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Original Research

Teacher Bullying and Mathematics Attainment: The Mediating Roles of Psycho-Socio-Emotional Factors in South-East Nigeria (Path Analysis)

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ABSTRACT

This study investigated teacher bullying and mathematics attainment: The mediating roles of psycho-socio-emotional factors in South-East, Nigeria. The study adopted the ex-post facto research design with a sample of 2,150 Senior Secondary School Students who reported teacher bullying, had low math scores, and received counselling from their school counsellors based on their experience of bullying. Ten valid instruments have been used. Two research questions were answered at the 0.05 level of significance. Data were analysed using multiple regression (backward solution) and path analysis. The result revealed in order of magnitude shows that emotional intelligence had the highest mediating effect (16.48%) on mathematics attainment of secondary school students bullied by teachers. This is followed by self-esteem (15.65%); readiness to learn (15.22%); self-efficacy (14.83%); interest in schooling (14.83%); teacher-student consultation (13.57%) on mathematics attainment of secondary school students bullied by teachers. Also, the entire psycho-socio-emotional mediating factors were shown to contribute differentially to the mathematics attainment of secondary school students bullied by teachers. Specifically, emotional intelligence mediated most significantly to the explained variation on mathematics attainment ($\beta = 0.23$, $p < .001$). This is followed in magnitude of beta weights by mathematics anxiety ($\beta = 0.18$, $p < .01$); self-efficacy ($\beta = 0.16$, $p < .05$); teacher-student consultation ($\beta = 0.08$, $p < .05$); Interest in school ($\beta = 0.08$, $p < .05$); Readiness to learn ($\beta = 0.06$, $p < .05$). However, the mediating effect of self-esteem ($\beta = -0.04$, $p < .05$), dejection ($\beta = -0.02$, $p < .05$) and achievement motivation ($\beta = -0.02$, $p < .05$) were not significant on mathematics attainment of students bullied by their teachers. Therefore, it was recommended that mathematics teachers in secondary schools should endeavour to use appropriate teaching methods and communication skills that would address the learning and developmental needs of students.

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1. INTRODUCTION

The acquisition of mathematical skills and knowledge is fundamental for daily human survival and societal development. It is crucial for technological advancement to be a significant constituent of numerous technologies used daily to make informed decisions needed to solve complex societal developmental problems (Okoiye et al., 2013). For example, technological creativity that made the use of internet connectivity, mobile phone, computer algorithms, and software to facilitate global communication, is made possible via the application of advanced mathematical concepts (Okoiye & Onah, 2024). Also, mathematics is the bedrock of every field of engineering, computer science, medical sciences, etc., and it is an influential tool that helps in facilitating economic growth, wealth creation, and sustainable development (Okoiye & Onah, 2024). Globally, competence in the application of mathematical skills enhances scientific advancement within nations, and Nigeria is no exception (Okoiye et al., 2013).

The crucial role mathematics plays in societal developmental dynamics cannot be overemphasized (Jayanthi, 2019; Okoiye & Onah, 2024). Competence in mathematics requires learners' readiness to learn, interest, passion, commitment, and resilience (Okoiye & Onah, 2024). Students' success in mathematics is not dependent only on skills and ability, but also on their self-belief and social cognition (Aleta, 2016). However, secondary school students' ability to develop the mathematical competence required for self and national development can be impaired by teachers' bullying during teaching and learning interactive experiences. Yu and Zhao (2021) established a negative correlational relationship between teachers' bullying and students' mathematics attainment. Rusteholz et al. (2023) study on community school students in Madrid, Spain, reported lower achievement in mathematics by students who experience bullying.

A positive link is established between mathematics problem-solving skills, thinking, competence, and teachers' encouragement (Ünal, 2017). A student is said to be bullied by the teacher when the teacher repeatedly subjects them to negative, intentional verbal, emotional, or physical actions that impair their psycho-socio-emotional and intellectual well-being (Olweus et al., 2019). Documentation in literature specifies that in Africa, bullying prevalence against secondary school students is between 16% and 63% (Biswas et al, 2020). High rates of bullying prevalence of 40.1%, 44.5%,54.6%, and 62.8% have been reported in Ghana, Malawi, and Sierra-Leone (Kubwalo et al., 2013). However, in Nigeria, Ismail et al. (2021) conducted a cross-sectional study in Sokoto state, Nigeria, that investigated the types and predictors of bullying perpetration among adolescents in secondary schools. They used a multistage sampling technique to select 390 adolescents and binary logistic regression and chi-square to examine the prevalence and predictors of bullying at a 5% level of significance. They found that the most prevalent type of bullying perpetrated was verbal [69.7%; 95% CI = 64.9-74.3%]. Overall, 307 among the selected adolescents [78.7%; 95% CI = 74.3-82.6%] had perpetrated at least one type of bullying.

Obioha et al. (2024) conducted a study in Nsukka, Nigeria, on interparental violence and school bullying among Nigerian adolescents: Moderating role of psychological resilience using a total of 609 senior secondary school students. They reported that interparental violence was positively associated with victimization and perpetration, while psychological resilience was positively associated with perpetration but not victimization. The study concludes that exposure to interparental violence is a potentially strong risk factor for bullying and should be taken into consideration by school psychologists and other stakeholders to reduce bullying behaviors among students. Ogboghodo et al. (2018) conducted a study that assessed and compared the knowledge, perception, and practice of bullying amongst in-school adolescents in urban and rural settings in Edo State, Nigeria. They employed a comparative cross-sectional study design, and participants for the study were selected using a multi-stage sampling technique from among students within urban and rural secondary schools in Edo State. Data was collected using a pre-tested structured interviewer-administered questionnaire comprising both open and closed-ended questions and analyzed using IBM SPSS version 21.0 software. The level of significance was set at $p < 0.05$. They found that urban respondents had better knowledge ($p<0.001$), better perception ($p=0.012$), and higher prevalence of bullying ($p<0.001$) compared to the rural respondents.

Tolu-Kolawole Deborah, a Punch Newspaper reporter in Nigeria, on 19th August (2021), gave a vivid report of a disheartening incident of teacher bullying in Government Secondary School, Kwali, Abuja, where a teacher beat and killed a 13-year-old JSS 2 student. The boy was flogged beyond limits by his teacher because he did not do his academic class assignment. These bullying incidents indicate that in Nigeria, bullying is a major issue of concern (Ighaede-Edwards et al., 2023) because it impairs not only the psycho-emotional and intellectual well-being of affected students, but it can also lead to the death of victims. Literature indicates that previous researchers in Nigeria have conducted studies on bullying, projecting prevalence and predictors of bullying, and the moderating role of psychological resilience using either a cross-sectional design and multi-stage sampling techniques on secondary school students. However, to the best of my knowledge, no previous studies have considered teachers as a bullying factor or the implications of teacher bullying on the academic attainment of students. Also, there is no known study in Nigeria that has used path analysis to investigate

teacher bullying and mathematics attainment while looking into the mediating roles of psycho-socio-emotional factors. This observed dearth in research on teacher bullying and mathematics attainment, despite the fact that it exists, is a necessary gap to fill. Therefore, to bridge this gap, this study focused on teacher bullying and mathematics attainment: The mediating roles of psycho-socio-emotional factors in South-East, Nigeria (path analysis). This approach would add to the body of literature as people would be informed of the fact that teacher bullying can make psycho-socio-emotional factors (dejection, achievement motivation, self-esteem, mathematics anxiety, self-efficacy, readiness to learn, interest in school, teacher-student consultation, emotional intelligence) have proportionate direct and indirect effects, mediating effects on the mathematics attainment of students bullied by teachers.

1.1. Problem statement

The inability of students to develop coping skills that would enable them to manage and overcome the trauma associated with teachers' bullying can make their learning and school experience frustrating and overwhelming, with apprehension. This negativity can make students who are victims lose interest in schooling, become unmotivated, and perform poorly in academic tasks. This, in turn, could impair students' emotional well-being, attitude to school, and undermine their academic motivation. Thus, negative motivation and lack of interest in school could stimulate the possible occurrence of students' poor academic performance and perhaps, eventual disengagement from school.

1.2. Present Study

The present study utilized a multiple hypothesized causal model (Figure 1) to investigate teacher bullying and mathematics attainment: The mediating roles of psycho-socio-emotional factors in South-East, Nigeria. Therefore, I built a confirmatory causal model to establish the linkages between the explanatory and the criterion variables in Figures 2 and 3.

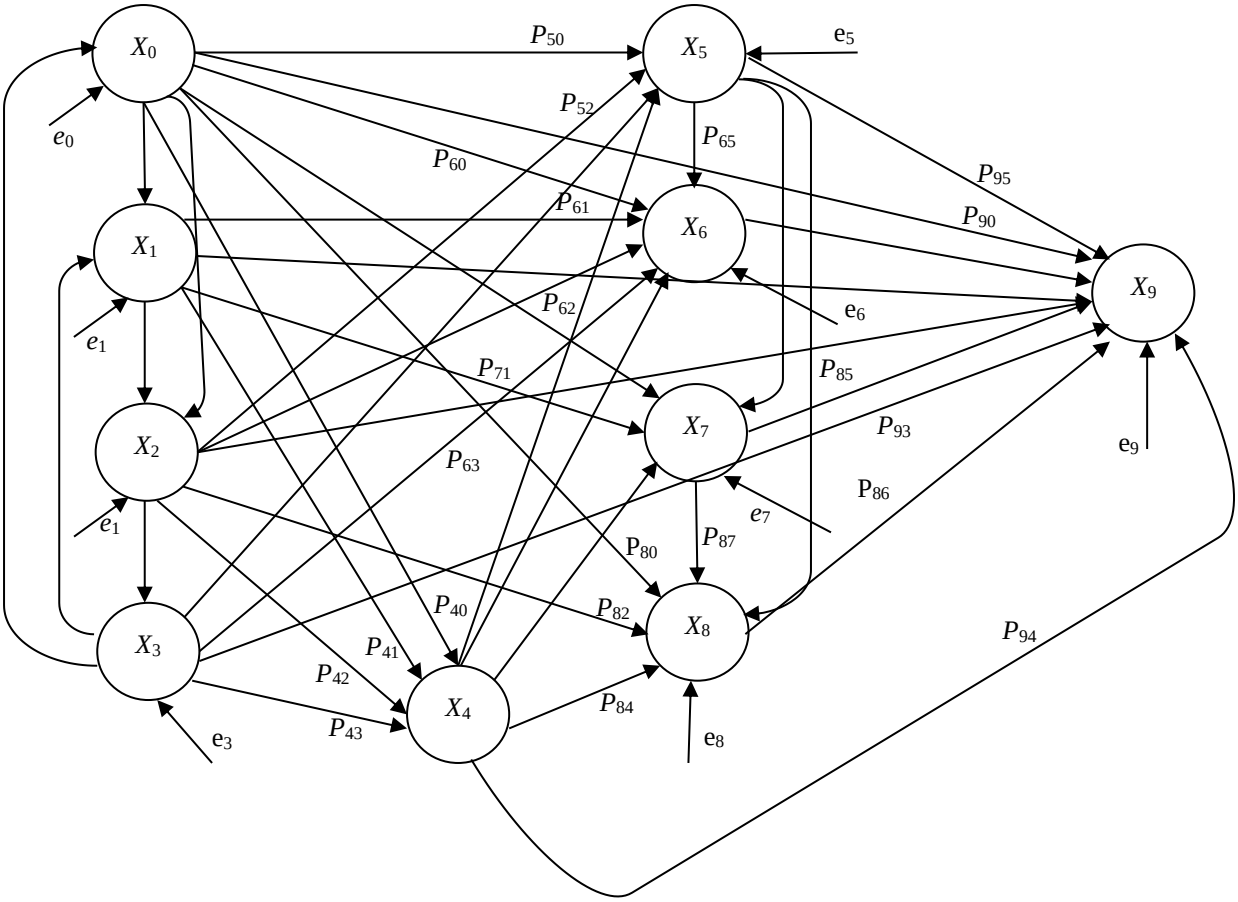

Figure 1. Hypothesized Causal Model

Figure 1 shows the hypothesized causal model relating to dejection, achievement motivation, self-esteem, mathematics anxiety, self-efficacy, readiness to learn, interest in school, teacher-student consultation, and emotional intelligence with teacher bullying on students' mathematics attainment.

X_0 = Dejection

X_1 = Achievement Motivation
X_2 = Self-Esteem
X_3 = Mathematics Anxiety
X_4 = Self-efficacy
X_5 = Readiness to Learn
X_6 = Interest in School
X_7 = Teacher-Student Consultation
X_8 = Emotional intelligence
X_9 = Teacher Bullying

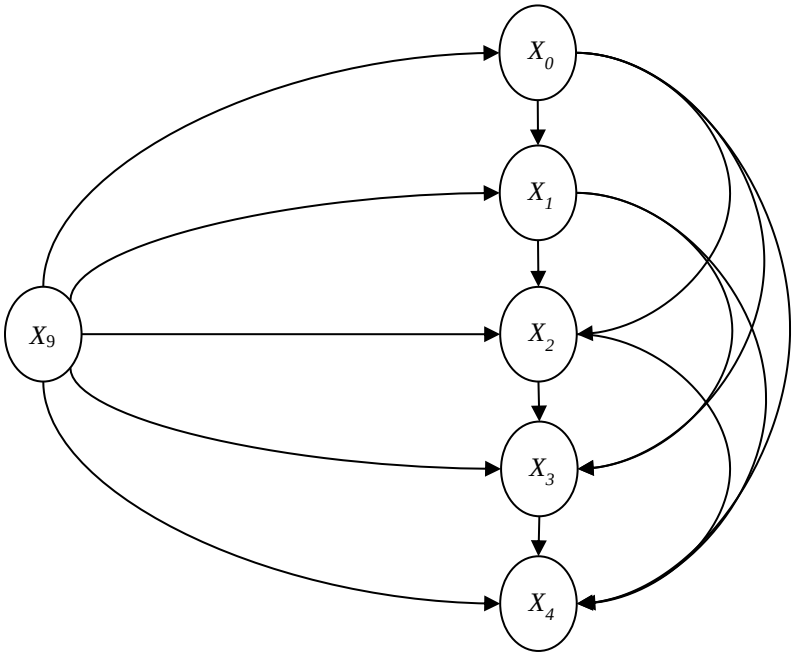

Figure 2. Interactions between teachers' bullying of students, dejection, achievement motivation, self-esteem, mathematics anxiety, and self-efficacy

From research findings, it was hypothesized that teachers' bullying ($X9$) influences the expression of depression and achievement motivation (X_0) (Nakamoto & Schwartz, 2010). Studies have also shown that teacher bullying (X_9) impairs achievement motivation (X_1) (Park et al., 2017). Literature documents that teacher bullying (X_9) negatively affects students' self-esteem (X_2) (van Geel et al., 2018). Also, literature revealed that teacher bullying (X_9) correlates with mathematics anxiety (X_3) (Halliday et al., 2021). Prior research has also found a significant relationship between teachers' bullying (X_9) and self-efficacy (X_4) (Goodboy et al, 2016). An illustration of the relationship between these variables is shown in Figure 2.

Teachers' bullying (X_9) has been found to significantly impair students' readiness to learn (X_5) (Huang, 2022). Also, Bowser et al. (2018) found that teacher bullying (X9) negatively affects students' interest in school (X_6). Likewise, teachers' bullying (X9), teachers' bullying behaviours (e.g., aggression, verbal assault) negatively predicted the quality of the teacher-student relationship over time (X_7) (Roorda & Koomen, 2021). Similarly, it is established that teacher bullying (X9) has devastating consequences on students' emotional well-being (X_8) (Huang & Vidourek, 2019). An illustration of the relationship between these variables is shown in Figure 3.

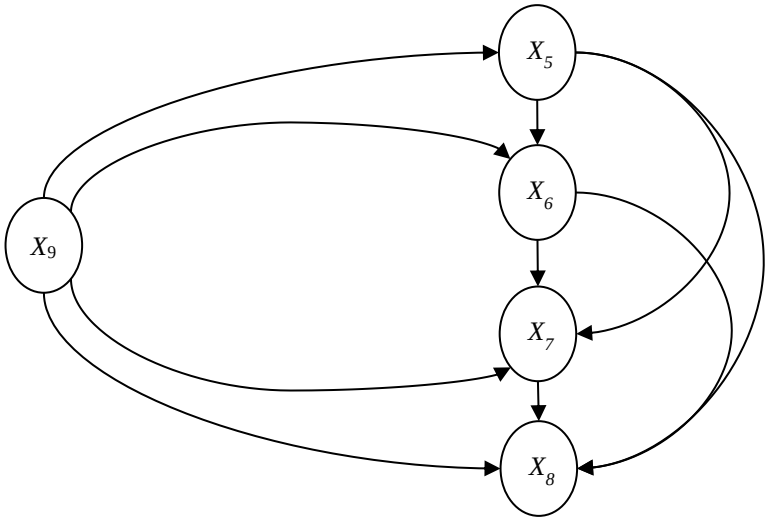

Figure 3. Interactions between teachers' bullying of students, readiness to learn, interest in school, teacher-student consultation, and emotional intelligence

1.3. Study objective

The main objectives of the study are to:

1. Determine the proportion of the total effect of (i) direct and (ii) indirect teacher bullying on the mathematics attainment of students based on mediating roles of psycho-socio-emotional factors through the use of path-analysis.
2. Ascertain the extent to which teacher bullying affects mathematics attainment based on the relative moderating roles of psycho-socio-emotional factors

1.4. Research Questions

Based on previous studies and associated theories, the following research questions were asked.

Research Question One: What is the proportion of the total effect of (i) direct and (ii) indirect teacher bullying on the mathematics attainment of students, based on the mediating role of psycho-socio-emotional factors (dejection, achievement motivation, self-esteem, mathematics anxiety, self-efficacy, readiness to learn, interest in school, and teacher-student consultation)?

Research Question Two: To what extent would teacher bullying affect mathematics attainment based on the relative mediating roles of psycho-socio-emotional factors (dejection, achievement motivation, self-esteem, mathematics anxiety, self-efficacy, readiness to learn, interest in school, and teacher-student consultation)?

2. REVIEW OF LITERATURE AND THEORETICAL FRAMEWORK

2.1. Review of literature

2.1.1. Teachers' bullying

Teachers in any educational system play fundamental roles in educational attainment and character formation of students. A strong association has been reported between teachers' behavioural conduct and students' motivation to learn. For instance, Erdoğdu (2013) posits that teachers' attitudinal dispositions are a significant factor that affects students' academic attainment in mathematics and other related subjects. Broeckelman Post et al. (2016) averred that teachers' belligerent and humiliating behaviour has a significant negative impact on students' academic attainment. Sürücü and Ünal (2018) affirmed that teachers' aggressive use of labelling and poor communication reduces students' enthusiasm to learn.

Teachers' bullying in the classroom has been associated with negative consequences on students' physical and mental health. Kelly et al. (2015) established the expression of psycho-emotional challenges, such as dejection and poor academic performance, among students bullied by teachers. Strøm et al.'s (2013) study in Norway confirmed that adolescents' experience of being bullied by a teacher is often associated with poor academic grades and maladjusted dispositions. The relationship between bullying, low self-esteem, and poor academic attainment in mathematics is well-documented in research (Okoiye & Asamaigo, 2011).

2.1.2. Dejection

Dejection is an expressed psycho-emotional sense of sadness by an individual that have a dislike for a particular life event or situation experience. For example, when teachers bully weak mathematics students, they can feel rejected and express emotional negativity as dejection (Romero-Canyas et al., 2010a). Consistent poor performance in mathematics can trigger feelings of helplessness among bullied students (Beaudoin et al.,

2024), make them exhibit poor problem-solving capabilities, and become dejected (Beaudoin et al., 2024). A sense of dejection can arise based on interaction with the human social environment, and it is characterized by internalized negative emotions detrimental to an individual's general well-being (Gilliom & Shaw, 2004).

2.1.3. Achievement motivation

Okoiye (2011) theorized that achievement motivation is a driving force that propels a learner to have a defined purpose and determination for success. Academic achievement motivation is a psychological phenomenon that stimulates positive goal-oriented behaviour (Okoiye et al., 2016). Awan et al. (2011) affirmed that low achievement motivation is a big barrier that can prevent quality learning and influence poor academic attainmentTeachers bully on students correlates negatively with reduced achievement motivation and poor attainment in mathematics (Oliveira et al., 2018).

2.1.4. Self-esteem

Bullying causes mental health challenges (Balluerka et al., 2023) and negatively damages victims' confidence and self-esteem (Moon & Mello, 2021). Self-esteem is a psychological construct that projects a person's confidence in his or her self-worth, values, capability, and life competence. Okoiye and Asamaigo (2011) found that low self-esteem triggers feelings of helplessness and impairs students' learning focus in class. Students with low self-esteem often have a poor sense of self-worth and are more likely to be unhappy with themselves and others (Balluerka et al., 2023). Bullied students are often helpless with psychological challenges and poor performance in school (Sigurdson et al., 2015).

2.1.5. Mathematics anxiety

Graham (2025) stated that school bullying is a fundamental gateway for low achievement in mathematics tasks. Among lots of damaging impacts, bullying and ill-treatment negatively affect student academic achievement (Murphy et al., 2022), including mathematics attainment (Carrasco et al., 2022). It weakens students' interest in acquiring mathematical skills and engagement in classroom academic learning tasks (Carrasco et al., 2022).

2.1.6. Self-efficacy

Self-efficacy is a psychological construct that implies a person's belief in their ability and capability to attain their desired plans and goals. The level of an individual's self-efficacy affects their everyday life experience. Strong sense of self-efficacy increases an individual's level of accomplishment and improves personal well-being. A highly self-efficacious individual sees challenges as normal for success (Bandura, 2010). In contrast, an individual with a low sense of self-efficacy sees challenges as a threat and tries as much as possible to avoid them due to a lack of confidence in their personal ability to succeed (Bandura, 2010). Mukminatien et al. (2019) affirmed that a significant correlation exists between bullying and a reduction in students' self-efficacy. Hidajat et al. (2020) and Menggo et al. (2023) stated that verbal bully abuse has deep effects on students' self-efficacy and academic attainment.

2.1.7. Readiness to learn

Teachers are significant authorities familiar with the implications of school bullying on students' readiness to learn and school attendance problems (Roorda & Koomen, 2021). The outcome of a cross-sectional study shows that bullied children are at risk of recording poor academic performance (Beran, 2009), increased absenteeism, and decreased interest in learning (Vaillancourt et al., 2013b). Significant negative correlation between being bullied, students' poor academic attainment, and lack of interest in engaging in daily school learning activities is evident even at kindergarten (Kochenderfer & Ladd, 1996) and continues into secondary school (Espinoza et al., 2013).

2.1.8. Interest in school

School can be a place of excitement and fun to be. But the prevalence of bullying has made school a scary environment, and as such, some victims lose interest in attending school. For example, a Norwegian study established that bullying experience in school is associated with the reason school adolescents attain poor grades and become uninterested in schooling (Strøm et al., 2013). The outcome of Nakamoto and Schwartz's (2010) meta-analytical review of 33 studies affirmed the negative correlation between school bullying, academic achievement, and the victim's lack of zeal to attend school.

2.1.9. Teacher-student consultation

Postulations of socialization theory affirm that the occurrence of positive teacher-student consultation is determined by the outcome of teachers' externalizing behaviours, that is, teachers' dispositions affect how students interact with them (Roorda & Koomen, 2021). Longitudinal study report indicates that teachers' bullying behaviours (e.g., aggression, verbal assault) negatively predicted quality of teacher-student relationship over time (Roorda & Koomen, 2021) and the outcome of one longitudinal study revealed that students' sensitivity to teacher warmness significantly predicts students' mathematics skill, mathematics efficacy, and improved mathematics performance (Forsberg et al., 2024).

2.1.10. Emotional intelligence

Emotional intelligence involves a variety of emotional, cognitive, and interpersonal skills (Mancini et al., 2022). Highly emotionally intelligent individuals are better able to regulate their emotions, understand other people's emotions, and effectively use emotional information to guide their behavioural dispositions (Moors et al., 2013). Research indicates that in schools, bullied students reported significantly high rates of emotional maladjustment (McCurdy et al., 2003). In the classroom, students low in emotional intelligence perform poorly on classroom tasks and in general academic engagement (McPherson et al., 2011).

2.2. Theoretical framework

This study is anchored on the theoretical postulations of Self-Determination Theory (SDT). This theory projects the influence of human motivation and personality consciousness in safeguarding human growth and resilience in other desired psychological needs. Human choice(s) are propelled by agency and commitment to attain success. Desire for success drives people to strive harder. This indicates that even when teachers bully their students, the life focus of the student to excel in academic tasks and life pursuits would motivate the student to articulate a concrete plan for success. This involves making a choice to fail or to grow. This context projects strive for autonomy, competence, and relatedness, which are essential psychological needs that drive motivation and personal growth. Students who are bullied will always seek measures that enable them to overcome their challenges (Ryan & Deci, 2000). This can be termed personal empowerment, which is a vital focus of self-determination theory. This makes this theory germane for this study.

3. METHOD

This study adopted the ex-post facto research design. This is necessary to establish cause-and-effect relationships. Kerlinger & Lee (2000) defined ex-post facto as a systematic empirical inquiry in which the researcher does not have the liberty to manipulate the variables of concern because they have already occurred or because they are inherently not manipulatable. The sample for this study consists of 2,150 Senior Secondary School Students (SSS1-SSSIII) who reported teacher bullying, had low math scores, and had received counselling from their school counsellors based on their experience of bullying. They were purposively selected from 50 randomly selected secondary schools in Abia, Anambra, Ebonyi, Enugu, and Imo States in South-East Nigeria. These students were purposively elected based on their bullying experience that had occurred over a year as they transitioned from junior to senior secondary school. The peculiarity of this study is the focus on the mathematics attainment of secondary school students who have experienced bullying from their teacher. This serves as a specific criterion control measure, and the need to use an ex-post facto research design.

3.1. Instrumentation

3.1.1. Perceived school bullying severity scale (PSBSS)

A 24-item instrument was used to measure students' bullying experience with their teachers, adapted from Chen et al. (2012). The instrument has a response format ranging from 'Really disagree (1) to Really agree (4) and a reliability coefficient of 0.81. The items of this instrument were adapted to suit the Nigerian language and cultural context. The adapted version has a scoring format ranging from (1) = Really disagree to (4) =Really agree (4) and it was validated using a test-retest measure and has a reliability coefficient of 0.77.

3.1.2. Students' Mathematics results

Students' mathematics results were used to ascertain their mathematics attainment. Evidence of mathematics attainment was measured using the cognitive cumulative examination scores of students who were bullied below 35% for two examinations of the students used for the study.

3.1.3. Loneliness and social dissatisfaction questionnaire

The Loneliness and Social Dissatisfaction questionnaire (Asher & Wheeler, 1985) was used to measure students' dejection. It is a 10-item questionnaire that addresses students' feelings of dejection and loneliness. It has an internal consistency of (Cronbach's alpha = 0.90). The items of this instrument were adapted to suit the Nigerian language and cultural context. The adapted version has a scoring format ranging from (1) = Strongly disagree to (4) =Strongly agree (4) and it was validated using a test-retest measure and has a reliability coefficient of 0.82. Cristine (2024) conceptualized that loneliness is more than simply being alone; it is the subjective feeling of being isolated or disconnected from others. Loneliness is characterized by a perceived lack of meaningful connections or relationships, and it can trigger feelings of expressed dejection. Likewise, Dejection is a psychological state characterized by intense feelings of a sense of inadequacy, probably due to lack of support or rejection.

3.1.4. Students' achievement motivation

Students' achievement motivation was measured using the Academic Achievement Motivation Inventory developed by Aremu & Hammed (2002). It has 24 items with a response pattern of strongly agree (4) to strongly disagree (1) and an internal consistency of Cronbach's alpha = 0.73. This is a Nigerian instrument, and it was adopted for this study in its original form.

3.1.5. Rosenberg's self-esteem scale (RSE)

Rosenberg's self-esteem scale (RSE) (1965) was used to measure the self-esteem of students in the study. It is a 10-item self-report 4-point scale (4 = strongly agree; 1 = strongly disagree). Higher scores indicate a stronger self-esteem. The scale has a reliability coefficient of 0.87. This instrument, in its original form, suits the Nigerian language and cultural context, so it was adopted for use without modification.

3.1.6. The mathematics anxiety rating scale (MARS)

The Mathematics Anxiety Rating Scale (MARS 30-item) (Suinn & Winston, 2003) was used to measure students' mathematics anxiety. It assesses feelings of anxiety and tension experienced when faced with a mathematics test or a problem-solving task. It is a 5-point Likert scale with responses ranging from Not at all=1 to Very much = 5. It consists of two components: Numerical anxiety and mathematics test anxiety, with a Cronbach's alpha Coefficient of 0.81. This instrument, in its original form, suits the Nigerian language and cultural context, so it was adopted for use without modification.

3.1.7. Morgan-Jinks student academic self-efficacy scale

Morgan-Jinks Student Academic Self-Efficacy Scale was used to measure students' self-efficacy. Developed by Morgan and Jinks (1999). The instrument has a reliability coefficient of 0.82. The instrument has a response format ranging from 'Really disagree (1) to Really agree (4). This instrument, in its original form, suits the Nigerian language and cultural context, so it was adopted for use without modification.

3.1.8. The self-directed learning readiness scale (SDLRS)

The Self-Directed Learning Readiness Scale (SDLRS) (Finestone, 1984) was used to measure students' readiness to learn. It helps evaluate students' readiness to engage in self-directed learning. The scale is anchored on eight factors, personality and attitudinal, associated with self-directness. It is a 58-item 5-point scale with response patterns of "almost never true" to "almost always true." Specifically, it has a good internal reliability coefficient of 0.72 to 0.96. The items of this instrument were adapted to suit the Nigerian language and cultural context. The adapted version has a scoring format ranging from (1) = Strongly disagree to (4) = Strongly agree (4) and it was validated using a test-retest measure and has a reliability coefficient of 0.86.

3.1.9. The interest in schooling scale

The interest in schooling scale by Umoinyang (1999) was used as a measure of students' interest in school. The scale has 10 items, measuring interest in schooling with a response format of strongly agree (4) to strongly disagree (1). The instrument revealed a reliability coefficient of 0.81. This is a Nigerian instrument, and it was adopted for this study in its original form.

3.1.10. Student-teacher relationship scale (STRS)

Student-Teacher Relationship Scale (STRS) (Pianta, 2001) was used to measure the pattern of teacher-student consultation. It assesses students' feelings about their relationship with their teachers as guardians and mentors. It is a self-reported scale with 28 items with a reliability coefficient of (Cronbach's $\alpha = 0.93$). The items of this instrument were adapted to suit the Nigerian language and cultural context. The adapted version has a scoring format ranging from (1) = Strongly disagree to (4) =Strongly agree (4) and it was validated using a test-retest measure and has a reliability coefficient of 0.81.

3.1.11. Swinburne University Emotional Intelligence Test (Adolescent SUEIT)

The adolescent self-report version was developed by Ben et al. (2003). The instrument consists of 57 items and has been designed to assess how effectively adolescents deal with emotions. Higher scores indicate high emotional intelligence. There are no right or wrong answers. The adolescent SUEIT has demonstrated good internal consistency with a Cronbach's alpha Coefficient of 0.78. The items of this instrument were adapted to suit the Nigerian language and cultural context. The adapted version has a scoring format ranging from (1) = Strongly disagree to (4) =Strongly agree (4) and it was validated using a test-retest measure and has a reliability coefficient of 0.72.

3.2. Procedure for administration and data collection

The administration of the questionnaire lasted for 8 weeks. The researcher sought permission from the school principals and counsellors. Also, the consent of parents and guardians of the students was sought during parent/teachers' association meetings. Also, mobile text messages were sent to parents and guardians of the students, and they replied, giving their consent. Furthermore, the consent of the students was sought, and they gave their consent to participate in the study. To facilitate and ensure the successful administration of the instruments, school counsellors were used as research assistants and were trained for one week on the principles and procedures of questionnaire administration. The participants were informed about the importance of the study and their need to be sincere in their responses.

3.3. Data analysis

Data collected was analyzed using a causal modeling technique that involved multiple regression, backward solution, and path analysis. Path analysis helped in identifying the total effects, i.e., direct and indirect effects of independent variables on the dependent variable. The researcher employed the technique of path analysis theorem (Wolfe, 1977) and Wright's Law (Asher, 1977) to construct the resultant structural

equations. Therefore, the effects of the nine explanatory variables (X_0 –X_8) were predicted on the criterion variable (X_9) using the structural equation model below.

$$R_1 = X_0 = B_0 X_0, B_1 X_1, \ldots\ldots\ldots B_8 X_8 \quad (1)$$

Where,

X_9 = Predicted Standardized Score

$X_0, X_1, \ldots\ldots\ldots, X_8$ = Mediator variables

$B_1, B_2, \ldots\ldots\ldots B_7$ = Associated Beta Weights.

Overall, the researcher derived a set of eight structural equations after exploring the hypothetical linkages and the input path diagram of the causal model for a nine-variable system presented in equations (2)–(7).

$$X_4 = P_{40} X_0 + P_{41} X_1 + P_{42} X_2 + P_{43} X_3 + e_4 \quad (2)$$

$$X_5 = P_{50} X_0 + P_{51} X_1 + P_{52} X_2 + P_{53} X_3 + P_{54} X_4 + e_5 \quad (3)$$

$$X_6 = P_{60} X_0 + P_{61} X_1 + P_{62} X_2 + P_{63} X_3 + P_{64} X_4 + P_{65} X_5 + e_6 \quad (4)$$

$$X_7 = P_{70} X_0 + P_{71} X_1 + P_{72} X_2 + P_{73} X_3 + P_{74} X_4 + P_{75} X_5 + P_{76} X_6 + e_7 \quad (5)$$

$$X_8 = P_{80} X_0 + P_{81} X_1 + P_{82} X_2 + P_{83} X_3 + P_{84} X_4 + P_{85} X_5 + P_{86} X_6 + P_{87} X_7 + e_8 \quad (6)$$

$$X_9 = P_{90} X_0 + P_{91} X_1 + P_{92} X_2 + P_{93} X_3 + P_{94} X_4 + P95\, X_5 + P_{96} X_6 + P_{97} X_7 + P_{98} X_8 + e_9 \quad (7)$$

The implication of the above equation is that the criterion variable, that is, teacher bullying on mathematics attainment (variable 9), is being significantly mediated by all the explanatory variables 0–8.

4. RESULTS

The parsimonious model in Figure 4, which highlights the significant paths, presents the new structural equations [see equations (8)–(13)].

$$X_4 = P_{42} X_2 + e_4 \quad (8)$$

$$X_5 = P_{51} X_1 + P_{54} X_4 + e_5 \quad (9)$$

$$X_6 = P_{61} X_1 + P_{62} X_2 + e_6 \quad (10)$$

$$X_7 = P_{72} X_2 + P_{73} X_3 + P_{75} X_5 + e_7 \quad (11)$$

$$X_8 = P_{85} X_5 + P_{87} X_7 + e_8 \quad (12)$$

$$X_9 = P_{92} X_2 + P_{94} X_4 + P_{95} X_5\, e_9 \quad (13)$$

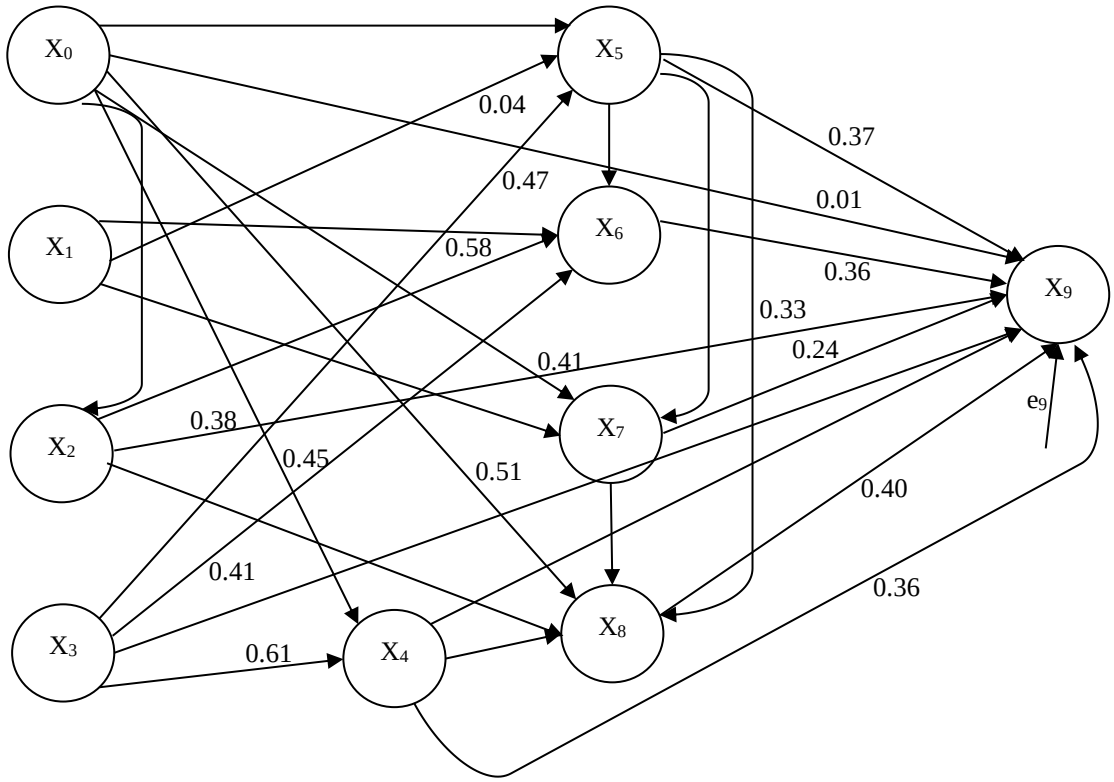

Figure 4. The more parsimonious model shows the significant paths

The path coefficients of the significant paths that are retained in the New Parsimonious model are outlined in Table 1

4.1. Research question one

This section answers the first question: what is the proportion of the total effect of (i) direct teacher bullying and (ii) indirect teacher bullying on students' mathematics achievement, taking into account the mediating role of psychosocial-emotional factors (sadness, achievement motivation, self-esteem, math anxiety, self-efficacy, learning readiness, interest in school, and teacher-student consultation).

Table 1. Proportions of the total effects of the independent variables that are direct and indirect

Criterion	Independent variables	Total effects	%	Direct Effect	%	Indirect Effects	%	%
	$X_0 - X_8$	(A)	(C)	(B)	(D)	(A-B)	(E)	(F)
X_9	X_0	0.01	0.09	0.01	0.10	0	0	0.38
	X_1	-0.02	-0.19	-0.02	-0.19	-0.04	-0.02	-0.83
	X_2	0.38	3.60	-0.04	-0.38	0.34	0.14	15.65
	X_3	0.24	2.27	0.18	1.70	0.06	-0.03	9.87
	X_4	0.36	3.41	-0.02	-0.19	0.34	0.14	14.83
	X_5	0.37	3.50	0.06	0.57	0.31	0.13	15.22
	X_6	0.36	3.41	0.08	0.76	0.28	0.12	14.83
	X_7	0.33	3.12	0.06	0.57	0.27	0.11	13.57
	X_8	0.40	3.79	0.23	2.18	0.17	0.07	16.48
Total		**2.43**	**23**	**0.54**	**5.12**	**0.46**	**0.73**	**100**

For X_0 (dejection) in Table 1, the proportion of the total direct effect was 0. 10%, while 0% was indirect. The proportion for the total direct effect of X_1 (achievement motivation) was -0.19%, and the indirect effect was -0.02%. However, for the proportion of the total effect of direct effect for X_2 (self-esteem), -0.38 was direct, while 0.14% was indirect. For X_3 (mathematics anxiety), the proportion of the total direct effect was 1.70%, and 0.03% was the proportion of the total indirect effect. In the case of X_4 (self-efficacy), the total effect in percentage of the direct effect -0.19%, while the indirect effect was 0.14%. Also, for X_5 (readiness to learn), the total direct effect in percentage was 0.57%, while 0.13% was for the indirect effect. Moreover, in X_6 (interest in school), the total direct effect in percentage was 0.76%, and the proportion of the total indirect

effect was 0.12%. In the case of X_7 (teacher-student consultation), the total direct effect in percentage was 0.57%, while the indirect effect was 0.11%. X_8 (emotional intelligence), the total direct effect in percentage 2.18%, while the indirect effect was 0.07%.

4.2. Research question two

This section answers the second question: To what extent would teacher bullying affect mathematics attainment based on the relative mediating roles of psycho-socio-emotional factors (dejection, achievement motivation, self-esteem, mathematics anxiety, self-efficacy, readiness to learn, interest in school, teacher-student consultation, and emotional intelligence)?

Table 2. Multiple regression analysis showing the relative mediating roles of each of the exogenous variables predicting the extent to which teacher bullying affects the mathematics attainment of secondary school students.

Model	B	STD Error	B	T	P	Sig.	Rank
Dejection	-0.84	0.22	-0.02	-3.82	0.96	>.05	8th
Achievement Motivation	-0.29	0.50	-0.02	-0.58	0.57	>.05	9th
Self-Esteem	0.21	0.14	-0.04	1.50	0.19	>.05	7th
Mathematics Anxiety	0.23	0.04	0.18	5.75	0.000	< 0.01	2nd
Self-Efficacy	0.21	0.04	0.16	5.25	0.57	>.05	3rd
Readiness to Learn	0.10	0.06	0.06	1.67	0.10	>.05	6th
Interest in School	0.15	0.08	0.08	1.88	0.04	<.05	5th
Teacher-student Consultation	0.18	0.05	0.08	3.60	0.09	>.05	4th
Emotional Intelligence	0.28	0.04	0.23	7.00	0.000	< 0.001	1st

The result in Table 2 showed that the beta (β) weights of the paths (path coefficients) give the estimates of the strengths of the causation. The entire psycho-socio-emotional mediating factors were shown to contribute differentially to the mathematics attainment of secondary school students bullied by teachers. Specifically, emotional intelligence mediated most significantly to the explained variation on mathematics attainment (β = 0.23, p < .001). This is followed in magnitude of beta weights by mathematics anxiety (β = 0.18, p < .01); self-efficacy (β = 0.16, p < .05); teacher-student consultation (β = 0.08, p < .05); Interest in school (β = 0.08, p < .05); Readiness to learn (β = 0.06, p < .05). However, the mediating effect of self-esteem (β = -0.04, p < .05), dejection (β = -0.02, p < .05) and achievement motivation (β = -0.02, p < .05) were not significant on mathematics attainment of students bullied by their teachers.

5. DISCUSSION

5.1. Research question one

What is the proportion of the total effect of (i) direct and (ii) indirect teacher bullying on the mathematics attainment of students, based on mediating roles of psycho-socio-emotional factors (dejection, achievement motivation, self-esteem, mathematics anxiety, self-efficacy, readiness to learn, interest in school, teacher-student consultation, and emotional intelligence)? In line with this research question, the study revealed that emotional intelligence (X_8) had the highest total mediating effects (16.48%) on mathematics attainment of secondary school students bullied by teachers (X_9). This suggests that emotional intelligence is vital to determining the ability of students to adjust and adapt to situational constraints that might be frustrating and stressful. This implies that if a student is emotionally intelligent, the student would be able to relate very well with his/her school environment, and if this is attained, managing and overcoming the negative effects of teachers' bullying behaviour is possible. Also, in Nigeria, attaining a credit pass in mathematics is compulsory for admission into a tertiary institution of learning.

This expectation most likely is a major reason why bullied students have to apply emotional intelligence in the way of positively controlling their emotions, fears, and frustration, and adopt good coping mechanisms to overcome challenges associated with their bullying experience. This supports the fact that emotional intelligence involves a variety of emotional, cognitive, and interpersonal skills (Mancini et al., 2022). Highly emotionally intelligent individuals are better able to regulate their emotions, understand other people's emotions, and effectively use emotional information to guide their behavioural dispositions (Moors et al., 2013). Self-esteem (X2) had the second-highest mediating effect (15.65%). The reason for this could be attributed to the fact that the level of a student's self-esteem gives him or her some measure of comfort and sense of self-worth. When bullied students receive appropriate counselling services, they tend to have the capacity to develop a positive sense of self-worth. A good sense of self-worth can help bullied students to be

positively focused. Self-esteem is a psychological construct that projects a person's confidence in his or her self-worth, values, capability, and life competence. Students with high self-esteem have a high sense of self-worth, are emotionally stable, and focused on their academic goals (Sahakian, 2024). Readiness to learn (X_5) had the third-highest mediating effect (15.22%). This implies that when students are determined to learn, they will strive to attain their goal, undermining the teacher's act of bullying. Considering the importance of attaining competence in mathematics to the future career aspirations of students, they would put up a thick skin, resist the frustration of bullying, and excel in mathematics. This is because the crucial role mathematics plays in societal developmental dynamics cannot be overemphasized (Jayanthi, 2019; Okoiye & Onah, 2024). Competence in mathematics requires learners' readiness to learn, interest, passion, commitment, and resilience (Okoiye & Onah, 2024).

Students' success in mathematics is not dependent only on skills and ability, but also on their self-belief and social cognition (Aleta, 2016). Also, academic self-efficacy (X_4) and interest in school (X_6) had respectively a mediating effect of (14.83%). This juxtaposes the fact that when a student is interested in school, the student would be confident about schooling and consequently be self-efficacious. Both factors help students to adjust well and overcome negative challenges experienced in school during teaching and learning interactive experiences. These dispositions are necessary because a strong association has been reported between teachers' behavioural conduct and students' motivation to learn. For instance, Erdoğdu (2013) posits that teachers' attitudinal dispositions are a very significant factor that affects students' attainment in mathematics and other related subjects. Broeckelman Post et al. (2016) averred that teachers' belligerent and humiliating behaviour has a significant negative impact on students' academic attainment. Sürücü and Ünal (2018) affirmed that teachers' aggressive use of labelling and poor communication reduces students' enthusiasm to learn. Teacher-student consultation (X_7) had a mediating effect of (13.57%). This presupposes the fact that when students consult with their teachers, they tend to have a positive attitude to learning and school and become determined to succeed. In concordance, the outcome of one longitudinal study revealed that students' sensitivity to teacher warmth significantly predicts students' mathematics skill, mathematics efficacy, and improved mathematics performance (Forsberg et al., 2024).

5.1. Research question one

To what extent would teacher bullying affect mathematics attainment based on the relative mediating role of psycho-socio-emotional factors (dejection, achievement motivation, self-esteem, mathematics anxiety, self-efficacy, readiness to learn, interest in school, teacher-student consultation, and emotional intelligence)? The result showed that the beta (β) weights of the paths (Path coefficients) give the estimates of the strengths of the causation. The entire psycho-socio-emotional factors were shown to mediate differentially on the mathematics attainment of secondary school students bullied by teachers. Specifically, emotional intelligence contributed most to the explained variation of mathematics attainment of secondary school students bullied by teachers, which was significant ($\beta = 0.23$, $p < .001$). This indicates that emotional intelligence is vital to human success. A highly emotionally intelligent student would show resilience in the face of bullying challenges and be focused on attaining success. The reason for this development could further be aligned to the fact that the participants of his study were senior secondary school students in Nigeria. These sets of students have chosen a career path, and for them to succeed, they need to be emotionally intelligent and stable. Highly emotionally intelligent individuals are better able to regulate their emotions, understand other people's emotions, and effectively use emotional information to guide their behavioural dispositions (Moors et al., 2013). This variable was followed in magnitude of beta weights by mathematics anxiety ($\beta = 0.18$, $p < .01$). This indicates that mathematics anxiety is a vital challenge students strive to overcome. Bullied students used for this study understand the fact that allowing mathematics anxiety to overwhelm them is a significant barrier to their academic success. Among lots of damaging impacts, bullying and ill-treatment negatively affect students' academic achievement (Murphy et al., 2022), including mathematics attainment (Carrasco et al., 2022). For these reasons, they effectively manage their weakness and turn it into a strength.

Self-efficacy comes next ($\beta = 0.16$, $p < .05$). Self-efficacy projects confidence in one's ability to excel in a given task. When bullied students turn their academic weakness into a strength, they will develop the confidence and resilience they need to succeed. The level of an individual's self-efficacy affects their everyday life experience. A strong sense of self-efficacy increases an individual's level of accomplishment and improves personal well-being. A highly self-efficacious individual sees challenges as normal for success (Bandura, 2010). In contrast, an individual with a low sense of self-efficacy sees challenges as a threat and tries as much as possible to avoid them due to a lack of confidence in their personal ability to succeed (Bandura, 2010).

Teacher-student consultation ($\beta = 0.08$, $p < .05$). This result shows that teacher-student consultation is a vital factor that enhances students' all-round development. When bullied students consult with teachers over their challenges, they tend to receive quality mentorship that helps them develop the capacity to overcome their challenges. For example, a longitudinal study revealed that students' sensitivity to teacher warmness significantly predicts students' mathematics skill, mathematics efficacy, and improved mathematics

performance (Forsberg et al., 2024). Interest in school comes next (β = 0.08, p < .05). The reason for bullied students to be interested in school is likely attached to their desire to have a better future. They are conscious of the fact that education, knowledge, and competence are vital tools for human capital development and a source of empowerment. Therefore, despite their bitter experience of bullying, they are determined to learn. On the contrary, in Norway, a Norwegian study established that bullying experience in school is associated with the reason school adolescents attain poor grades and become uninterested in schooling (Strøm et al., 2013). This development can be attributed to different resilience and the need to use education as a tool for economic empowerment from the African perspective, and this is quite different from the Western European orientation towards life and survival.

Readiness to learn comes next (β = 0.06, p < .05). The outcome of this study shows that readiness to learn has a positive mediating role on bullied students' mathematics attainment. These students had received counselling from their school counsellors, and this disposition helped them to have a positive attitude towards learning and overcoming their challenges. However, previous studies have reported that a significant negative correlation between being bullied, students' poor academic attainment, and lack of interest in engaging in daily school learning activities is evident even at kindergarten (Kochenderfer & Ladd, 1996) and continues into secondary school (Espinoza et al., 2013). Next in the decreasing order, self-esteem (β = -0.04, p < .05), dejection (β = -0.02, p < .05), and achievement motivation (β = -0.02, p < .05) had the least mediating effect on mathematics attainment of students bullied by their teacher. Students' socio-economic status, lack of parental or peer support, and initial math ability can be an inducing factor why self-esteem, depression, and achievement motivation do not have a significant mediating effect on the mathematics attainment of students bullied by their teacher. When students face challenges and do not have people to comfort them psychologically, they might feel dejected, helpless, develop low self-esteem, and be less motivated to achieve their set academic goals. The reason for this could be that bullying causes mental health challenges (Balluerka et al., 2023) and negatively damages victims' confidence and self-esteem (Moon & Mello, 2021). A sense of dejection can arise based on interaction with the human social environment, and it is characterized by internalized negative emotions detrimental to an individual's general well-being (Gilliom & Shaw, 2004). Students with low achievement motivation often have negative dispositions towards learning and poor academic outcomes (Okoiye, 2011).

6. STUDY LIMITATION

The study only focused on the use of path analysis technique to establish and estimate the paths of causal linkages (direct and indirect) between teacher bullying and mathematics attainment: The mediating roles of psycho-socio-emotional mediating roles of (dejection, achievement motivation, self-esteem, mathematics anxiety, self-efficacy, readiness to learn, interest in school, teacher-student consultation and emotional intelligence) factors in South-East, Nigeria. Also, due to financial constraints, the study was restricted to two thousand one hundred and fifty Senior Secondary School Students of SSSI-SSSIII classes selected from 50 randomly selected secondary schools in Abia, Anambra, Ebonyi, Enugu, and Imo States in the South-East. Nigeria, which reported teacher bullying and had low math scores, had received counselling from its school counsellors based on the experience of bullying. Furthermore, only nine variables were examined in the study.

7. CONCLUSION

Based on the foregoing, the following conclusions are made: Out of the nine psycho-socio-emotional mediating factors, six of them (self-esteem, self-efficacy, readiness to learn, interest in school, teacher-student consultation, and emotional intelligence) have a significant direct mediating effect on the mathematics attainment of students bullied by their teachers. The other three (dejection, achievement motivation, and mathematics anxiety) had an indirect mediating effect that was not significant on the mathematics attainment of students who are bullied by teachers. Also, the beta (β) weights of the paths (Path coefficients) that give the estimates of the strengths of the causation show that the entire psycho-socio-emotional mediating factors had relatively different mediating effects on mathematics attainment of secondary school students bullied by teachers. Therefore, mathematics teachers should endeavour to encourage and motivate students as a means to help them acquire the mathematical skills and knowledge they need to excel in mathematical tasks.

8. RECOMMENDATIONS

Based on the findings of this study, I offer the following recommendations.

(1) Students should be assertive in the face of being bullied and report bullying incidents and experiences to the appropriate authorities.
(2) Mathematics teachers in secondary schools should endeavour to use appropriate teaching methods and communication skills that would address the learning and developmental needs of students.

(3) Teachers should be given adequate orientation that would help them have a clear understanding of adolescents' developmental needs and challenges, so that they are in a better position to help in-school adolescents overcome the trauma of adjusting to associated learning challenges.
(4) Counselling and school psychologists should expose students to psycho-therapeutic interventions that would help them develop necessary adaptive skills that would help them overcome academic and environmental challenges.

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DECLARATION OF INTEREST

I hereby declare that throughout the process of conducting this study, there is no conflict of interest whatsoever.

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ETHICAL STATEMENT

The ethical committee on research of the Department of Educational Psychology/Guidance & Counselling reviewed the research instruments and their intended purpose to determine the suitability for the target participants of the study (senior secondary school students). Necessary inputs were made, and clearance was given as the study procedures upheld confidentiality principles, and it is beneficial to all.

AI USE STATEMENT

The author declares that no generative artificial intelligence (AI) tools were used in the preparation, analysis, or writing of this manuscript.

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