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Assessing Students' Mathematics Interests and Perceived Teacher Effectiveness in Rural Communities: Implications for Rural Mathematics Education

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Abstract

Students in rural areas in developing nations are at risk of under-performing and dropping out of school. This worsens when it comes to science subjects such as mathematics. Sustaining their mathematics interests demands understanding the factors that impact their mathematics learning outcomes. Our study adopted a cross-sectional survey research design to examine the association between teacher effectiveness and rural students' mathematics interests. Our sample comprised 205 randomly sampled secondary school students from six community schools in Awka, Anambra State, Nigeria. Our findings revealed that all the components of teacher effectiveness were positively related to students' mathematics interests. After controlling for gender, the regression analysis revealed that the dimensions of teacher effectiveness had a joint significant association with students' mathematics interests, with the student-teacher dimension having the greatest predictive capacity on students' mathematics interests. We concluded that affective aspects of teacher effectiveness are crucial for stimulating rural students' interest in mathematics.

Keywords: Mathematics interests, Nigeria, rural communities, rural mathematics, teacher effectiveness.

1. Introduction

Rural education is seen as a key aspect of the growth of rural communities. Mathematics has long been recognized as a science discipline at the epicenter of scientific progress. However, desirable mathematics skills and competencies appear lower in rural areas than in urban areas (Ajai, Imoko, 2013). As such, researchers have shifted their focus from individuals and individual understanding in science education towards how learning contexts impact science students' knowledge and abilities (Carlone et al., 2010). Undermining relevant contexts to mathematics teaching is likely to negate sociocultural systems' impact on learning mathematics.

Overtly, some research on rural-urban disparities in mathematics learning has shown that students in urban areas achieve significantly better than students in rural areas (Nworgu, Nworgu, 2013; Ochoche, Oguche, 2022) and that urban students engage in mathematics significantly better than rural students (Ayub et al., 2016). This disparity has been attributed to a lack of access to high-quality educational facilities (Adenuga, Adeniran, 2022) and the continual marginalization and neglect of rural schools, which stymies the development of rural communities in Nigeria (Nworgu, Nworgu, 2013). Despite international proclamations to achieve education for all for

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sustainable development, many nations are failing to provide high-quality education for their citizens (Beckman, Gallo, 2015). In Nigeria, for example, more than 14.6 million children are out of school (Olaniyan et al., 2018), and the burden of the out-of-school children is more in rural communities. According to parity indicators, the out-of-school rate of children in secondary school in rural areas is 33 %, while it is 12.6 % in urban areas (Adenuga, Adeniran, 2022).

One of the issues that have been fingered as a factor impeding the teaching and learning of mathematics in rural areas in most developing nations is the teacher factor (Anigbo, 2016; Ochoche, Oguche, 2022), which bothers on how effective the teacher is in teaching mathematics. Teacher effectiveness has been considered necessary to improve mathematics learning outcomes of students (Ramezani-Monfared et al., 2015), and the shared features of rurality as well as the unique features of each rural place and people could interfere with how effective mathematics teaching could be (Hardré, 2011). Hardré further notes that these complex circumstances influence students' interest in mathematics. Interest in mathematics is a significant factor in mathematics learning outcomes since it has the capacity to induce in the learner a consistently high cognitive commitment and emotional attachment to learning (Tembe et al., 2020). As a result, teacher effectiveness may be a powerful element in arousing students' interest in mathematics. However, there is insufficient data in the literature on how teacher effectiveness is related to students' mathematical interests in rural settings.

Perceived teacher effectiveness and mathematics learning in a rural setting

Teacher effectiveness is a crucial factor influencing students' academic achievement and learning outcomes (Kamayubonye, Mutarutinya, 2022). Students who perceive their teachers as more effective are more likely to be engaged in mathematics learning, to have positive attitudes towards mathematics, and to attain higher levels of mathematics achievement (Akram, 2019). This is because teaching behavior, student ability, and student background work hand in hand to support students' learning (Garcia et al., 2019). In rural settings, it has been established that teachers perceived as effective in terms of content knowledge and pedagogical skills produced students whose achievement was high (Marshall, Sorto, 2012; Adams, 2012). Teacher effectiveness is closely linked to student engagement (Shin, Shim, 2021). Also, the study carried out by An et al. (2022) using a sample of urban and rural students in China established that there is a significant positive relationship between teacher support, learning motivation and learning engagement.

Interests in mathematics of students in rural communities

There is a close relationship between interest and students' performance in mathematics (Wong, Wong, 2019). When students manifest interest in a subject, they focus more on the work, gain/ apply more skills, and are better equipped to face challenges emanating from the subject (Abin et al., 2020). Rural communities are shaped by factors like poor means of transportation/roads, inadequate facilities, and the literacy level of parents, and all these factors negatively influence teaching and learning (Shikalepo, 2019). Students, schools, teachers, and stakeholders in rural communities often face different challenges (Hardré, 2011) when learning mathematics. These challenges include limited access to internet resources, inadequate infrastructure, lack of specialist teachers, and effective teaching methods (Darkis, 2020), which invariably affect interest in mathematics. However, findings regarding the mathematics interest of rural and urban students have been inconsistent. For example, Ayub et al. (2016) and Ababneh and Kodippili (2020) established that rural students manifested lesser interest in mathematics than urban students. In contrast, Ajai and Imoko (2013) and Illiyas and Charles (2017) demonstrated that rural students showed greater interest in mathematics, while Rajak and Gayen (2022) established no significant difference in mathematics interest between students in the rural and urban areas.

2. Methods

Research design

The design for this study was correlation research design, which aimed to describe and measure the degree of relationship between two or more variables (Devi et al., 2022). This design is suitable for this study because it sought to predict the relationship between teacher effectiveness and students' interest in mathematics in rural public secondary schools in Anambra State.

Participants

Our respondents consisted of 205 randomly sampled senior secondary II students (male = 47 %; female 53 %) from six public secondary schools in six rural communities in Anambra State.

Instrument for data collection

We employed two instruments for data collection in this study with a demographic section consisting of students' gender. The demographic section consisted of a single-item question demanding that students indicate whether they are males or females. The first is the Academic Interest Scale for Adolescents (AISA), a generic multi-dimensional instrument used to measure academic interest across different school subjects developed by Luo et al. (2019). It was anchored on Hidi and Renninger's (2006) four-phase interest development model and consists of 29 items structured on a four-point scale of strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). It has four clusters – emotion, value, knowledge, and engagement. The reliability coefficient for mathematics using Cronbach's alpha (α) was originally 0.80. This surpassed the 0.70 value benchmark (Nunnally, Bernstein, 1994). In our current study, the reliability index using Cronbach's α is 0.97.

The second instrument is the Teacher Effectiveness Questionnaire (TEQ) - a researcher-developed scale – consisting of 37-item statements. The questionnaire was structured on a four-point rating scale with response options of Strongly Disagree (SD), Disagree (D), Agree (A) and Strongly Agree (SA). It is developed after an extensive literature review. We drew from the works of Macia and Sanchez (2015), Meng et al. (2012), Moreno-Murcia et al. (2015), and Swathi (n.d) to frame the TEQ. Because teacher effectiveness is a multi-dimensional construct, we structured the scale to reflect this reality. The clusters include subject mastery (9 items), classroom management (10 items), student-teacher relationship (9 items), and use of instructional materials (9 items). The reliability index using Cronbach's α for the four clusters is 0.97. 0.93; 0.92; 0.90 respectively.

Method of collection and analysis

Our data-gathering procedure adhered to the ethical guidelines for behavioral sciences data collection and was in line with the Helsinki Declaration of 1964. We discussed the purpose of our study with the school authorities and got their approval to conduct the study in the schools. We also explained to the students the essence of the research and highlighted that their participation was strictly for research purposes. Participation was voluntary, and students' names and registration numbers were not included in the questionnaire to protect our respondents' identities. A password-protected private computer was used to manage the data. With the aid of the teachers, we distributed the questionnaire to the students during the school hour. Fifty students were randomly sampled from each school, making up 300 students. However, only 205 students completed the filling out of the questionnaire, accounting for 68.33 % of the total distribution. We collected the questionnaires from students who were able to finish filling the questionnaire on the spot, while the teachers helped in collecting copies of the questionnaire from students who requested to fill in the questionnaire later. No completion or inappropriate filling out of the scale appears to result from the students who could not complete the questionnaire immediately upon receipt. It is possible that the response burden could have resulted in the students not filling in the questionnaire upon receipt. This resulted in a low response rate in filling out the questionnaire. The two scales were framed in the English language. Our respondents were instructed to pay careful attention to each item and respond in an honest manner to the items.

Moreover, we employed SPSS version 25 to analyze our data. Mean, Standard deviation, bivariate correlation and multiple regression analysis were adopted to answer the research questions and test the hypothesis at a 0.05 significance level.

3. Results

Table 1. Mean Responses on Rural Students' Mathematics Interests

SN	Items	Mean	SD
1	I enjoy the fun of learning mathematics	2.90	.89
2	Studying mathematics makes me feel happy	2.71	.92
3	I am interested in mathematics classes	2.92	1.03

SN	Items	Mean	SD
4	The content I learn from mathematics topics is interesting	2.73	.95
5	I enjoy studying mathematics	2.72	1.01
6	I really like mathematics topics	2.71	.99
7	I enjoy when I study mathematics topics	2.70	1.02
8	The knowledge of mathematics is important	3.36	.88
9	A good mark in mathematics means a lot to me	3.27	.89
10	I think that mathematics is helpful for my career in the future	3.29	.90
11	The knowledge of mathematics makes my daily life easier	2.87	.97
12	The knowledge of mathematics promotes my growth	2.62	.99
13	I find that the knowledge of mathematics is useful in daily life	3.04	.99
14	The knowledge of mathematics is valuable for my future development	3.08	1.02
15	I think that learning mathematics is significant for my growth	2.59	1.08
16	I know all kinds of things about mathematics at my level	1.96	.91
17	I am expert in mathematics at my level	1.97	.93
18	I can answer all kinds of questions that teachers ask in the mathematics class	1.90	.84
19	I am familiar with the knowledge and skills required in mathematics	2.16	1.01
20	I do well in mathematics lessons	2.45	1.03
21	I have a lot of things to say about mathematics topics	2.42	1.01
22	I have a lot of knowledge about mathematics	2.28	1.01
23	I want to learn things that are not included in mathematics textbooks	2.71	1.10
24	I hope to explore things about mathematics	2.78	1.08
25	I will read more books about mathematics if I have the chance	2.83	1.11
26	I want to know more things about the field of mathematics	2.87	1.10
27	I will take part in an extracurricular training class for mathematics if I have the opportunity	2.84	1.10
28	I want to find various ways to complete the mathematics assignment	2.99	1.09
29	I am willing to spend time on the skills or methods learned from mathematics lessons	2.79	1.13

Results in Table 1 showed that students' interest in mathematics was high except in a few places that had to do with evaluating their competence in mathematics. They enjoyed mathematics, were willing to invest in the study of mathematics, and saw mathematics as relevant to their future career.

Table 2. Mean Responses on Perceived Teacher Effectiveness in Mathematics Teaching

S/N	Items	Mean	*SD*
	Subject Mastery		
1	My teacher is well organized and prepared for mathematics class	3.19	.94
2	My teacher always displays authority when teaching mathematics	3.18	.974
3	My teacher introduces mathematics topics in an interesting way	2.97	.99
4	My teacher answers mathematics questions satisfactorily	2.73	1.03
5	My teacher shows thorough understanding of lesson taught during mathematics lessons	2.86	.96
6	My teacher has a good knowledge of mathematics	3.26	.93
7	My teacher goes the extra mile to ensure students understand mathematics	2.63	1.09
8	My teacher exhibits ability to teach a lot of mathematics topics	2.88	1.02

S/N	Items	Mean	*SD*
9	My teacher can solve all mathematics problems correctly	2.93	1.09
	Effective Classroom Management		
1	My teacher is always composed in class	3.10	.93
2	My teacher writes on the chalkboard clearly	2.95	1.06
3	My teacher uses lesson time efficiently	3.07	.95
4	My teacher ensures good behavior in the classroom	3.10	1.01
5	My teacher marks and corrects assignment on time	2.91	1.04
6	My teacher asks appropriate questions during lessons	2.99	.98
7	My teacher is audible and clear in class	3.07	1.04
8	My teacher is regular and punctual	3.187	.98
9	My teacher ensures that the classroom is orderly before teaching mathematics	3.08	1.05
10	My teacher ensures that the classroom orderliness is maintained during mathematics teaching	2.96	1.06
	Student-Teacher Relationship		
1	My teacher motivates me to learn	2.51	1.17
2	I work well with my teacher	2.35	1.04
3	My teacher is interested in me especially when he is teaching mathematics	2.23	1.06
4	My teacher maintains a good relationship with me	2.33	1.07
5	My teacher treats me with respect	2.35	1.03
6	My teacher treats me equally with other students	2.61	1.14
7	My teacher encourages me to contribute in class	2.56	1.09
8	My teacher is approachable during and after class	2.48	1.14
9	My teacher is patient with me even when I don't understand mathematics	2.26	1.17
	Efficient Use of Instructional Materials		
1	My teacher uses the board effectively	3.08	1.04
2	My teacher uses instructional materials to make teaching mathematics real	2.35	1.10
3	My teacher makes me interested in mathematics using instructional materials	2.23	1.09
4	My teacher uses a variety of instructional materials to make teaching mathematics interesting	2.25	1.12
5	My teacher comes with materials that aid my understanding of mathematics	2.14	1.10
6	My teachers' use of instructional materials makes teaching mathematics clearer for me.	2.18	1.07
7	My teacher makes use of a board mathematical set for construction effectively	2.43	1.20
8	My teacher's use of power point (visual aid) aids my understanding of mathematics during mathematics teaching	1.84	.99
9	Overall, my teacher uses instructional materials (visual, audio, and audio-visually) effectively during mathematics teaching.	1.63	.92

Table 2 showed that students in rural areas perceived their mathematics teachers to be proficient in the subject matter. They reported that their mathematics teachers have a very good understanding of mathematics and could be seen as authorities in the subject they teacher. Also, teachers were perceived by students in rural areas as being effective in classroom management while teaching mathematics. However, students reported that their teachers were ineffective in ensuring productive relationships with students. They were also poor in the use of instructional materials in the teaching of mathematics.

Table 3. Bivariate Relationship among the Variables

S/N	Variables	1	2	3	4	5
1	Subject Mastery	-	.759**	.655**	.625**	.578**
2	Effective Classroom Management		-	.660**	.642**	.602**
3	Student-Teacher Relationship			-	.757**	.684**
4	Efficient Use of Instructional Materials				-	.481**
5	Interest					-
	Mean	26.62	30.41	21.67	20.13	78.46
	SD	6.74	7.81	7.77	7.20	21.38
	Skewness	-.473	-.553	-.637	.195	-.584
	Kurtosis	-.844	-.058	-1.089	-.945	-.557

Note: **. Correlation is significant at the 0.01 level (2-tailed).

Table 3 revealed that the dimensions of perceived teacher effectiveness - subject mastery, effective classroom management, student-teacher relationship and efficient use of instructional materials – were significantly and positively related to students' interest in mathematics, r = .578**, r = .602**, r = .684**, and r = .481** respectively.

Table 4. Gender and Dimensions of Teacher Effectiveness as Predictors of Students' Mathematics Interests

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	Std. Error	Beta		
1	(Constant) R^2 = 0.013	85.763	4.873		17.601	.000
	gender	-4.858	3.032	-.113	-1.602	.111
2	(Constant) ΔR^2 = 0.518	18.951	6.208		3.053	.003
	gender	2.602	2.173	.060	1.197	.233
	Subject Mastery	.442	.256	.138	1.723	.086
	Effective Classroom Management	.669	.224	.244	2.991	.003
	Student-Teacher Relationship	1.653	.226	.600	7.308	.000
	Efficient Use of Instructional Materials	-.617	.238	-.206	-2.593	.010

Note: Dependent Variable: Interest

Table 3 showed that the dimensions of teacher effectiveness had a joint positive significant relationship with students' mathematics interest after controlling for gender. We entered gender as a predictor in model 1. This model was not statistically significant, F (1, 199) = 2.567; p > 0.05. Entering the dimensions of teacher effectiveness (subject mastery, effective classroom management, student-teacher relationship and efficient use of instructional materials) in model 2, the total variance explained by the model was 53.1% (F (5, 195) = 44.164; p = 0.000). It explained an additional 51.8% of the variance in students' interests in mathematics after controlling for gender (ΔR^2 = 0.518, ΔF (4, 195) = 53.881; p = 0.000). In the final adjusted model, the student-teacher relationship made the highest individual positive contribution to students' interest in mathematics (β = 0.600, p = 0.000), followed by effective classroom management (β = 0.244, p = 0.003). Efficient use of instructional materials, however, negatively predicted students' interest in mathematics (β = -0.206, p = 0.010) in spite of the fact that it positively correlated with students' interest in the bivariate relationship analysis. Only teachers' mastery of the subject did

not predict students' interests in mathematics (β = -0.138, p = 0.086) despite its significant positive relationship with mathematics interests.

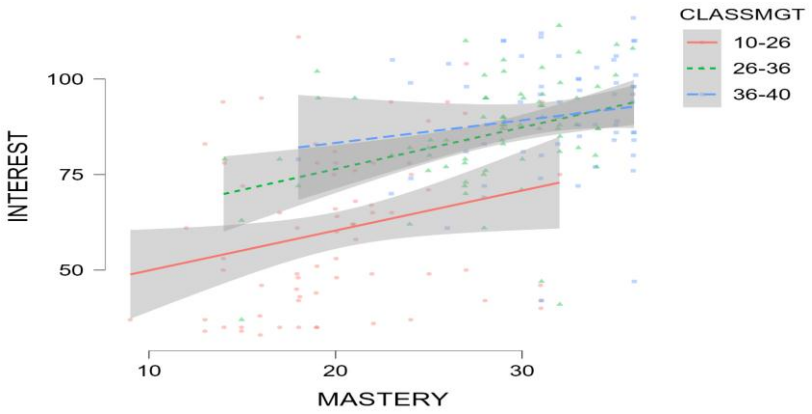

Fig. 1. Flexplot

4. Discussion

Our study examined students' mathematics interests in rural areas and their perceived teacher effectiveness, as well as how perceived teacher effectiveness is associated with students' mathematical interests. Findings revealed that students in rural areas had high mean scores in mathematics interests and also reported that their mathematics teachers were effective in mathematics teaching, especially in subject mastery and classroom management. However, they noted that their teachers were ineffective in ensuring productive relationships with students and using instructional materials to teach mathematics. Students reporting high interest in mathematics align with similar studies showing that rural students' interests in mathematics are measured comparatively with their urban counterparts (Rajak, Gayen, 2022; Vandana, 2014). These studies reported that students had high mean scores in their interest in mathematics and that their interest in rural and urban areas did not differ significantly. However, some studies (Acharya, Poudel, 2016; Ayub et al., 2016) have also reported contradictory findings when rural students' mathematics interests are compared with urban students'. They demonstrated that students in urban areas were more interested in mathematics than those in rural areas. Although our current findings are comparable to those listed above, they differ from them since our study did not focus on the urban-rural interest divide.

In addition, students also stated that their mathematics teachers were effective in teaching mathematics, particularly in the areas of subject mastery and classroom management, but not in the areas of fostering positive relationships with students or the use of teaching aids. Our findings regarding students' perceptions of teachers' expertise in the field go against those of Tshabalala and Ncube (2012), who claimed that pupils in rural areas of the Nkayi District had an unfavourable opinion of their teachers' subject knowledge. In our survey, teachers were evaluated as having a strong understanding of mathematics and being able to convey that knowledge authoritatively. Although there is little research on how rural and urban students perceive their teachers' ability to manage the classroom in mathematics, a similar study that compared the perceptions of rural and urban students revealed that rural students have a moderate perception of their teachers' management skills (Rajoo, 2011). This finding is consistent with our current finding that teachers controlled their classrooms during the teaching and learning process in mathematics. Rural students perceived their teachers as being able to maintain orderliness before and during mathematics teaching. It also reflected that teachers possess the pedagogical competence to retain students' engagement during mathematics lessons. Conversely, students rated their teachers poorly in fostering positive relationships with students or using teaching aids, which are critical components of teacher effectiveness. Poor student-teacher relationships might suggest teachers' inability to invest time and energy in building productive relationships with their students. This could be inimical to students' mathematics achievement since research has shown that it is critical in enhancing the mathematics achievement of rural students (Adams, 2012). More so, teachers being rated poorly by rural students on effective instructional materials may reflect the resource-

constrained contexts in which mathematics teachers in rural schools operate (Adenuga, Adeniran, 2022; Nworgu, Nworgu, 2013). This could be a hindrance to the concretization of abstract aspects of mathematics.

Looking at the relationships existing between the composites of teacher effectiveness and rural students' mathematics interests, all the dimensions - subject mastery, effective classroom management, student-teacher relationship and efficient use of instructional materials – were significantly and positively related to students' interests in mathematics. This implies that the higher the teachers' subject mastery, effective classroom management, student-teacher relationship and efficient use of instructional materials, the higher the mathematics interest of rural students. The regression analysis revealed that the dimensions of teacher effectiveness had a joint positive significant relationship with students' mathematics interest after controlling for gender. This is consistent with relevant literature, which has shown that effective mathematics teaching can motivate students to engage in mathematics and improve their attitude towards mathematics (Akram, 2019). This can be explained from the evidence in literature that effective teachers have mastery of their subjects, have confidence in teaching, are effective in classroom management, and can build effective relationships with students (Mbaye, 2017).

The student-teacher relationship and good classroom management had the strongest individual positive effects on students' interest in mathematics when the components of teacher effectiveness were disentangled. Researchers have highlighted that instructors' social-emotional support behaviors strongly influence students' perceptions of good-quality relationships with their teachers (Prewett et al., 2019). However, studies in this area targeting rural pupils are still lacking. Our results align with those of Anderson and Chambers (2020), who found that children from low-income homes who felt their teachers were helpful and compassionate experienced improvement better than their peers. It is possible that positive relationships between the teacher and the students can foster a sense of belonging, which can increase students' mathematics interests, thereby enhancing their overall mathematics learning experience. Efficient use of instructional materials negatively predicted students' interest in mathematics, although it positively correlated with students' interest in the bivariate relationship analysis, indicating possible interaction and covariance with other variables. A thorough examination of the bivariate relationship analysis reveals that student-teacher relationships and efficient use of instructional materials correlate highly. It could be that they occur together even though they represent distinguishable constructs. It is plausible that accounting for the student-teacher relationship in the multiple regression model undid the positive significant relationship observed in the bivariate relationship analysis. This must be taken into consideration in the interpretation of these findings and should not be taken as being a negative predictor of students' mathematics interests.

The classroom management of teachers significantly influenced rural students' interest in mathematics. This suggests that efforts made by teachers to prevent disruptions in their courses while mathematics is being taught could increase students' interest in mathematics. Therefore, controlling students' behavior for efficient learning may increase their interest in mathematics. Understanding the potential impact classroom management could have on students' mathematics performance, Ahmad and Setyaningsih (2020) undertook a study to investigate students' perceptions of classroom management by mathematics teachers. According to their findings, students had a favorable opinion of how their teachers handled the classroom. Similar findings were made by Dijk et al. (2019), who found that teachers' classroom management directly impacted students' motivation for learning mathematics while also indirectly impacting their mathematical achievement.

Furthermore, Kunter et al. (2007) had shown a positive correlation between teachers' classroom management and students' interests in mathematics. Although few studies have looked into the connection between teachers' classroom management and students' interest in mathematics, particularly in the rural setting, the current findings that show a positive relationship impact of classroom management on mathematics interests could be explained based on the fact that a well-managed classroom may produce an ambient environment that may encourage students' engagement in mathematics. Even though it has a substantial association with students' interest in mathematics, teachers' mastery of the subject did not predict their interests. This runs counter to earlier research that showed instructors' subject-matter expertise to strongly predict students' mathematics achievement, especially among students in rural locations (Marshall, Sorto, 2012).

Our study has made significant contributions to knowledge. First, it closed the existing gap in the literature on how teacher effectiveness could impact the mathematics interests of students in rural communities in Nigeria. Second, the fact that we unbundled the components of teacher effectiveness contributed to understanding which components would deserve more attention than the others in advancing the mathematics interests of students in rural areas. In spite of the contributions mentioned above, the fact that our study is a cross-sectional research study, which makes it difficult to obtain a causal relationship between teacher effectiveness and students' mathematics interests, may limit the generalizability of our findings. Also, the low response rate in filling in the questionnaire could impact the validity of the inferences that could be drawn from the findings. However, current literature demonstrates that low response rates may not necessarily lead to biased inferences, especially when multivariate models are used (Rindfuss et al., 2015).

5. Conclusions and Implications for Rural Mathematics Education

Our study found that students in rural areas had a high interest in mathematics. They also reported that their mathematics teachers were effective in teaching mathematics, particularly in subject mastery and classroom management, but less so in ensuring a positive relationship with students and using teaching resources. Mathematics interest among students was positively correlated with student-teacher relationships and instructors' classroom management abilities in rural areas. Therefore, we draw the conclusion that affective aspects of teacher efficacy are crucial for stimulating rural students' interest in mathematics.

Our findings are significant for rural mathematics education because teachers lacking a strong rapport with their students may jeopardize their interest in mathematics learning. Therefore, the curriculum for mathematics teacher education should be designed to contain content that will help mathematics teachers develop supportive roles and relationships. The utilization of teaching resources by teachers, as reported by students, has numerous consequences for rural mathematics. It can imply that teachers in rural areas struggle with a lack of resources and don't regularly use teaching aids for mathematics. This shows that mathematics teachers in rural areas can have trouble making abstract mathematical concepts concrete. More specifically, the positive relationships between student-teacher relationships, teachers' classroom management practices, and rural students' mathematical interests highlight the necessity of emphasizing teacher affective, managerial, and motivational skills in teacher education and professional development, particularly for mathematics teachers who want to work with rural students.

6. Declarations

Ethics approval and consent to participate

Our data-gathering procedure adhered to the ethical guidelines for behavioural sciences data collection and was in line with the Helsinki Declaration of 1964. We discussed the purpose of our study with the school authorities and got their approval to conduct the study in the schools.

Consent for publication

Not applicable.

Availability of data and materials

Data and materials associated with this study are available upon request.

Conflict of interest statement

The authors of the manuscript declare that there is no conflict of interest, and all reference materials were duly acknowledged.

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