.05. Hypothesis testing was conducted entirely using non-parametric statistics because the initial data distribution did not meet the normality assumption. Hypothesis testing was performed by comparing the effectiveness of the two media using the Wilcoxon Signed-Rank Test to measure significant differences in values between pre- and post-treatment in each class. Meanwhile, to compare the effectiveness of score/grade improvement between the two classes (the experimental class and the control class), the Mann-Whitney U test was used. The test of the effectiveness of score improvement from the pre-test to the post-test in each group was also calculated using the Normalized Gain (N-Gain) formula.

Result and Discussion

Result

The data for this study were collected through tests administered individually to each student, in accordance with the research stages or procedures. Pre-test data were obtained through self-administered tests conducted to determine students' initial abilities before the intervention, and post-test data were obtained through self-administered tests conducted to determine the extent of improvement in students' abilities after the intervention; subsequently, N-gain data were obtained through calculations using the N-gain formula. A summary of the descriptive statistics of the pre-test and post-test scores and the N-gain index for both classes is presented as follows:

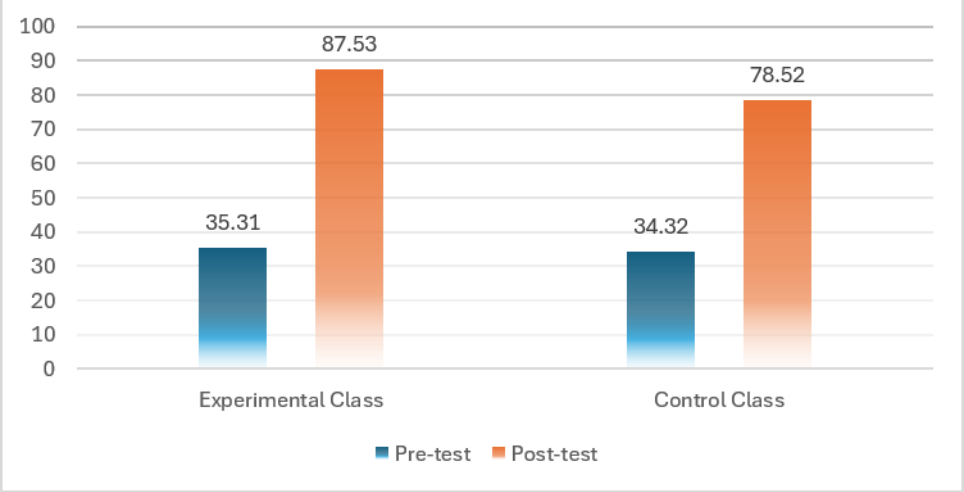
Table 1. Descriptive Analysis of Research Results

	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation
Pre-Test Experimental	30	48.15	11.11	59.26	1059.23	35.3077	12.74645
Post-Test Experimental	30	59.26	40.74	100.00	2625.96	87.5320	16.69173
Pre-Test Control	30	51.85	11.11	62.96	1029.63	34.3210	15.74168
Post-Test Control	30	74.07	25.93	100.00	2355.56	78.5187	18.66792
Valid N (listwise)	30						

(*Source: Primary Research Data, 2026*)

Table 1 presents a summary of the statistical data for both classes. Based on their mean scores, the two groups actually started from nearly identical baseline levels of understanding. The initial ability of the experimental class was 35.31, only slightly different from the control class's score of 34.32, while a significant difference in achievement became apparent only after the two classes received different treatments. The group of students facilitated with Google Maps achieved a class average of 87.53, while the group using the Flat Map also saw an increase, but their average score was only 78.52. The following is a bar chart comparing the pre-test and post-test results for both classes:

Figure 1. Comparison of Pre-test and Post-test Average Scores in Both Classes



Before testing the hypotheses, the data were first tested using tests of the prerequisites for analysis, including the Shapiro-Wilk normality test. This procedure was conducted to determine whether the collected data were normally distributed, with the results shown below:

Table 2. Results of the Shapiro-Wilk Normality Test

		Shapiro-Wilk		
	Class	Statistic	df	Sig.
Score	Experimental Class	.919	30	.025
	Control Class	.929	30	.047

(Source: Primary Research Data, 2026)

According to the Shapiro-Wilk test guidelines, a dataset can be considered normally distributed only if it has a significance level (p-value) > 0.05. However, as shown in Table 2 above, the p-value for the experimental group was only 0.025, and similarly, the control group reached only 0.047. Since both values are still below the threshold of 0.05, the conclusion is that the data distribution in both groups is not normal or is skewed. The failure of the normality assumption has a direct impact on the selection of the next analytical step; therefore, to test the research hypothesis, we switch entirely to non-parametric statistical methods.

Meanwhile, here is the table of homogeneity tests:

Table 3. Results of Levene's Test for Homogeneity

		Levene Statistic	df1	df2	Sig.
Nilai	Based on Mean	3.192	1	58	.079
	Based on Median	2.706	1	58	.105
	Based on Median and with adjusted df	2.706	1	57.857	.105
	Based on trimmed mean	3.103	1	58	.083

(Source: Primary Research Data, 2026)

As shown in Table 3 above, the Levene's test for homogeneity of variances, based on the means, yielded a p-value of 0.079. Since the p-value is > 0.05, the data are considered homogeneous, meaning that the level of variation in student ability between the experimental and

control classes is comparable. After the prerequisite assumption of homogeneity was met and the data were determined to be non-normally distributed, hypothesis testing proceeded using non-parametric statistical analysis.

The first hypothesis test was conducted to address the research question regarding the effectiveness of using Google Maps in the experimental class by comparing pre-test and post-test scores using the Wilcoxon Signed-Rank Test. The results of this statistical test are presented as follows:

Table 4. Results of the Wilcoxon Test for the Experimental Class

		N	Mean Rank	Sum of Ranks	Nilai Z	Asymp. Sig. (2-tailed)
Post-test - Pre-test	Negative Ranks	0[a]	.00	.00	-4.787[a]	0,001
	Positive Ranks	30[b]	15.50	465.00		
	Ties	0[c]				
	Total	30				

a. Post-test < Pre-test
b. Post-test > Pre-test
c. Post-test = Pre-test

(*Source: Primary Research Data, 2026)*

Table 4 above shows an Asymp. Sig. (2-tailed) value of 0.001. Since this significance value is less than 0.05 (0.001 < 0.05), it can be concluded that there is a significant difference between the pre- and post-test scores in the experimental class. For more details, refer to the Ranks table, which shows that all students are in the Positive Ranks category meaning their post-test scores are higher than their pre-test scores with 0 students in the Negative Ranks and Ties categories. To measure the magnitude of the impact of this media intervention, Peres (2026) calculated the effect size using the formula ($r = Z/\sqrt{N}$) where if the Z value is already known based on the SPSS results, then N is the total sample size or N = n1 + n2 (in this study, N for the effect size is $\sqrt{60}$ = 7.746), yielding ($r = 4.787/\sqrt{60} = 4.787/7.746 = 0.618$). Referring to Cohen's criteria (small: 0.1 – moderate: 0.3 – large: 0.5), this value is categorized as "Large" because it exceeds the minimum threshold for the "Large" criterion. Furthermore, based on the results of the N-gain score test, the N-gain value obtained is 0.82, which falls into the high N-gain classification. Similarly, when examining the N-gain score in percentage terms, the result obtained is 82.37%, meaning that Google Maps has an influence or effectiveness of 82.37% with an effectiveness category of "High."

This indicates that the use of Google Maps effectively enhances students' ability to determine geographic locations.

The second hypothesis test was conducted to assess the effectiveness of using flat maps in the control class by comparing pre-test and post-test scores using the Wilcoxon Signed-Rank Test, with the results presented as follows:

Table 5. Results of the Wilcoxon Test for the Control Group

		N	Mean Rank	Sum of Ranks	Nilai Z	Asymp. Sig. (2-tailed)
Post-test - Pre-test	Negative Ranks	0[a]	.00	.00	-4.784[a]	0,001
	Positive Ranks	30[b]	15.50	465.00		
	Ties	0[c]				
	Total	30				

a. Post-test < Pre-test
b. Post-test > Pre-test
c. Post-test = Pre-test

(Source: Primary Research Data, 2026)

From Table 5 above, it can be observed that the Asymp. Sig. (2-tailed) value is 0.001. Since this significance value is less than 0.05 (0.001 < 0.05), it can be concluded that there is a significant difference between the pre- and post-tests in the control class. The Ranks Table shows that all students are in the Positive Ranks category, with a value of 0 for Negative Ranks and Ties. To measure the magnitude of the impact of this media intervention, an effect size calculation was performed using the formula ($r= Z/\sqrt{N}$), yielding ($r = 4.784/\sqrt{60} = 4.784/7.746 = 0.618$). Referring to Cohen's criteria (small: 0.1 – moderate: 0.3 – large: 0.5), this value is categorized as "Large" because it exceeds the minimum threshold for the "Large" criterion. Furthermore, based on the N-gain score test results, the N-gain value obtained was 0.68, which falls into the "Moderate" N-gain classification with a percentage of 68.80% (Fauzi et al., 2022). This indicates that the use of the Flat Map medium remains effective in improving students' ability to determine geographic locations.

Next, to address the third research question regarding the comparison of effectiveness across groups, a comparison test was conducted using the nonparametric Mann-Whitney U test, with the results shown below:

Table 6. Results of Hypothesis Testing Using the Mann-Whitney U Test

Class	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Nilai Z	Asymp. Sig. (2-tailed)
Post-Test Experimental	30	35.97	1079.00			
Post-Test Control	30	25.03	751.00	286.000	-2.443	0.015
Total	60					

(Source: Primary Research Data, 2026)

The results of the Mann-Whitney U test in Table 6 above show that the mean rank of the experimental class (35.97) is higher than that of the control class (25.03), which means that the experimental class demonstrated better learning outcomes than the control class. This is also supported by the effect size calculation using the formula ($r = Z/\sqrt{N}$), namely ($r = 2.443/\sqrt{60} = 2.443/7.746 = 0.315$), which, according to Cohen's criteria (small: 0.1 – moderate: 0.3 – large: 0.5), this value is categorized as "Moderate." Regarding the significance test results, the table shows an Asymp. Sig (2-tailed) of 0.015, which is smaller than 0.05 ($0.015 < 0.05$); therefore, it can be concluded that the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted at a 95% confidence level. Therefore, it can be concluded that there is a significant difference between the ability to determine geographic locations among students using Google Maps and those using a flat map.

Discussion

Based on the research findings, it is clear that the use of Google Maps as a learning tool has a highly significant impact on fifth-grade elementary school students' ability to determine geographic locations. This is evidenced by a dramatic increase in the average scores of students in the experimental class, from a pre-test score of 35.31 to a post-test score of 87.53. An N-gain of 0.82 (classified as "High") and an effect size of 0.618 (classified as "Large") underscore the strong impact of this digital media intervention. In general, the superior performance of the experimental class is driven by the characteristics of Google Maps, which provides interactive

navigation features, such as scale manipulation (zoom-in and zoom-out) and live satellite views. These features provide a realistic visual experience for fifth-grade students to observe space concretely, thereby significantly enhancing their cognitive ability to map geographic locations compared to observing static media alone. This classroom setting aligns with the principles of Technology-Enhanced Learning (TEL) as outlined by Sari (2024), where technology functions as a cognitive tool that alleviates students' mental load in visualizing spatial concepts. This digital-based learning simultaneously transforms teaching and learning activities into a student-centered approach. The use of digital media has also proven effective in helping students develop precise concepts regarding geographic locations, which aligns with Tolman's cognitive mapping theory and the concept of spatial representation by Downs & Stea (2011). These findings are supported by research conducted by Fadillah et al. (2023), which states that Google Maps satellite imagery can provide a contextual learning experience to enhance students' spatial literacy. Furthermore, these field findings align with the findings reported by Sihotang & Hidayat (2021), who found evidence that digital interactive media can increase students' interest and engagement in geography—a subject often perceived as rigid and boring. Furthermore, research by Olivia (2022) reinforces that visual stimuli from digital maps play an active role in strengthening students' long-term memory. It is also important to note that the use of digital media must be complemented by teachers' mastery of the subject matter and their proficiency in utilizing such technology-based media to ensure optimal learning outcomes (Susilawati et al., 2024). This aligns with the findings of Aeni et al. (2024), who emphasize that in addition to mastering the use of media, teachers must also be able to innovate in integrating these media into the learning process.

On the other hand, the results of the study on the control class, which used conventional Flat Map (wall map) media, also showed an improvement in learning outcomes that is still worth considering. The control class's average score increased from 34.32 on the pre-test to 78.52 on the post-test. An N-gain of 0.68 confirms that the improvement in learning outcomes in the control class falls within the "Moderate" criterion, and an effect size of 0.618 (the "Large" category), obtained from the within—group test, further confirms the significant impact of using this physical medium. The improvement observed in the control class demonstrates that conventional media such as the Flat Map (wall map) still possess strong pedagogical value. Although its physical form is static and lacks digital animation, the effectiveness of the Flat Map stems from its clear classical visualization and the direct physical interaction between students and the map in the classroom. Given that fifth-grade elementary school students generally remain in the concrete operational stage according to Jean Piaget's developmental stages, where students' experiences tracing latitude, longitude, and territorial boundaries directly on paper can help

solidify children's cognitive structures before they are able to reason about space in abstract digital forms (Handika et al., 2022). A positive aspect of the limited interactive features on these printed maps is their ability to minimize the risk of cognitive overload, a condition that facilitates students' focus on mastering basic cartographic skills—such as reading legends and compass directions-in a gradual manner, aligning with Levie & Lentz's theory of visual attention functions (Daulay et al., 2025). Flat maps that prominently highlight essential symbols have proven effective at maintaining students' concentration without distraction from secondary digital features. This analysis is supported by various research findings, such as the study conducted by Vitriana et al. (2024), which concluded that physical maps still play a crucial role at the elementary school level because they foster hands-on experience through tactile interaction with the map. A similar view is expressed in Mustamin's (2020) study, which demonstrates that flat maps help students maintain full visual focus without the risk of disorientation caused by sudden scale changes (zooming) as seen in digital maps. With their stable visual presentation and ease of use—independent of internet connectivity—these conventional tools have demonstrably proven their ability to help students achieve optimal learning outcomes in the field.

Next, to address the third research question regarding the comparison of effectiveness between the two classes, an analysis was conducted using the Mann-Whitney U test. Based on the statistical results, a p-value of 0.015 was obtained. Since this significance value is less than 0.05 ($0.015 < 0.05$), it can be concluded that the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted at a 95% confidence level. This conclusion is supported by the experimental class's Mean Rank of 35.97, which outperformed the control class, which only reached 25.03. To measure the magnitude of the difference in effectiveness between the groups, an effect size calculation was performed using the formula ($r = Z/\sqrt{N}$), namely ($r = 2.443/\sqrt{60} = 2.443/7.746 = 0.315$). Referring to Cohen's criteria (small: 0.1 – moderate: 0.3 – large: 0.5), this value is categorized as "Moderate." This statistical finding clearly confirms that there is a significant difference in effectiveness between the two types of media, where the use of Google Maps proved to be superior to the Flat Map in improving students' ability to determine geographic locations. This difference in effectiveness makes perfect sense, as Google Maps is equipped with dynamic spatial manipulation capabilities, thereby making it easier for fifth-grade students to precisely identify territorial boundaries. The advantages of this spatial technology have also been widely validated in various international publications, such as the research by Lalotra et al. (2025), which confirms that the integration of geographic information systems like Google Maps can enhance students' geographic literacy (geo-literacy) and spatial reasoning skills. Similar findings were reported in a study by Hickman (2023), which noted that learning utilizing digital

media can optimize learning outcomes because the learning process becomes more engaging, contemporary, and interactive. Through the integration of Google Maps, the limitations of flat maps can be effectively bridged, while transforming passive learning into an interactive visual experience tailored to students' needs.

Although the results were positive, the researchers acknowledge that there were several limitations in the conduct of this study. Among these was the data collection instrument used to measure students' ability to determine geographic locations, which was limited to 10 test items in the form of short-answer and essay questions consequently, it was not possible to explore the full range of variations in students' spatial abilities. Relying solely on written cognitive essay tests may not fully capture the students' actual behavioral mapping skills. Furthermore, this study was conducted within the scope of a single elementary school, namely SDN 102 Cikudayasa, with a limited sample size of 30 students in the experimental class and 30 students in the control class. The researcher is also aware of limitations in controlling external factors that could introduce bias into the research results, such as students' level of familiarity or habit of using gadgets at home, as well as the level of support and guidance from parents during learning. Therefore, drawing conclusions or generalizing the results of this study to a much broader population with different demographic characteristics and school facilities must be done with great caution.

Conclusion

Based on the results of the research and data analysis conducted, several conclusions can be drawn: the use of Google Maps and Flat Map as learning media has proven effective in helping fifth-grade elementary school students visualize abstract spatial concepts in a more concrete way. This demonstrates that these media can enhance students' ability to determine geographic locations, although the two tools exhibit different levels of effectiveness. Specifically, the use of Google Maps was found to be significantly effective in improving fifth-grade elementary school students' ability to determine geographic locations, with the average improvement in their ability falling into the high category, achieving an N-Gain score of 0.82 (82.37%). A similar finding was observed with the use of the Flat Map (Wall Map) medium, which was found to be significantly effective in improving fifth-grade elementary school students' ability to determine geographic locations; however, the improvement level for this group remained in the moderate category, with an average N-Gain score of 0.68 (68.80%). The results of the final comparative test demonstrated a significant difference in effectiveness between the use of Google Maps and Flat Map media regarding fifth-grade elementary students' ability to determine geographic locations, where the experimental class's average Mean Rank score outperformed the control class (35.97 > 25.03),

with an effect size (0.315) in the "Moderate" category. This value indicates that the impact of using digital maps is superior to that of conventional printed maps, as they are capable of providing dynamic spatial manipulation features and more interactive visualizations for students.

Recommendation

Based on all the findings, it can be concluded that the use of digital technology is more effective in fostering a more equitable understanding across all levels of student ability, and is capable of shifting learning patterns from mere memorization of locations to the development of critical spatial analysis skills. Based on these implications, several operational recommendations can be proposed for classroom teachers, particularly fifth-grade elementary school teachers: it is recommended to implement a blended media approach by integrating Flat Map into introductory activities to anchor students' attention on map symbols, then transitioning to Google Maps during core activities to foster broader spatial understanding. Teachers are also encouraged to take the time to learn more about the use of technology-based media (such as zooming in, viewing Street View, or using satellite maps) so that teaching in the classroom runs more smoothly, while still maintaining the Flat Map as a structured pedagogical alternative in case the school faces technical network issues or digital resource limitations. For school administrators, the results of this study can serve as a basis for budget allocation to support the procurement of stable internet infrastructure, the installation of interactive displays (such as Smart TVs or projectors) in classrooms, and the regular conduct of In-House Training (IHT) for educators on how to integrate basic technology applications into the Merdeka Curriculum teaching modules. Finally, future researchers are advised to develop a more diverse range of research instruments by incorporating practical, map-reading performance tasks to capture actual geographical competencies much more accurately, expand the sample scope to include several elementary schools with different demographic backgrounds, and control for external factors—such as students' familiarity with devices at home—in data analysis to ensure that future research findings are more robust.

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