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Teacher's empathy as correlate of mathematics achievement among senior secondary school students in Oyo State, Nigeria

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Abstract

This study investigated the correlation between teachers' empathy and students' mathematics achievement among Senior Secondary School students in Oyo State, Nigeria. Despite the importance of mathematics in scientific and technological development, students' persistent underperformance in the subject remains a pressing issue. While numerous studies have examined factors influencing mathematics achievement, limited attention has been given to the role of teachers' empathy. A correlational research design was adopted, involving 490 Senior Secondary School 2 (SS2) students across six secondary schools in Ibadan North and Egbeda Local Government Areas. Data were collected using the Students' Perception of Teachers' Empathy Questionnaire (SPTEQ) (r = 0.81) and a Mathematics Achievement Test (MAT)(KR20 = 0.7). The analysis was conducted using Pearson Product-Moment Correlation. Findings revealed that 43.7% of students perceived their teachers' empathy as low, 19% as medium, and 37.3% as high. Additionally, results showed a significant and positive correlation between teachers' empathy and students' mathematics achievement ($r = 0.1$, $p < 0.05$), suggesting that higher teacher empathy is associated with improved mathematics performance. This study concludes that fostering teacher empathy could enhance students' academic engagement and achievement. It recommends the implementation of training programs to improve teachers' empathetic skills and strengthen teacher-student relationships for better mathematics outcomes.

Keywords: Teachers' empathy, Mathematics achievement, Correlational study, Teacher-student relationship, Student Perception

Background to the Study

Mathematics as a discipline encompasses the study of numbers and shapes, serving as a fundamental pillar across various fields of knowledge. It is widely regarded as the science of magnitude and number, playing an indispensable role in virtually every domain. The significance of mathematics lies in its ability to cultivate problem-solving skills and foster critical thinking among learners, laying a sturdy foundation for numerous disciplines and careers. Akinoso (2011) underscores mathematics as the bedrock for scientific and technological advancements, emphasising its pivotal role in driving progress. Indeed, mathematics is often hailed as the universal language, serving as a conduit for communication and understanding across cultures and disciplines. Its mastery is imperative for academic success and extends to practical applications in daily life, from financial management to the facilitation of technological innovations.

Mathematics achievement stands as a crucial component of academic success in today's era. Hussein M., Ow, S., Elaish, M., and Jensen, E. (2022) delineate achievement as the quantifiable measure of accomplishment within a specific realm of study, emphasizing the demonstration of students' abilities to reach prescribed levels of instructional objectives stemming from their classroom learning and experiences. Schoenfeld and Kilpatrick (2008) expound on mathematical achievement by defining it as the proficiency exhibited by students in the domain of mathematics. This proficiency encompasses the application of acquired knowledge, understanding, skills, and techniques within the subject, reflective of a particular stage of learning. The yardstick for mathematical achievement typically manifests in students' scores on mathematics achievement tests. Indeed, mathematical achievement serves as a linchpin for success across numerous professions, underlining its significance beyond

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the classroom. As such, the cultivation of mathematical proficiency holds considerable weight in preparing individuals for diverse career pathways and contributing to their overall academic attainment.

However, mathematics presents a significant hurdle for many students, stemming from a variety of factors that impede their ability or willingness to overcome it. Yet, the importance of mathematics cannot be overstated, as it serves as a foundational element for progress in virtually all fields driven by science, engineering, and technology, ultimately shaping future employment prospects (Everingham, Gyuris, and Connolly, 2017). This ordeal and the poor performance of students in mathematics have been attributed to several factors. Several researchers have delved into the reasons behind the persistent poor performance in mathematics. One commonly cited factor contributing to students' inability to attain the necessary proficiency in mathematics is a phenomenon known as mathematical anxiety (Everingham, Gyuris, and Connolly, 2017). Dugger (2021) has linked poor mathematics performance to the unfair distribution of qualified teachers across the country, while Odhiambo (2021) argues that the root cause lies in the inadequate preparation of teachers. Additionally, factors such as ineffective teaching methods, insufficient mathematics resources, school environment, parental influence, and peer pressure have also been identified as contributing elements. These factors are typically categorized as parental, teacher, and student-related factors. In the light of these considerations, this study investigated the relationship between teachers' empathy and mathematics achievement.

Research has emphasised the crucial role of instructors in influencing students' learning and accomplishment in school. Teacher empathy is a crucial element in building a supportive and inclusive educational atmosphere. The perceptions students and teachers have of one another substantially affect learning outcomes. Lumpkin (2007) observed that pupils who regard their teachers as compassionate tend to demonstrate elevated motivation and academic achievement relative to those lacking a connection with their educators. Furthermore, Göncz (2017) asserts that teaching is intrinsically linked to the teacher's personality, which subsequently influences the learning environment encountered by pupils. The learning environment, as emphasised in studies, is a crucial factor influencing students' academic achievement. Thus, it is unsurprising that Lakshmi and Paul (2018) recognise empathy as a fundamental teacher attribute that significantly impacts the teaching and learning environment. Teacher empathy significantly enhances students' emotional well-being and academic engagement and accomplishment.

Empathy encompasses the ability to understand and connect with the emotions and experiences of others. It entails comprehending the emotions of others, perceiving situations from their viewpoint, and imagining oneself in their circumstances. Empathy fundamentally involves immersing oneself in another person's situation and experiencing their emotional state. Empathy encompasses both the comprehension and sharing of other people's emotions, as well as the proper response to them. It necessitates a deep intellectual and emotional understanding of another individual's circumstances, acting as a crucial prerequisite for several forms of adaptive social engagement. Empathy cultivates intimacy with others, thereby acting as a fundamental element of interpersonal connections. Its importance resonates throughout all aspects of human interaction, including the educational environment. Empathy is essential for fostering meaningful relationships, with its benefits resonating across various settings, including educational institutions.

In education, it is clear that educators at all levels must demonstrate an adequate degree of empathy to effectively comprehend their students (Vaquier L. Pérez, V, and González, M. 2020). Pavarini and Souza (2010; as quoted by Vaquier et al., 2020) assert that empathy is an evolutionarily significant trait essential for promoting cohesion in human communities. Empathy possesses considerable educational significance, unlike pity. Sympathy is an interpersonal emotional tendency marked by

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spontaneity and mutuality, whereas empathy encompasses an emotional understanding of others that may not be reciprocal or spontaneous. Empathy has received considerable focus in multiple disciplines, including philosophy, theology, psychology, and ethology. Empathy is particularly significant in education, especially for teacher-student relationships (Wang, L., and Zhang, J. 2019). Educational psychologists have increasingly concentrated on identifying elements that facilitate effective learning and instruction, with empathy recognised as a crucial aspect of successful teaching methodologies.

Empathy is essential for fostering open and effective communication between students and teachers. This capability relies on emotional intelligence that allows educators to perform their professional duties proficiently. Through empathising with their students, teachers acquire insights into the fundamental motives influencing student behaviour, enabling them to design techniques that more successfully assist and engage their students. Studies indicate that elevated empathy enhances efficiency in collaborative learning and professional settings. Furthermore, empathy within educational environments has demonstrated beneficial impacts on academic achievement (Barr, 2011). Consequently, cultivating empathy in educators not only augments their capacity to engage with kids but also facilitates enhanced learning outcomes and overall academic success.

In the realm of education, empathy is essential for creating profound connections, building rapport, and promoting acceptance among individuals. This study asserts that fostering teacher empathy in the classroom is an effective pedagogical strategy for improving teacher-student interactions, advancing holistic education, and reducing negative incidents like school violence and bullying. Multiple researches such as McAllister, Irvine, Yalvac, among others have shown the crucial importance of empathy in effective teaching methodologies (McAllister and Irvine, 2002; Arghode V., Yalvac, B., and Liew, J., 2013). Teacher empathy involves educators' ability to comprehend and resonate with their students' emotional experiences in the academic environment. Teacher empathy denotes educators' capacity to comprehend and resonate with the feelings and experiences of their pupils, fostering a helpful and nurturing educational atmosphere. Teacher empathy encompasses educators' ability to identify and address the ideas, emotions, and needs of their pupils, thereby cultivating strong teacher-student interactions and improving student well-being. Arghode et al. (2013). Teacher empathy is defined by educators' expression of understanding, acceptance, and validation of students' viewpoints, feelings, and obstacles, fostering a sense of belonging and trust in the classroom. Teacher empathy is educators' readiness and capacity to interact compassionately with students' varied backgrounds, experiences, and cultural contexts, hence promoting inclusive and culturally responsive teaching methods. Teacher empathy encompasses educators' deliberate actions to establish a secure and nurturing learning atmosphere in which students feel acknowledged, esteemed, and comprehended, hence improving student engagement, motivation, and academic performance.

The crucial impact of teachers' empathy on pupils' success in mathematics is undeniable. Research underscores the significance of instructors' empathic behaviours in cultivating healthy teacher-student connections and establishing supportive learning environments. Empathetic educators are more adept at comprehending the many demands and obstacles faced by their pupils, particularly in relation to mathematics acquisition. A study by Ayodele and Aremu (2018) identified a favourable association between instructors' empathy and pupils' mathematics performance in Nigerian secondary schools. Educators exhibiting elevated empathy levels were more proficient in accommodating students' learning styles and delivering tailored assistance, resulting in enhanced academic achievement in mathematics.

Moreover, the impact of instructors' empathy goes beyond academic results. Goroshit and Hen (2016) asserted that empathic educators foster a secure and supportive classroom atmosphere in which students felt appreciated, comprehended, and inspired to participate actively in

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mathematics learning. The empathy of teachers markedly affects pupils' performance in mathematics in Nigeria. Empathetic educators enhance academic achievement by comprehending students' needs, delivering tailored assistance, and cultivating strong teacher-student connections. Furthermore, they are crucial in fostering students' socio-emotional growth, establishing supportive learning environments, and improving overall well-being. Aldrup, K., Carstensen, B., and Klusmann, U (2022) reported that teachers' empathy is crucial in educational settings, facilitating inclusive teaching methods, fostering positive teacher-student connections, and improving student well-being. Fostering empathy among educators is crucial for establishing supportive and loving educational settings in which all students feel appreciated and comprehended. Educators may cultivate an inclusive and sympathetic classroom environment that improves student engagement and academic achievement by emphasising empathy in teacher training programs and implementing measures to encourage empathetic interactions.

Statement of the Problem

The poor academic achievement of students in Mathematics has been a great concern to all educational stakeholders in the country. This has led to a public outcry that calls for urgent attention because of the importance of mathematics to national development. In Nigeria, mathematics as a subject is made compulsory at both primary and secondary school levels of education because of its importance. Despite its importance to individuals, and national, technological, and economic development, the performance of students over the years has been unimpressive. Its teaching and learning as well as the diminishing interest of students in the subject had posed a lot of concerns.

Research has shown that the poor performance of students in mathematics has been attributed to several factors among which are poor teachers' pedagogical skills, mathematical anxiety, lack of teaching materials, students' attitude to learning mathematics, and so on. However, the results of students in mathematics are still below average.

There have been few studies that have looked at teachers' empathy as a correlate of students' achievement in mathematics. Therefore, this study is designed to correlate teachers' empathy and students' mathematics achievement.

Research Questions

This study intends to answer the following research questions

1. What is the level of students' perception of teachers' empathy?
2. What is the strength and direction of the relationship between teachers' empathy and student mathematics achievement?

Scope of the Study

This study covers all Senior Secondary 2 Students (SS2) in Ibadan, Oyo State, Nigeria. The study was limited to six senior secondary schools across two local governments; Ibadan North and Egbeda Local Government Areas. The study established how teachers' empathy correlates with students' achievement in mathematics.

Significance of the Study

The findings of this study have significant implications for teachers, students, parents, and other stakeholders of educational policies and practices in Nigeria. By understanding the influence of teachers' empathy on students' achievement in mathematics, teachers can improve on their expected responsibilities that will enhance good mathematics achievement. Furthermore, this study will also give insight into further research on variables that are linked to mathematics achievement.

Methodology

This study adopts a non-experimental design of correlational research type. The design is appropriate because the study investigates and explains the relationship between teachers' empathy and students' mathematics achievement. The researcher is only interested in the relationship between these variables. The target population for this study was the senior secondary school 2 students that were drawn from public secondary schools across Ibadan North and Egbeda local governments in Ibadan, Oyo State.

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The study adopted a multistage sample procedure. The eleven local governments within Ibadan city have already been stratified into two namely; Ibadan metropolis and less city. Ibadan North (Ibadan metropolis) and Egbeda (less city) local government areas (LGAs) were purposively selected for the study from each stratum respectively as a result of the number of students to be used by the researcher because the high population of students of schools in these LGAs. The Senior Secondary 2 level of students were selected purposively in each of the schools because it is the preceding class to the certificate class and the students at this level had been taught by the teachers rated. An intact class of the senior secondary school 2 (SS 2) students were used in each school visited across all arms making a total of 490 students to have a good sample representation of the targeted population. The demographic data of the sample are shown in the tables below:

Table 1: Class categorization of respondents

Variable	Category	Frequency	Percent
Class Categorizations	Not Specified	69	14.1
	Science	264	53.9
	Commercial	51	10.4
	Arts	106	21.6
	Total	490	100

Table 1 reveals that the larger proportion of the respondents 53.9%(264) were science students, followed by art students 21.6% (106), while commercial students were the least 10.4% (51) and 14.1% (69) students did not specify their class.

Table 2: Distribution of respondents based on Sex

Variable	Group	Frequency	Percent
Sex	Male	166	33.9
	Female	324	66.1
	Total	490	100

Table 2 shows that the larger proportion of the participant of the study were females accounting for 66.1%(324) while 33.9%(166) were males.

Table 3: Age distribution of respondents

Variable	Group	Frequency	Percent
Age	12-14	137	28
	15-16	192	39.2
	17 -23	161	32.9
	Total	490	100

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Table 3 reveals that the larger proportion of the respondents 39.2%(192) were between age 15-16, followed by age group (17-23) 32.9% (161), while age group (12-14) was the least 28 % (137). This shows that the youngest among the respondents was 12 years old while the oldest was 23 years old.

Two instruments were administered to the respondents of the study: Students' Perception of Teachers' Empathy Questionnaire (SPTEQ) and Mathematics Achievement Test (MAT).
The Students' Perception of Teachers' Empathy Questionnaire (SPTEQ) was used to measure the students' perception about teachers' empathy. Students' Perception of Teachers' Empathy Questionnaire (SPTEQ) of Likert type was were administered to the respondents to measure their perception of teachers' empathy. The questionnaire has two sections. Section A contains the demographical data of respondents which includes student' class, sex, and age. Section B contains 30 items on empathy. Mathematics Achievement Test (MAT) consists of 30 multiple-choice items that were used to measure students' achievement which was correlated to teachers' empathy.
The instruments were submitted to at least two experts in the Institute of Education, University of Ibadan for face, content, and construct validity. The reliability of the Students' Perception of Teacher's Empathy Questionnaire (SPTEQ) was established using Cronbach alpha to measure the internal consistency of the items, and the reliability coefficient of the instrument was found to be 0.81 while the Mathematics Achievement Test (MAT) was pilot-tested and the reliability coefficient level was estimated to be 0.7 using Kuder Richardson (KR-20).
The procedure for data collection included a letter of introduction collected from the Head of the Institute of Education, International Centre for Educational Evaluation (ICEE) which was taken to the principals of each school to be sampled to gain approval for the schools selected. The selected schools were visited to seek permission from the school authorities and to get informed consent from the students. The Student Perception of Teachers' Empathy Questionnaire (SPTEQ) and Mathematics Achievement Test (MAT) were administered to students with the help of research assistance. The data collected for the study was analyzed using Pearson Product-Moment Correlation at a 0.05 level of significance.

Results

Research question 1: What is the level of students' perception of teachers' empathy?

Table 4: Descriptive analysis of the level of students' perception of teachers' empathy

Teacher Empathy		
Levels	Frequency	Percent
Low	214	43.7
Medium	93	19
High	183	37.3
Total	490	100

Table 4 shows a descriptive breakdown of the student perception about teachers' empathy among participants. Out of a total sample size of 490 students, the majority of students perceived their teachers' empathy at a low level, constituting 43.7% (214 students). This indicates that a significant portion of students felt that their teachers demonstrated minimal empathy in their interactions. However, 37.3% (183 students) of the participants perceived a high level of empathy from their teachers, suggesting that a considerable proportion of students were supported by their teachers and taught compassionately. A smaller proportion, comprising 19% (93 students), reported a medium level of empathy from their teachers. This category represents students who perceived some degree of empathy but perhaps felt it was not consistently or strongly demonstrated. Therefore, the findings highlight a varied outcome of students' perceptions regarding their teachers' empathy, with a

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significant number feeling that there is room for improvement in the empathetic engagement displayed by their teachers.

Research question 2: What is the strength and direction of the relationship between teachers' empathy and student mathematics achievement?

Table 5: Pearson correlation analysis showing the relationship between student mathematics achievement and teachers' empathy

		Student Mathematics Achievement	Teacher Empathy
Student Mathematics Achievement	Pearson Correlation	1	
	Sig.(2tailed)		
	N	490	
Teacher Empathy	Pearson Correlation	.105*	1
	Sig.(2tailed)	0.02	
	N	490	490

*Correlation is significant at 0.05 level (2-tailed).

The result displayed in Table 5 shows the correlational matrix between students' mathematics achievement and teacher teachers' empathy. The result revealed that there is a significant and positive correlation between student mathematics achievement and teachers' empathy ($r = 0.1, p < 0.05$). This implies there is a statistically significant relationship between student achievement in mathematics and teachers' empathy although at a very weak correlation level. This coefficient suggests that as teachers' empathy levels increase, there is a slight tendency for student mathematics achievement also to increase.

Discussion of Findings

The significant and positive correlation between students' achievement in mathematics and teachers' empathy in this study aligns with the assertion of Adeyemi, and Okoli, (2019), Ogunyemi and Ibrahim (2020), Adebayo and Okeke (2018), Abdullahi and Musa (2017), and Abubakar and Ahmed (2016), who found that significant positive relationship between teacher empathy and mathematics achievement among urban secondary school students in Nigeria. These studies collectively emphasize that students who perceive their teachers as empathetic tend to perform better in mathematics. This result is also in terms with Schonert-Reichl, Blom, Ripoll-Gallardo, and Leloup, (2015) who stated that a positive correlation exists between teacher empathy and student motivation, engagement, and academic performance. For instance, Ogunniyi and Olubiyi (2020) reported that empathetic teachers understand and respond to students' needs, fostering positive teacher-student relationships and enhancing academic performance. The result also confirms the assertion of Abdullahi and Musa (2017) that high school students with highly empathetic teachers had higher mathematics achievement scores compared to those with less empathetic teachers. The result also agrees with Astor, V., Benbenasty, J., and Borkowski, J. G. (2011) who found that students with teachers who scored high on measures of empathy demonstrated higher levels of academic achievement compared to students with less empathetic teachers.

Conclusion

Drawing from the summary of the findings, it could be concluded that teachers' empathy influences students' mathematics achievement hence teachers should be empathetic in their teaching in order to create a more robust and conducive environment for learning.

The following recommendations were made to

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improve students' achievement in mathematics

Recommendation

- Teachers are to improve their level of empathy for the students both within and outside the classroom as this will encourage a conducive learning environment which will foster positive teacher-student relationships and enhance academic performance.
- Educational stakeholders should look into factors that enhance teachers' empathy and ensure that the level of mathematics teachers' empathy is improved since this study revealed that teachers' empathy significantly contributes to students' achievement in mathematics.

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