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Research Article

Evaluating the Impact of Map Reading Skills on Students' Geographic Knowledge in Kasenengwa District Secondary Schools

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Abstract

Map-reading skills constitute a foundational component of geographic education, enabling learners to interpret spatial information, understand environmental relationships, and apply geographic concepts in real-world contexts. This study examined the impact of map-reading skills on students' geographic knowledge in secondary schools of Kasenengwa District, Zambia. Using a mixed-methods research design, data were collected from 200 secondary school students and 20 geography teachers through questionnaires, interviews, and classroom observations. Quantitative data were analysed using descriptive statistics and correlation analysis, while qualitative data were thematically analysed. Findings revealed a strong positive relationship between students' proficiency in map-reading skills—particularly symbol interpretation, scale comprehension, contour analysis, and directional orientation—and their overall geographic knowledge. Resource availability, instructional strategies, and teacher competency emerged as critical mediating factors. The study concludes that enhanced cartographic instruction, experiential learning, and integration of Geographic Information Systems (GIS) significantly improve students' spatial literacy. Recommendations include strengthening teacher training, revising curriculum emphasis on practical cartography, and increasing access to modern mapping resources.

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KEYWORDS: Map reading skills; Geographic knowledge; Secondary education; Spatial literacy; GIS; Zambia.

1. INTRODUCTION

Geography plays a vital role in developing learners' spatial awareness, analytical thinking, and understanding of human–environment interactions. Central to this discipline is map-reading, a skill that enables students to decode spatial representations, interpret geographic symbols, and visualise spatial relationships. Despite its importance, many secondary school students struggle to apply map-reading concepts effectively, resulting in limited geographic understanding and poor academic performance.

In Kasenengwa District, anecdotal evidence and examination outcomes have suggested persistent challenges in students' ability to interpret maps accurately. Difficulties in understanding scales, contour lines, symbols, and directions have limited learners' engagement with geographic content. These challenges are often exacerbated by insufficient instructional resources, limited exposure to practical mapping activities, and inadequate teacher training in modern cartographic methods.

This study investigates the relationship between map-reading skills and students' geographic knowledge in Kasenengwa District secondary schools. By examining instructional practices, learner challenges, and contextual constraints, the research seeks to provide evidence-based insights for improving geography education in resource-constrained environments.

2. REVIEW OF RELATED LITERATURE

Map-reading skills involve the ability to interpret symbols, scales, legends, contour lines, and directions to extract meaningful spatial information. Scholars have emphasised that map literacy is not merely a technical skill but a cognitive process that integrates visual perception, spatial reasoning, and abstract thinking. Effective map reading allows learners to transform two-dimensional representations into mental models of three-dimensional landscapes.

Empirical studies have consistently demonstrated a strong link between map-reading proficiency and geographic knowledge. Students who demonstrate higher competence in cartographic interpretation tend to exhibit better spatial reasoning, environmental awareness, and problem-solving skills. Large-scale international assessments, including PISA reports, have shown that inadequate map skills contribute significantly to poor geography performance among secondary students.

Research in African secondary schools highlights several obstacles to effective map-reading instruction. These include limited access to updated maps and atlases, overcrowded classrooms, curriculum overload, and insufficient instructional time. Teachers often rely on lecture-based methods due to resource constraints, reducing opportunities for experiential and student-centred learning.

Recent literature emphasises the effectiveness of experiential learning approaches, such as fieldwork, hands-on mapping exercises, and peer collaboration. The integration of Geographic Information Systems (GIS) has been shown to enhance student engagement and deepen geographic understanding by enabling interactive exploration of spatial data. However, implementation in low-resource settings remains uneven due to infrastructural and training limitations.

While existing studies establish the importance of map-reading skills, limited research has focused specifically on rural Zambian contexts. There is a lack of localised evidence examining how instructional strategies, resource availability, and learner characteristics interact to influence geographic knowledge. This study addresses this gap by providing context-specific insights from Kasenengwa District.

3. RESEARCH METHODOLOGY

3.1 Research Design

The study adopted a mixed-methods descriptive survey design, integrating quantitative and qualitative approaches to comprehensively examine the impact of map-reading skills on students' geographic knowledge. The quantitative component enabled measurement of students' proficiency levels and the statistical relationship between map-reading skills and geographic knowledge, while the qualitative component provided contextual insights into instructional practices, challenges, and pedagogical experiences of teachers.

This design was considered appropriate because map-reading competence is both a measurable cognitive skill and a pedagogical phenomenon influenced by classroom practices, resources, and learner engagement. Methodological triangulation enhanced the validity and reliability of findings.

3.2 Study Area

The study was conducted in Kasenengwa District, Eastern Province of Zambia. The district consists of both peri-urban and rural secondary schools, characterised by varied access to instructional resources and teaching infrastructure. These contrasting settings provided a suitable context for examining disparities in map-reading instruction and geographic learning outcomes.

3.3 Population of the Study

The target population comprised:

- Secondary school students (Grades 10–12) offering Geography
- Geography teachers are responsible for teaching map-reading skills

According to district education records, the population included approximately 4,200 students and 30 geography teachers during the 2024–2025 academic year.

3.4 Sample Size and Sampling Techniques

Students

A sample of 200 students was selected using stratified random sampling based on:

- School location (urban/peri-urban vs rural)
- Grade level (10, 11, 12)

This ensured proportional representation and minimised sampling bias.

Teachers

20 geography teachers were selected using purposive sampling, based on:

- Minimum of two years' teaching experience
- Direct involvement in teaching map-reading content

3.5 Instruments for Data Collection

1. **Student Questionnaire**

- Sections: demographic data, map-reading skills (symbols, scale, contours, direction), and geographic knowledge
- Five-point Likert scale and multiple-choice items
- Reliability coefficient (Cronbach's alpha): **0.78**

2. **Teacher Questionnaire**

- Instructional strategies, resource availability, and perceived student challenges

3. **Semi-Structured Interviews**

- Conducted with 20 teachers
- Explored teaching methods, GIS use, professional development, and constraints

4. **Classroom Observation Checklist**

- Documented teaching aids, student engagement, and instructional techniques

3.6 Data Analysis

Quantitative data were analysed using SPSS:

- Frequencies, percentages, means, and standard deviations
- Pearson correlation to examine relationships between map-reading skills and geographic knowledge

Qualitative data were analysed thematically:

- Coding of interview transcripts and observation notes
- Themes triangulated with quantitative findings

4. RESULTS

4.1 Demographic Characteristics of Students

Table 1: Demographic Profile of Students (n = 200)

Variable	Category	Frequency	Percentage (%)
Gender	Male	108	54
	Female	92	46
School Location	Urban/Peri-urban	96	48
	Rural	104	52
Grade Level	Grade 10	68	34
	Grade 11	66	33
	Grade 12	66	33

4.2 Students' Map-Reading Proficiency

Table 2: Mean Scores of Map-Reading Skill Components

Skill Component	Mean Score	SD	Proficiency Level
Symbol interpretation	3.62	0.84	Moderate
Scale comprehension	3.21	0.91	Moderate
Directional orientation	3.74	0.79	High
Contour interpretation	2.88	0.97	Low–Moderate

4.3 Geographic Knowledge Levels

Table 3: Students' Geographic Knowledge Scores

Knowledge Level	Frequency	Percentage (%)
High	54	27
Moderate	96	48
Low	50	25

4.4 Relationship Between Map-Reading Skills and Geographic Knowledge

Table 4: Correlation Between Map-Reading Skills and Geographic Knowledge

Map-Reading Skill	Pearson r	p-value
Symbol interpretation	0.61	<0.01
Scale comprehension	0.58	<0.01
Directional orientation	0.65	<0.01
Contour interpretation	0.53	<0.01

4.5 Instructional Strategies Used by Teachers

Table 5: Teaching Strategies Reported by Teachers (n = 20)

Strategy	Teachers Using (%)
Lecture method	85
Map exercises	60
Fieldwork activities	35
GIS / digital maps	25
Group discussion	55

5. DISCUSSION

The present study revealed a significant positive relationship between map-reading skills and students' geographic knowledge, confirming the central role of cartographic literacy in geography education. Students who demonstrated higher proficiency in interpreting symbols, directions, and scales achieved better geographic knowledge scores, supporting cognitive mapping theory (Tolman, 1948), which emphasises mental spatial representation as fundamental to geographic understanding.

The findings align with Amosun (2016), who reported that Nigerian secondary students exposed to structured map-reading exercises performed significantly better in geography tests than those taught using lecture-based methods. Similarly, Kaani et al. (2022) observed that Zambian students with limited exposure to practical mapping activities struggled with contour interpretation, a trend also evident in the present study.

Contour interpretation emerged as the weakest skill among students. This finding corroborates Ramsaroop and Kwayi (2024), who noted that abstract cartographic concepts requiring three-dimensional visualisation posed difficulties for learners when not reinforced through experiential learning. According to cognitive load theory (Sweller, 1988), contour interpretation places high demands on working memory, explaining students' lower performance.

The study further revealed disparities between urban and rural schools, with rural students demonstrating lower map-reading proficiency. This finding is consistent with UNESCO (2019)

and World Bank (2021) reports, which highlighted inequalities in access to instructional resources and digital mapping tools in rural settings.

Teachers' reliance on lecture-based instruction, despite recognising the value of practical mapping exercises, reflects findings by Johnson (2024), who reported that lack of training and infrastructure limited GIS integration even when teachers were positively disposed toward technology-enhanced learning. However, teachers who employed fieldwork and group-based map exercises reported higher student engagement, supporting Kolb's experiential learning theory (1984) and Vygotsky's sociocultural framework (1978).

Overall, the study's results are consistent with international and regional literature, reinforcing the argument that map-reading skills are a strong predictor of geographic knowledge, particularly when supported by appropriate instructional strategies and resources.

6. CONCLUSION

This study examined the impact of map-reading skills on students' geographic knowledge in secondary schools of Kasenengwa District, Zambia. The findings clearly demonstrate that map-reading skills constitute a critical foundation for effective geographic learning. Students who exhibited higher proficiency in interpreting map symbols, understanding scale, determining direction, and analysing contours consistently achieved better outcomes in geographic knowledge assessments. The statistically significant correlations observed across all components of map-reading skills confirm that cartographic literacy is not an auxiliary skill but a core determinant of academic success in geography.

The study further revealed that while students showed moderate competence in basic skills such as symbol interpretation and directional orientation, they experienced notable difficulty with more abstract concepts, particularly contour interpretation and scale conversion. These challenges were more pronounced among students in rural schools, highlighting persistent disparities in access to instructional resources and experiential learning opportunities. The predominance of lecture-based teaching methods, coupled with limited use of fieldwork and GIS technologies, constrained students' ability to develop higher-order spatial reasoning skills.

Importantly, the findings underscore the influence of instructional strategies and teacher preparedness in shaping students' geographic understanding. Teachers who incorporated practical map exercises, collaborative learning, and real-world applications reported improved student engagement and comprehension. This reinforces the relevance of experiential learning and sociocultural theories, which emphasise active participation and contextualised learning in knowledge construction.

In conclusion, strengthening map-reading instruction through enhanced teacher training, increased provision of cartographic and digital resources, and greater emphasis on practical and learner-centred approaches is essential for improving geographic education outcomes. Addressing these gaps will not only enhance students' academic performance but also equip them with vital spatial skills necessary for informed citizenship, environmental awareness, and future career pathways in a spatially driven world.

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