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# The Role of Bloom's Taxonomy and Digital Technology in Improving Map Reading and Interpretation Skills in Geography: A Case Study of Kisarawe District, Tanzania

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**Abstract.**
This study explores the role of digital technology in enhancing Geography education, particularly in improving students' map reading and interpretation skills. Traditional teaching methods often fail to develop spatial thinking, but interactive tools like Google Earth provide engaging learning experiences. Using a descriptive correlational research design, the study analyzed the role of digital tools on students' performance in Kisarawe District, involving 144 students. The findings revealed significant improvements, especially in higher-order cognitive skills, following the integration of digital tools guided by Bloom's Taxonomy. While digital technology proves effective, challenges such as the digital divide and teacher training must be addressed for successful implementation. Policymakers and educators must invest in infrastructure and pedagogical adaptation to modernize Geography instruction and ensure equitable access to digital learning resources.
Keywords: Digital technology, Geography education, Map reading skills, Google earth, Higher-thinking skills, Lower-thinking order.

## Introduction

Education in the 21st century has witnessed significant advancements due to the integration of digital technology in teaching and learning processes. The ability to read and interpret maps is a fundamental skill in Geography education, yet many students struggle with understanding spatial relationships, symbols, and geographical coordinates. Traditional teaching methods, often reliant on printed maps and textbook explanations, have proven insufficient in developing students' spatial thinking skills. The introduction of digital technology, such as Google Earth, GIS tools, and other interactive platforms, has provided an opportunity to enhance students' engagement and comprehension in map reading and interpretation. However, for digital tools to be effectively utilized, structured learning approaches such as Bloom's Taxonomy must be incorporated to guide students through different cognitive levels from basic knowledge recall to higher-order analytical skills.

This study aligns with Sustainable Development Goal (SDG) 4, which emphasizes "ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all" (United Nations, 2015). In Tanzania, the education sector has made efforts to integrate digital technology into teaching, but challenges such as inadequate resources, lack of teacher training, and limited digital literacy among students persist (Mtebe & Raphael, 2018). Kisarawe District, like many other rural areas, faces these challenges, making it crucial to explore how Bloom's Taxonomy and digital technology can be leveraged to improve Geography education, particularly in map reading and interpretation skills.

Despite the increasing global emphasis on digital learning, there is limited empirical research in Tanzania that investigates the role of digital technology in enhancing map reading and interpretation skills among secondary school students. Most studies on Geography education in Tanzania have focused on general teaching methodologies and student performance without examining how digital tools, guided by structured learning frameworks like Bloom's Taxonomy, can improve students' understanding of maps. Moreover, while the government has encouraged the adoption of ICT in education, research has not adequately assessed the impact of digital tools on specific geographical skills (Bhalalusesa et al., 2013). This study seeks to bridge this gap by analyzing the relationship between digital technology, cognitive learning stages, and students' academic performance in map reading and interpretation within Kisarawe District.

The findings of this study will be significant in several ways. First, they will provide educators with insights into how digital technology can be effectively integrated into Geography teaching to improve students' map interpretation skills. This is particularly important in Tanzanian secondary schools where traditional teaching methods dominate. Second, the study will inform policy development by offering evidence-based recommendations to educational policymakers on strategies to promote digital learning in secondary education. The research will also highlight the need for teacher training programs focusing on integrating Bloom's Taxonomy with digital technology to enhance student engagement. Lastly, the study will contribute to bridging the digital divide by exploring how technology can be used to improve Geography education in under-resourced schools.

The primary aim of this study is to investigate how the integration of Bloom's Taxonomy and digital technology can enhance map reading and interpretation skills among secondary school students in Kisarawe District, Tanzania. Objectives of the Study

To examine the extent to which digital technology is used in Geography education in secondary schools in Kisarawe District.

To analyze the relationship between digital technology use and students' performance in map reading and interpretation.

## Methodology

Descriptive research design is a type of research methodology used to systematically describe characteristics, behaviors, or phenomena of a particular population or subject without manipulating variables. It focuses on "what is" rather than "why it is" and is used to provide a detailed picture of a situation, event, or condition. According to Kothari (2004), descriptive research is concerned with describing the characteristics of a particular individual or group, while Creswell (2014) emphasizes that it provides an accurate account of a population or phenomenon based on observation, surveys, or case studies. The study used Example: Studying the relationship between digital technology use and students' performance in Geography in blooms taxonomy model

**Research procedures**.

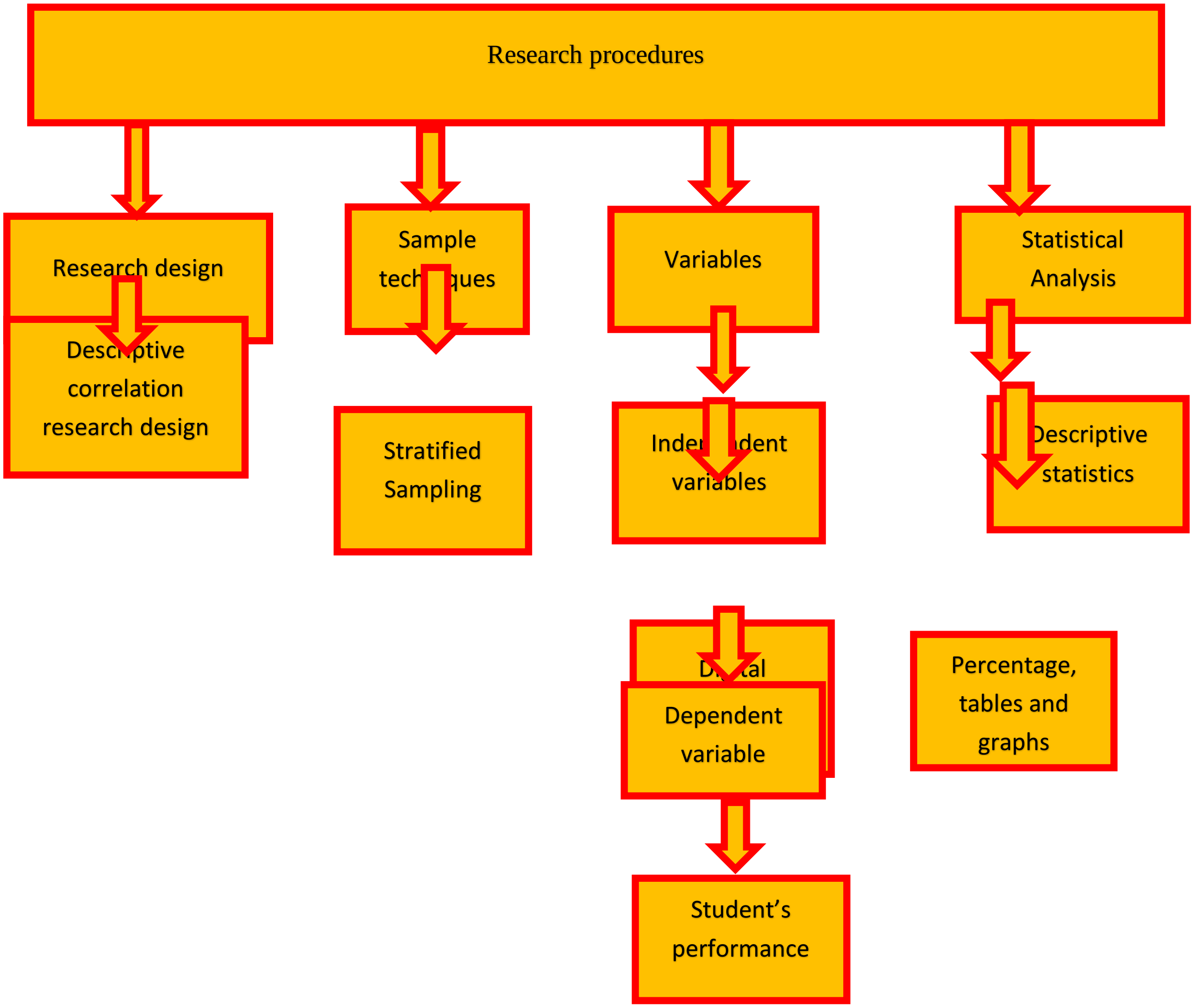


**Figure 1 illustrating the stages used to conduct this study**

**Research Procedures**

According to figure 1 this study followed a systematic approach to ensure the validity and reliability of the findings. The research process was carefully planned and executed in various stages, including research design, sampling techniques, identification of variables, and statistical analysis. Each stage played a crucial role in obtaining accurate and meaningful results.

**Research Design**

The study adopted a descriptive correlational research design. This design was used to examine the relationship between digital technology and students' performance. The descriptive aspect of the study helped in summarizing and presenting data in an organized manner, while the correlational aspect allowed for the analysis of the degree and direction of the relationship between the two variables. Since the study did not involve experimental manipulation, the correlation design was appropriate for assessing naturally occurring associations between digital technology and academic performance.

## Sampling Techniques

The study employed stratified sampling as the main sampling technique. This method was chosen to ensure that different subgroups within the population were adequately represented. The population was divided into meaningful strata based on specific characteristics, such as gender, school type, or performance levels. Within each stratum, participants were randomly selected to participate in the study. This approach minimized sampling bias and improved the generalizability of the findings. By using stratified sampling 144 students were selected female were 73 and male were 71.The researcher ensured that the sample reflected the diversity of the target population, thereby increasing the reliability of the study.

## Variables

The study involved two main types of variables: independent and dependent variables.
Independent Variable: The independent variable in this study was digital technology. This included various technological tools and platforms, such as digital maps, Google Earth, and other geographical information systems, which were integrated into the teaching and learning process. The level of digital technology use varied among students, depending on the availability of resources and their exposure to these tools.
Dependent Variable: The dependent variable was students' performance. This referred to the academic achievement of students in geography, particularly in the area of map reading and interpretation. The performance was measured through students' test scores, assessments, and their ability to analyze and interpret maps using digital tools. The study aimed to determine whether digital technology had a positive, negative, or no significant effect on students' academic performance. According to National Examination Council of Tanzania (NECTA, 2019) the arrangement of marks are as following; 0-29% regarded as F, 30-44% regarded as D, 45-64% regarded as C, 65-74% regarded as B while 75-100% regarded as A

## Statistical Analysis

The collected data were analyzed using **descriptive statistics**. This method helped in summarizing and presenting data in a meaningful way. The main statistical techniques used included:
Percentages: The percentage method was used to analyze the distribution of students based on various categories, such as those who used digital technology frequently versus those who did not. It also helped in comparing performance levels across different groups.
Tables: Data were organized into tables for better visualization and interpretation. Tables presented the frequency distribution of key variables, such as students' test scores, for those exposure to digital technology
Graphs: Graphical representations, such as bar charts were used to illustrate trends and relationships between digital technology usage and student performance. Graphs provided a clear and concise way to interpret the results and identify patterns within the data.

**Results**

**Table1**

**Comparison of Students' Performance in Map Reading and Interpretation Before and After Intervention in Remembering**

| Marks interval | Grade | Before intervention (%) | After intervention (%) |
|---|---|---|---|
| 0-29 | F | 23.33 | 16.67 |
| 30-44 | D | 63.33 | 10 |
| 45-64 | C | 3.33 | 33.33 |
| 65-74 | B | 3.33 | 10 |
| **75-100** | **A** | **6.67** | **0** |

**Data obtained from Research Field (2024)**

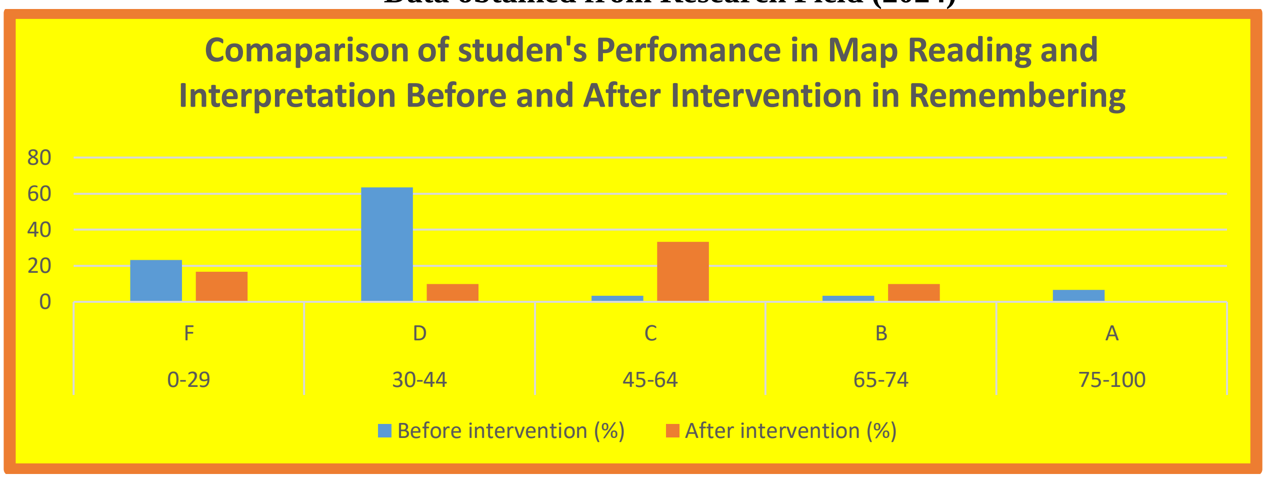


**Figure 2** Illustrating Comparison of Students' Performance in Map Reading and Interpretation Before and After Intervention in Remembering

**Source:** Research Field (2024)

**Table 2**

**Comparison of Students' Performance in Map Reading and Interpretation Before and After Intervention in Understanding**

| Marks interval | Grade | Before intervention (%) | After intervention (%) |
|---|---|---|---|
| 0-29 | F | 26.67 | 3.33 |
| 30-44 | D | 56.67 | 3.33 |
| 45-64 | C | 23.33 | 63.33 |
| 65-74 | B | 3.33 | 23.33 |
| **75-100** | **A** | **0.00** | **6.66** |

Data obtained from field (2024)

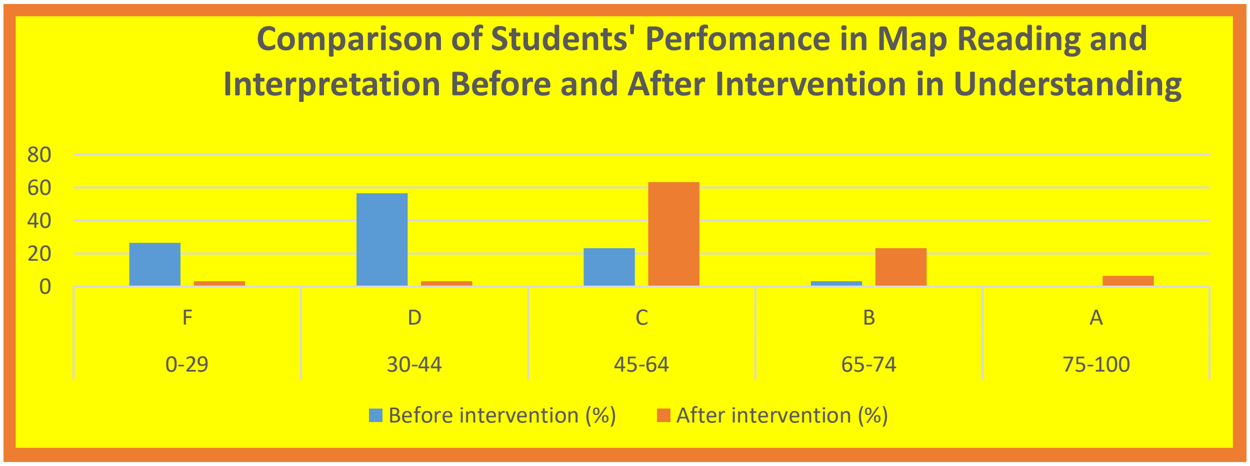


**Figure 3** Illustrating Comparison of Students' Performance in Map Reading and Interpretation Before and After Intervention in Understanding
**Source:** Research Field (2024)

**Table 3**
**Comparison of Students' Performance in Map Reading and Interpretation Before and After Intervention in Application**

| Marks interval | Grade | Before intervention (%) | After intervention (%) |
|---|---|---|---|
| 0-29 | F | 16.67 | 13.33 |
| 30-44 | D | 46.66 | 26.66 |
| 45-64 | C | 36.66 | 33.33 |
| 65-74 | B | 00.00 | 26,66 |
| **75-100** | **A** | **00.00** | **3.33** |

**Data obtained from Research Field (2024)**

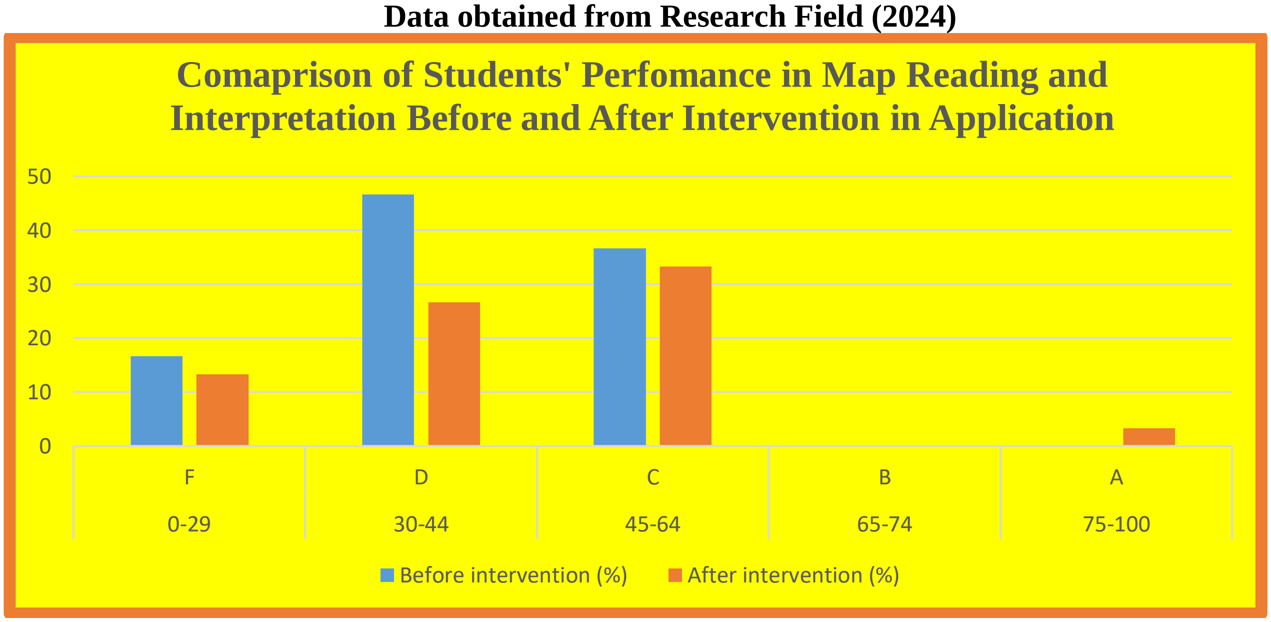

**Figure 4** *Illustrating Comparison of Students' Performance in Map Reading and Interpretation Before and After Intervention in Application*
**Source:** Research Field (2024)

**Table 4 Comparison of Students' Performance in Map Reading and Interpretation Before and After Intervention in Analysis**

| Marks interval | Grade | Before intervention (%) | After intervention (%) |
|---|---|---|---|
| 0-29 | F | 26.66 | 3.33 |
| 30-44 | D | 33.33 | 9.09 |
| 45-64 | C | 33,33 | 70 |
| 65-74 | B | 6.66 | 13.3 |
| **75-100** | **A** | **00.00** | **3.33** |

**Data obtained from Research Field (2024)**

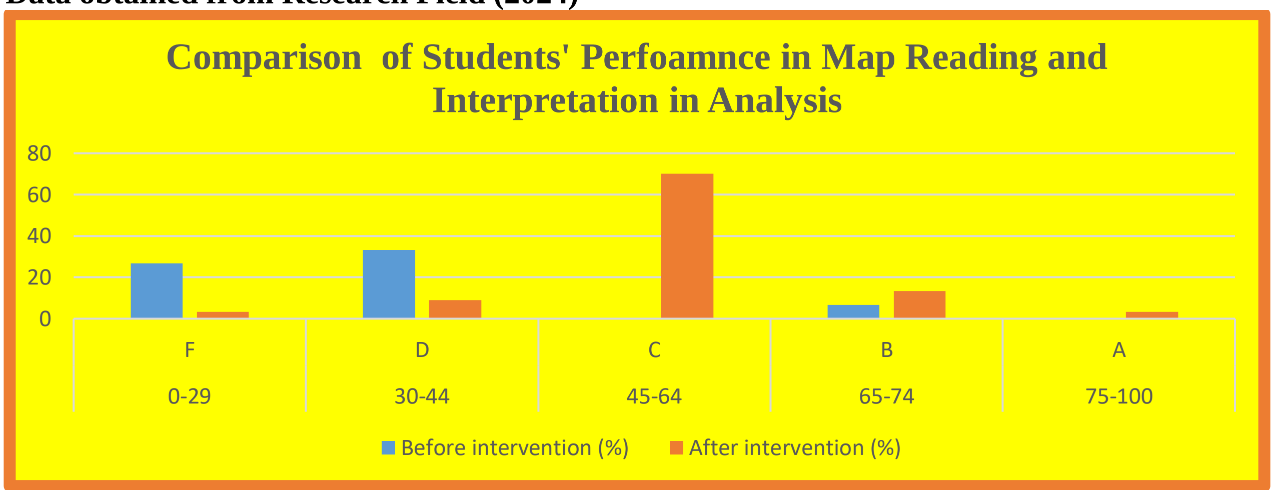


**Figure 5** Illustrating Comparison of Students' Performance in Map Reading and Interpretation Before and After Intervention in Analysis
**Source:** Research Field (2024)

**Table 5 Comparison of Students' Performance in Map Reading and Interpretation Before and After Intervention in Evaluation**

| Marks interval | Grade | Before intervention (%) | After intervention (%) |
|---|---|---|---|
| 0-29 | F | 20.00 | 3.33 |
| 30-44 | D | 46.66 | 30.3 |
| 45-64 | C | 30.00 | 66.66 |
| 65-74 | B | 3.33 | 26.6 |
| **75-100** | **A** | **00.00** | **33.33** |

**Data obtained from Research Field**

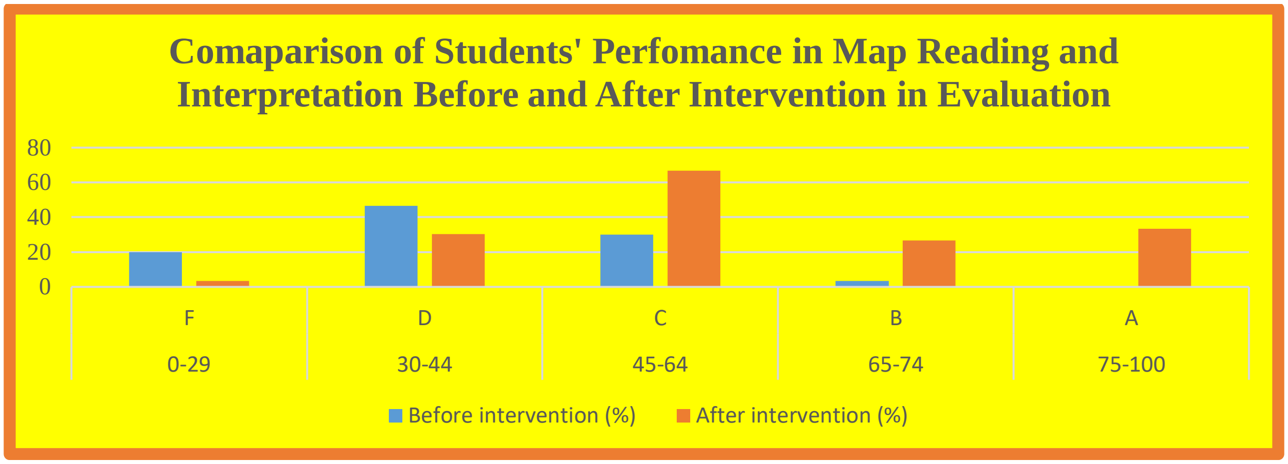


**Figure 6** *Illustrating Comparison of Students' Performance in Map Reading and Interpretation Before and After Intervention in Evaluation*
**Sources:** Research Field (2024)

**Table 6 Comparison of Students' Performance in Map Reading and Interpretation Before and After Intervention in creation**

| Marks interval | Grade | Before intervention (%) | After intervention (%) |
|---|---|---|---|
| 0-29 | F | 50.00 | 66.66 |
| 30-44 | D | 6.66 | 6.66 |
| 45-64 | C | 20.00 | 30.00 |
| 65-74 | B | 3.33 | 13.3 |
| **75-100** | **A** | **0.00** | **43.3** |

**Data obtained from Research Field**

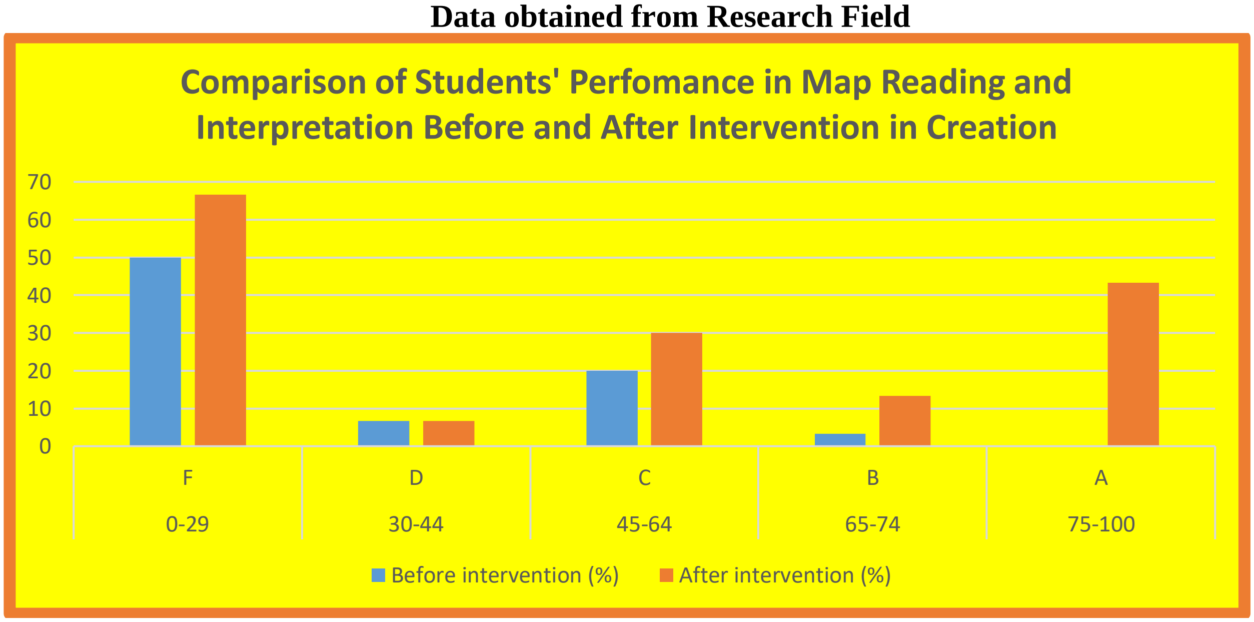

**Figure 7** Illustrating Comparison of Students' Performance in Map Reading and Interpretation Before and After Intervention in Creation
**Source:** Research Field (2024)

## Discussion

The Table 1 and Figure 2 present a comparative analysis of students' performance in map reading and interpretation skills before and after an intervention integrating Bloom's Taxonomy and digital technology. The focus of this analysis is on the "Understanding" stage, which is the second level of Bloom's Taxonomy. At this stage, students go beyond simple recall and demonstrate the ability to explain concepts, interpret spatial information, and describe relationships between geographical elements (Bloom et al., 1956). In the context of Geography education, this includes interpreting map symbols, describing contour patterns, and explaining spatial relationships between physical and human features.

Prior to the intervention, students' understanding of map reading was notably weak. The table shows that 23.33% of students scored in the F grade range (0-29%), while 63.33% fell into the D category (30-44%). These results indicate that the majority of students struggled with interpreting maps, understanding contour representation, and explaining spatial patterns.

The low percentage of students in the C (3.33%), B (3.33%), and A (6.67%) categories suggests that traditional teaching methods were ineffective in helping students grasp fundamental map-reading concepts. These findings align with existing research in Tanzania, which highlights that Geography students often fail to develop map interpretation skills due to over-reliance on passive learning methods, such as memorization of map symbols, rather than interactive, inquiry-based learning (Mushi, 2020; Komba & Mwandanji, 2015).

Following the intervention, which incorporated digital tools such as Google Earth, GIS software, and interactive maps, students demonstrated significant improvement in understanding map concepts. The percentage of students scoring in the F and D categories dropped to 16.67% and 10.00%, respectively, indicating that fewer students struggled with basic map comprehension. At the same time, the number of students in the C (33.33%), B (10.00%), and A (0.00%) categories increased, suggesting that a larger proportion of students were able to interpret spatial relationships and describe geographic features with greater accuracy.

These improvements are consistent with research in Tanzania that has found digital learning tools enhance students' ability to visualize and interact with spatial data, thereby deepening their conceptual understanding (Mtebe & Raphael, 2018). By providing real-time, interactive, and visual representations of geographical data, digital tools help students make meaningful connections between map symbols and real-world features, thus strengthening their understanding.

The Table 2 and Figure 3 provides a comparison of students' performance in map reading and interpretation skills before and after an intervention that integrated Bloom's Taxonomy and digital technology. The focus of this analysis is on the "Understanding" stage of Bloom's Taxonomy, which involves the ability to explain concepts, interpret information, and demonstrate comprehension beyond simple recall (Bloom et al., 1956). In Geography education, understanding in map reading includes interpreting symbols, explaining contour patterns, describing spatial relationships, and making connections between map elements and real-world geography.

Before the intervention, students exhibited low levels of understanding in map reading, as reflected in the high percentage of students scoring F (26.67%) and D (56.67%). This indicates that many students struggled to grasp basic map concepts and interpret spatial information beyond memorization. The limited number of students scoring in higher grades suggests that traditional teaching methods, which often rely on rote learning, were ineffective in developing students' conceptual understanding of maps. These findings are supported by Tanzanian studies, which have found that Geography students often perform poorly in map interpretation due to a lack of interactive learning resources and over-reliance on teacher-centered instruction (Komba & Mwandanji, 2015; Mushi, 2020).

Following the intervention, students demonstrated a significant improvement in understanding map concepts, as shown by the increase in students scoring C (63.33%), B (23.33%), and A (6.66%). The percentage of students scoring F and D decreased dramatically to 3.33% each, suggesting that the intervention enabled students to comprehend and interpret geographical information more effectively. This improvement aligns with findings from Tanzanian research, which indicates that ICT-based teaching enhances students' ability to process and understand geographical data (Mtebe & Raphael, 2018).

The Table 3 and Figure 4 presents students' performance in map reading and interpretation skills before and after an intervention integrating Bloom's Taxonomy and digital technology. The focus of this analysis is on the "Application" stage, which is the third level of Bloom's Taxonomy. At this stage, students move beyond understanding and begin to apply knowledge in real-world contexts, such as using map reading skills to analyze spatial relationships, measure distances, interpret contour variations, and solve geographical problems (Bloom et al., 1956).

In the context of Geography education in Tanzania, the ability to apply map reading skills is crucial for interpreting topographical features, understanding environmental changes, and making location-based decisions (Mosha, 2018).

Prior to the intervention, students exhibited significant challenges in applying map reading and interpretation skills. The table shows that 16.67% of students scored in the F grade range (0-29%), while 46.66% fell into the D category (30-44%). These figures indicate that more than half of the students struggled to apply map reading knowledge in practical tasks, such as identifying landforms, using grid references, or interpreting elevation changes on topographical maps.

Additionally, only 36.66% of students scored in the C grade range (45-64%), and there were no students in the B (65-74%) or A (75-100%) categories. This suggests that traditional teaching methods failed to cultivate students' ability to use maps in real-world applications, likely due to a lack of hands-on learning activities and insufficient integration of digital tools. These findings align with Tanzanian research indicating that Geography students often struggle with applying map skills due to over-reliance on teacher-centered instruction and limited access to interactive learning resources (Komba & Mwandanji, 2015; Mushi, 2020).

Following the intervention, which incorporated digital learning tools such as Google Earth, and interactive topographic maps, students showed substantial improvements in their ability to apply map reading skills. The percentage of students scoring F and D dropped to 13.33% and 26.66%, respectively, indicating that fewer students had difficulties with practical map reading tasks. The number of students in the C grade category (33.33%) remained relatively stable, but the most significant improvements were seen in the higher grade ranges: 26.66% of students achieved a B grade (compared to 0.00% before the intervention).3.33% of students reached the A grade range, demonstrating advanced application skills in map reading.

These improvements suggest that the use of digital tools facilitated students' ability to apply their knowledge of maps in practical situations, enabling them to interpret contour features more effectively, measure distances with greater accuracy, and analyze spatial relationships with confidence.

The Table 4 and Figure 5 presents students' performance in map reading and interpretation skills before and after an intervention integrating Bloom's Taxonomy and digital technology. The focus of this analysis is on the "Analysis" stage, which is the fourth level of Bloom's Taxonomy. At this stage, students are expected to break down complex geographical data, examine spatial relationships, identify patterns in topographical maps, and compare different map elements (Bloom et al., 1956).

In Geography education in Tanzania, developing analytical skills is crucial, as students must critically assess map features, understand the interaction between physical and human geography, and evaluate spatial data for decision-making (Mosha, 2018).

Prior to the intervention, students exhibited significant difficulties in analyzing maps and interpreting spatial relationships. The table shows that: 26.66% of students scored in the F grade range (0-29%), indicating that they struggled to deconstruct map features and analyze geographical data. 33.33% of students were in the D category (30-44%), suggesting that they had limited ability to examine topographical details critically. 33.33% of students scored in the C category (45-64%), indicating a moderate level of analytical skills but not enough to demonstrate advanced interpretation abilities. Only 6.66% of students reached the B category (65-74%), and none scored in the A category (75-100%), highlighting a clear weakness in higher-order thinking skills related to Geography.

These results suggest that traditional teaching methods failed to cultivate students' ability to analyze map elements effectively, likely due to a lack of hands-on practice, critical thinking exercises, and interactive learning experiences. Previous studies in Tanzania have found that students often rely on rote memorization rather than analytical thinking when studying maps, which limits their ability to break down and interpret spatial data effectively (Komba & Mwandanji, 2015; Mushi, 2020).

Following the intervention, which incorporated digital learning tools such as GIS applications, Google Earth, and 3D topographical maps, students demonstrated substantial improvements in their analytical skills: The percentage of students scoring F dropped drastically from 26.66% to 3.33%, showing that fewer students struggled with analyzing map features. The D category also decreased from 33.33% to 9.09%, indicating a significant improvement in students' ability to deconstruct and examine map data critically. The C category rose significantly from 33.33% to 70%, suggesting that the majority of students developed stronger analytical skills and were able to compare, contrast, and interpret map patterns with greater confidence. The B category increased from 6.66% to 13.3%, and for the first time, 3.33% of students achieved an A grade, demonstrating high-level analytical thinking and problem-solving skills in map interpretation.

The Table 5 and Figure 6 present students' performance in map reading and interpretation skills before and after an intervention integrating Bloom's Taxonomy and digital technology. The focus of this analysis is on the "Evaluation" stage, which is the fifth level of Bloom's Taxonomy. At this stage, students are expected to assess, critique, and make judgments based on geographical data, maps, and spatial patterns (Bloom et al., 1956).

In the context of Geography education in Tanzania, developing evaluative skills is crucial for enabling students to analyze map data critically, justify geographical conclusions, and apply their understanding to real-world spatial challenges (Mosha, 2018).

Before the intervention, the data indicate that many students struggled with evaluative thinking, as evidenced by their poor performance: 20.00% of students scored in the F grade range (0-29%), indicating that they had difficulty making informed judgments about spatial data. 46.66% of students were in the D category (30-44%), suggesting that a significant proportion of students lacked the ability to critically assess geographical information and justify their interpretations. 30.00% of students scored in the C category (45-64%), showing that they had a moderate ability to evaluate maps and justify their conclusions, but they still faced challenges in demonstrating advanced judgment. Only 3.33% of students reached the B category (65-74%), and no student scored in the A category (75-100%), highlighting a lack of advanced evaluative skills.

These results suggest that traditional teaching methods did not effectively develop students' ability to critically assess and justify geographical interpretations. Research in Tanzania has shown that many Geography students struggle with the evaluation stage because they are not trained to apply critical thinking and reasoning to geographical challenges (Komba & Mwandanji, 2015). Instead, students often rely on memorization rather than evaluating different sources of spatial data and making reasoned conclusions (Mushi, 2020).

After implementing digital learning tools such as GIS applications, Google Earth, and digital topographical maps, students' ability to evaluate geographical data improved significantly: The percentage of students scoring F decreased from 20.00% to 3.33%, showing that fewer students struggled with making critical assessments of map data. The D category declined from 46.66% to 30.3%, suggesting that students developed a stronger ability to analyze and justify their geographical interpretations. The C category increased from 30.00% to 66.66%, indicating a significant improvement in students' ability to evaluate and compare spatial information critically. The B category rose from 3.33% to 26.6%, demonstrating that more students could now make well-supported geographical evaluations and draw conclusions from spatial data. Notably, 33.33% of students achieved an A grade for the first time, meaning that they were able to assess and justify geographical arguments at an advanced level.

The Creation stage in Bloom's Taxonomy represents the highest level of cognitive learning, where students synthesize knowledge, generate new ideas, and construct original solutions to problems (Bloom et al., 1956). In the context of Geography education in Tanzania, this stage involves students using their understanding of map reading and interpretation to design, modify, and develop their own spatial representations and geographical analyses. This skill is critical in geospatial problem-solving, urban planning, environmental management, and disaster preparedness, which are key aspects of Geography as a discipline (Mosha, 2018).

The Table 6 and Figure 7 analysis examines how students' ability to create and apply map-related knowledge changed before and after an intervention involving digital technology.

Before implementing digital tools, most students struggled significantly with the creation stage, as reflected in the performance distribution: 50.00% of students scored in the F category (0-29%), indicating that they lacked the ability to synthesize map information or create meaningful spatial representations. 6.66% were in the D category (30-44%), suggesting limited ability to construct or manipulate geographical data. 20.00% scored in the C category (45-64%), meaning they had moderate skills in applying map interpretation techniques but struggled to create their own spatial analyses. Only 3.33% achieved a B grade (65-74%), demonstrating that very few students were able to generate and justify their own cartographic representations. No student (0.00%) reached the A grade (75-100%), highlighting a critical deficiency in students' ability to engage in map creation and geographical synthesis.

These results align with findings from Geography education research in Tanzania, where students often rely on rote learning rather than developing skills in constructing, modifying, and evaluating their own maps (Mushi, 2020). Traditional teaching methods in secondary schools focus on memorization and recognition, but lack hands-on opportunities for students to design and interpret their own geographical data (Komba & Mwandanji, 2015).

After introducing digital learning tools such as Google Earth, and interactive digital maps, students demonstrated a significant improvement in their ability to create and modify spatial data: Surprisingly, the percentage of students scoring in the F category increased from 50.00% to 66.66%. This may indicate that more students were challenged by the shift to a higher-order cognitive task, requiring more advanced thinking skills than they had previously used. The D category remained the same at 6.66%, suggesting that some students still struggled with map creation despite the intervention. The C category increased from 20.00% to 30.00%, reflecting a moderate improvement in students' ability to apply and modify spatial information. The B category rose from 3.33% to 13.3%, indicating that more students were beginning to demonstrate competence in designing and interpreting maps. Most notably, the A category increased dramatically from 0.00% to 43.3%, meaning that after the intervention, nearly half of the students were now able to successfully create and synthesize their own geographical interpretations.

This dramatic improvement in higher-order cognitive skills suggests that digital technology played a crucial role in enhancing students' ability to generate new geographical ideas and construct spatial representations.

The increase in F grades after intervention suggests that many students initially struggled with the transition to higher-order thinking tasks. This is consistent with research showing that Tanzanian secondary school students often find it difficult to move from basic knowledge recall to advanced synthesis and creation tasks (Komba & Mwandanji, 2015). The sudden demand for creative map-making skills may have overwhelmed students unaccustomed to problem-solving and independent spatial analysis.

## Implications of the Study

### Enhancing Geography Education through Digital Integration

The study demonstrates that integrating digital tools such as Google Earth and GIS applications into Geography education significantly improves students' understanding, application, and analytical skills in map reading. This suggests that education policymakers and curriculum developers should prioritize incorporating digital learning resources to enhance Geography instruction, particularly in resource-constrained schools. Aligning with **SDG 4 (Quality Education)**, the study emphasizes the need for innovative, technology-driven teaching strategies to improve learning outcomes.

### Bridging the Digital Divide in Secondary Education

The findings highlight the positive impact of digital technology in improving students' higher-order thinking skills, such as analysis and evaluation. However, the initial struggle of students in adapting to creative map-making tasks suggests that there is a need for early exposure to digital learning tools. This aligns with **SDG 9 (Industry, Innovation, and Infrastructure)** by advocating for investments in digital infrastructure in schools to bridge the digital divide and foster 21st-century skills among students.

### Improving Geospatial Literacy for Sustainable Development

The study underscores the importance of equipping students with geospatial literacy skills, which are crucial for environmental management, urban planning, and disaster preparedness. By strengthening students' ability to interpret and analyze spatial data, the study contributes to SDG 4 (Quality of Education) by preparing future professionals who can use geospatial technologies to address urbanization challenges, climate change, and sustainable land-use planning.

## Recommendations of the Study

### Integrating Digital Tools into the Geography Curriculum

Given the study's findings on the effectiveness of digital tools in improving students' map reading and interpretation skills, the Ministry of Education and curriculum developers should integrate technologies such as Google Earth and GIS software into Geography instruction. Providing teacher training on digital pedagogies will ensure effective implementation. This supports SDG 4 (Quality Education) by promoting innovative and engaging learning experiences.

### Expanding Access to Digital Infrastructure in Schools

To bridge the digital divide, education stakeholders should invest in digital infrastructure, including computers, internet access, and interactive mapping software, particularly in resource-limited schools. Partnerships with private sector organizations and NGOs can support this initiative, aligning with SDG 9 (Industry, Innovation, and Infrastructure) to enhance technological access in education.

### Promoting Geospatial Skills for Sustainable Development

Schools should incorporate hands-on, problem-solving activities using digital maps to develop students' geospatial literacy. These skills are essential for addressing real-world challenges such as environmental conservation and urban planning. This recommendation aligns with SDG 4 (Quality of Education) by equipping students with practical knowledge for sustainable land use and disaster preparedness.

## Conclusion

This study underscores the transformative potential of digital tools in enhancing map reading and interpretation skills among secondary school students in Tanzania. By integrating technologies such as Google Earth and GIS applications, students not only improved their understanding of spatial concepts but also developed higher-order thinking skills essential for Geography and real-world problem-solving. However, the study also reveals significant challenges, including the digital divide and the need for teacher training, which must be addressed for successful implementation. Critically, while digital tools offer an innovative approach to Geography education, their effectiveness depends on proper infrastructure, pedagogical adaptation, and student readiness. The study highlights the urgency for policymakers, educators, and stakeholders to prioritize digital integration in secondary education, ensuring equitable access and sustainable implementation. By doing so, Geography instruction can be modernized to better prepare students for future academic and professional demands, ultimately contributing to national and global development goals.

## Conflict of Interest Statement

The authors declare no conflict of interest related to this study. The research was conducted independently, without any financial, institutional, or personal influences that could have affected the findings or interpretations. Additionally, there were no affiliations with organizations that could benefit from the results. The study was carried out purely for academic and educational advancement, aligning with the objective of improving Geography education in Tanzanian secondary schools.

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