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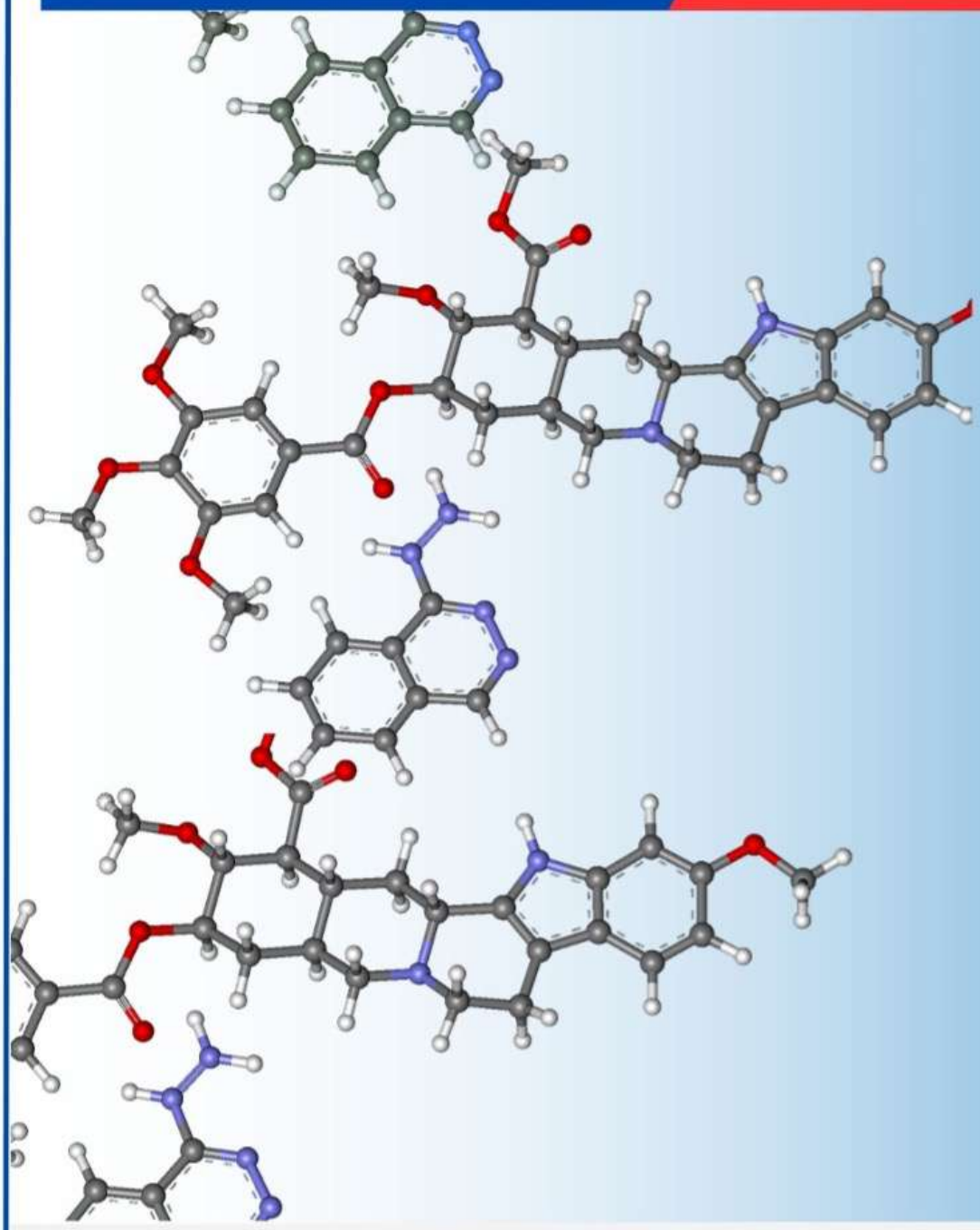

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PROF. EBELE .C. OKIGBO

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EDITORIAL

STEM Journal of Anambra STAN (STEMJAS) is a publication of **Science Teachers Association of Nigeria, Anambra State Chapter.** STEMJAS is developed to disseminate information on Science, Technology, Engineering and Mathematics (STEM) to teachers, teacher-trainers, researchers and other interested persons. Articles that are of relevance to STEM education are published in this journal.

We are grateful to the contributors and hope that our readers will enjoy reading these contributions.

Prof. Ebele C. Okigbo
Editor-in-Chief

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ASSESSMENT OF PRE-SERVICE SCIENCE TEACHERS' WILLINGNESS TO IMPLEMENT INCLUSIVE STEM EDUCATION IN ANAMBRA STATE

[1]Nwune, Emmanuel Chibuike; [2]Samuel, Nkiru Naomi C.; [3]Nwanga, Chimuanya Philomina; [4]Onyeador, Chinecherem Juliet

ce.nwune@unizik.edu.ng, nkc.samule@unizik.edu.ng, cph.nwanga@stu.unizik.edu.ng, cjh.onyeador@stu.unizik.edu.ng

[1,2,3,4]Department of Science Education, Nnamdi Azikiwe University, Awka, Nigeria

ABSTRACT

The study investigated the willingness of pre-service science teachers (PSTs) to implement inclusive STEM education in regular classrooms in Anambra State. Four research questions and two hypotheses, tested at 0.05 level of significance, guided the study. A cross-sectional survey design was adopted on a sample of 304 students. Data were collected using a structured questionnaire adapted from Nwosu et al. (2020), which demonstrated high reliability with an overall Cronbach alpha coefficient of 0.881. The instrument was validated by three experts from the Faculty of Education, Nnamdi Azikiwe University, Awka. Data analysis involved descriptive statistics (mean and standard deviation) and inferential statistics (one-way ANOVA). The findings revealed that PSTs demonstrated a greater willingness to teach academically weak and at-risk students than those with behavioural challenges. Furthermore, PSTs were willing to provide emotional and adaptive support to special needs students, such as adapting curricula and modifying assessments. A significant gender difference was observed, with female PSTs showing a greater willingness than their male counterparts both to teach special needs students and to provide emotional and adaptive support. It was recommended among other things that STEM teacher education curricula should incorporate specialized modules on inclusive classroom management and provide structured practicum experiences.

Keywords: STEM education, pre-service science teachers, special needs students, inclusion

1.0 INTRODUCTION

STEM education is an integrated educational approach that emphasizes real-world application, critical thinking, creativity, and collaboration across various science disciplines. It integrates concepts from science, technology, engineering, and mathematics to solve real-world problems (Nugraha et al., 2024). In recognition of the problem-solving role of STEM education, global educators have advocated for its adoption as a panacea to systemic shortcomings, arguing that it better prepares learners to meet 21st-century learning demands (Chisom et al., 2024). This assertion aligns with the World Bank's (2023) position that STEM education supports national

development by enhancing human capital and fostering economic growth in innovation-driven societies.

In response to this global advocacy for STEM education, the Nigerian government has taken tangible steps to advance this educational approach through well-defined, evidence-based initiatives. These initiatives include the recent school curriculum reforms led by the Nigerian Educational Research and Development Council (NERDC), emphasizing experiential learning, critical thinking, and project-based instruction over rote memorization (Amie-Ogan &Oguru, 2025). According to the researchers, these initiatives have led to a 45% increase in STEM programs in Nigerian schools. This growth demonstrates a strong nationwide push to boost technical and analytical competencies vital for economic growth. To complement the government's educational reforms in STEM education, Sakpere (2025) posited that several hands-on programs, such as STEM boot camps and mobile science labs, organized in collaboration with local Non-governmental Organizations (NGOs) have been adopted to improve student engagement and classroom participation in STEM across Nigerian communities. Nevertheless, the success and sustainability of such initiatives largely depend on the competence of the teachers implementing them. Thus, the effectiveness of STEM education in Nigeria depends on the quality and readiness of in-service teachers, who currently teach STEM subjects and pre-service science teachers (PSTs), who are being prepared to teach them.

PSTs refer to undergraduate students or teacher candidates enrolled in scientific disciplines in teacher education programs. These programs are offered in institutions such as colleges of education or faculties of education in universities. According to Nwune et al. (2023), these science teacher education programs prepare PSTs to become qualified science teachers. While enrolled in these programs, PSTs learn how to teach science, including both constructing and evaluating scientific ideas, before taking full classroom teaching responsibilities (Zhao et al., 2021). As future educators, PSTs play a pivotal role in shaping the delivery of STEM subjects in classrooms. Their training period serves as a crucial window for developing not only content knowledge but also inclusive pedagogical strategies that promote equity and accessibility. Yet, Adigun (2021) and Nwune et al. (2024) observed that PSTs have a solid grasp of STEM content but struggle to implement inclusive teaching strategies that can effectively support all learners, especially special needs students (SNS).

Special needs students (SNS) are learners who experience disabilities such as intellectual, physical, sensory, emotional, behavioural, or neurodevelopmental conditions. These conditions significantly interfere with their ability to participate in typical classroom instruction without adaptive support. According to Ojeda and Carugno (2022), SNS includes students with learning disabilities, attention-deficit/hyperactivity disorder (ADHD), autism spectrum disorder (ASD), sensory and physical impairments, and twice-exceptional learners. These students often require individualized education plans (IEPs), differentiated instruction, assistive technologies, or environmental modifications to meet their learning and social needs (Lersilp et al., 2018).

Without such accommodations, these students may face significant barriers to academic achievement, independence, and social inclusion. According to Ojeda and Carugno, these students' educational decisions are often guided by the principle of the least restrictive environment, emphasizing inclusive settings. This environment encourages their inclusion in general education settings. Given the learning and social needs of SNS, Ranbir (2024) posited that it is essential to provide them with equitable learning opportunities, active participation, and tailored support within an inclusive education framework.

Inclusive education is the process of addressing and responding to the diverse needs of all learners by increasing participation in learning and reducing exclusion within and from education (Federal Ministry of Education, 2017). It is a philosophy and practice that seeks to enhance the full inclusion of individuals with disabilities into mainstream society without any discrimination and to improve and sustain social justice (Adigun, 2021). When this inclusive philosophy is applied to STEM education, it gives rise to the concept of inclusive STEM education.

Inclusive STEM education is an educational approach that adapts science instruction to meet the needs of all learners, including those with special needs. It refers to the integration of inclusive teaching strategies and support systems into regular STEM classrooms to ensure that students of all abilities engage meaningfully with STEM content (Killpack &Melón, 2016). Research (Klimaitis& Mullen, 2021) shows that SNS often perform better when they learn alongside their peers, rather than in isolated classrooms. Despite the benefits of inclusive education, many PSTs may still face significant challenges applying the principles in STEM classrooms. These challenges include inadequate adaptive facilities, negative social attitude, unfriendly school environment, inadequate funding, inadequate human resources and training for teachers, lack of awareness of inclusive education application mechanisms, and policy and legislative issues (Oluremi, 2015; Tafirenyika et al., 2023; Nwune et al., 2024). Thus, to make inclusive STEM education a reality, teachers need more than just content knowledge. They need to demonstrate a willingness to implement the practices, whether in the absence or presence of challenges that mitigate against their implementation.

Teachers' inclusive education willingness refers to their psychological readiness and motivation to engage in inclusive teaching practices and provide the necessary support to SNS (Gilor& Katz, 2019). It involves teaching and providing emotional and adaptive support to SNS. While emotional support involves demonstrating empathy, patience, and encouragement to students facing learning or physical challenges, adaptive support includes strategies such as differentiated instruction, modification of learning materials, and the use of assistive technologies to meet the learning needs of SNS (Gilor& Katz; Jacob & Pillay, 2022). PSTs' willingness to teach and support SNS is often shaped by a combination of personal attitudes, self-efficacy, and institutional support (Gal et al., 2025).

Personal attitudes toward inclusion play a major role in determining PSTs' willingness to implement. For example, Gilor and Katz (2019) posited that PSTs who value diversity and recognize the benefits of inclusive education are more motivated to engage with SNS. Self-efficacy is another crucial factor influencing PSTs' willingness to implement inclusive STEM education practices. According to Jacob and Pillay (2022), PSTs who feel competent in adapting instruction, managing classroom behaviours, and implementing inclusive strategies are more willing to provide both emotional and adaptive support to SNS. Institutional support, including access to mentorship, inclusive education training, practical experiences, resources and infrastructure, also significantly affects PSTs' willingness, as well-prepared teachers demonstrate greater readiness to apply inclusive practices (Killpack &Melón, 2016; Sharma & Nuttal, 2016; Adigun, 2021). Additionally, systemic barriers such as negative societal attitudes toward disabilities, insufficient policy guidance, and inadequate funding for inclusive programs may limit PSTs' willingness, even when personal motivation and competence are high (Adesokan&Bojuwoye, 2023). The assertions of these researchers suggest that PSTs who understand the social and professional expectations around inclusion are more willing to implement the practices in STEM classrooms to support all learners.

Given that PSTs' willingness can be influenced by personal factors, it is important to consider how demographic variables, such as gender, may interact with these influences to shape willingness for inclusive STEM education. Gendered expectations and socialization often shape how teachers perceive inclusion. For example, Doucette and Singh (2024) suggest that female preservice teachers may demonstrate greater openness toward inclusive practices due to socially ascribed traits such as empathy and patience, while male teachers may report higher confidence in managing technical challenges, which could also influence their willingness to adopt inclusive STEM practices. Similarly, Adigun (2021) argued that gender differences may emerge in preservice teachers' attitudes, with females often showing stronger positive dispositions toward inclusion. Contrariwise, Jacob and Pillay (2022), in a comparative study of preservice teachers in Nigeria and South Africa, found that training, knowledge, and exposure to inclusive practices played a more significant role than gender in shaping attitudes. Likewise, Gal et al. (2025) reported that teacher preparation, self-efficacy, and institutional support were the strongest determinants of willingness to include learners with special needs in STEM classrooms, with gender showing no significant effect.

Even with the growing attention given to inclusive education and STEM in Nigeria, not much is known about how willing PSTs are to implement the practice in regular classrooms. Most of the available studies tend to treat inclusive education and STEM education as separate issues. Also, most available studies focused more on in-service teachers while neglecting PSTs, who are the future implementers of inclusive STEM education practices in schools. This study, therefore, sought to determine PSTs' willingness to implement inclusive STEM education in regular classrooms in Anambra State. Specifically, the study sought to determine the:

1. willingness of PSTs to teach special needs students in regular classrooms in Anambra State
2. willingness of male and female PSTs to teach special needs students in regular classrooms in Anambra State
3. willingness of PSTs to provide emotional and adaptive support to special needs students in regular classrooms in Anambra State
4. willingness of male and female PSTs to provide emotional and adaptive support to special needs students in regular classrooms in Anambra State.

2.0 METHODS

2.1 Research Design

The study employed the cross-sectional survey research design to determine PSTs' willingness to implement inclusive STEM education in regular classrooms in Anambra State. According to Nworgu (2015), this type of research design involves studying a group of people or items by collecting and analysing data from a sample, which is considered representative of the entire population.

2.2 Research Participants

The sample size for the study was 328 PST (male = 36.5%, female = 63.5%), selected from the Department of Science Education in Nnamdi Azikiwe University, Awka. The sample size was determined using a multi-stage sampling procedure. However, only 304 questionnaires were successfully retrieved from the field, representing a 92.7% response rate.

2.3 Instrument for Data Collection

The instrument used for data collection was a structured questionnaire adapted from Nwosu et al. (2020). The questionnaire was designed to obtain relevant information from PSTs regarding their willingness to implement inclusive STEM education. It consisted of two parts, with Section A focusing on the demographic variables of the respondents, while Section B comprised ten questions divided into two clusters. The first cluster measured the willingness of PSTs to teach students SNS in regular classrooms, and the second cluster measured their willingness to provide emotional and adaptive support to the students.

The content validity of the instrument was established through a review by a panel of three experts, including two from the Science Education Department and one from the Measurement and Evaluation unit of the Educational Foundations Department, all from the Faculty of Education, Nnamdi Azikiwe University, Awka. The reliability coefficient of the

instrument was assessed using the Cronbach's alpha technique. The results showed that Cluster A had a coefficient value of 0.836, while Cluster B had 0.746. The overall reliability coefficient was 0.881.

2.4 Data Collection and Analysis

The data for this study were collected online using Google Forms. The link to the forms was distributed to the students via the class WhatsApp group. The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 27. Descriptive statistics, such as means and standard deviations, were used to answer the research questions. The weighted average mean, obtained by calculating the average of the mean scores of items under each cluster, served as the benchmark for interpretation. Thus, any item mean score equal to or greater than the weighted average mean was taken to indicate a willingness of PSTs, while an item mean score below the weighted average mean indicated unwillingness of PSTs to implement inclusive STEM education practices in regular classrooms. In addition, inferential statistics were employed to test the hypotheses. Specifically, a one-way Analysis of Variance (ANOVA) was conducted at the 0.05 level of significance. For the hypothesis testing, the null hypotheses were rejected if the p-value was less than or equal to 0.05 ($p \leq 0.05$) and retained if the p-value was greater than 0.05 ($p > 0.05$).

3.0 RESULTS

Research Question One: Are preservice science teachers in Anambra State willing to teach special needs students in regular classrooms?

Table 2: Mean and Standard Deviation Scores of PSTs' Willingness to Teach SNS

S/N	Item	Mean	SD	Remark
1	I am willing to teach behaviourally challenging classes	2.30	.88	Disagree
2	I wouldn't mind teaching academically weak students	3.45	.72	Agree
3	I am prepared to teach the naughtiest students	2.40	.90	Disagree
4	I am ready to teach at-risk kids	3.10	.76	Agree
	Weighted Mean and SD	**2.81**	**.82**	

N = 304

The result above shows PSTs' willingness to teach special needs students in regular classrooms in Anambra State. When compared with the weighted mean, the result indicates that PSTs are willing to teach academically weak (M = 3.45) and at-risk students (M = 3.10), but are unwilling to teach behaviourally challenging (M = 2.30) and naughty (M = 2.40) students. Also,

the weighted standard deviation score of .82, which is low, indicates that the PSTs do not deviate much in their perceptions of willingness to teach SNS in regular classrooms in Anambra State.

Research Question Two: Are male and female preservice science teachers in Anambra State willing to teach special needs students in regular classrooms?

Table 3: Mean and Standard Deviation Scores of PSTs' Willingness to Teach SNS by Gender

S/N	Gender	N	Mean	Std. Deviation
1	Male	111	2.85	0.64
2	Female	193	3.08	0.59
	Weighted Mean and SD		**3.00**	**0.61**

N = 304

Table 3 shows that female PSTs (M = 3.08) in Anambra State demonstrated a higher willingness to teach special needs students compared to their male counterparts, with a mean score of 2.85. This result is because their mean score is greater than the weighted mean score of 3.00. Also, the low weighted standard deviation score of .61 indicates that the male and female PSTs did not deviate much in their perceptions of willingness to teach SNS in regular classrooms in Anambra State.

Research Question Three: Are preservice science teachers in Anambra State willing to provide emotional and adaptive support to special needs students in regular classrooms?

Table 4: Mean and Standard Deviation Scores of PSTs' Willingness to Provide Emotional and Adaptive Support to SNS

S/N	Item	Mean	SD	Remark
1	I am willing to encourage students with disabilities to participate in all social activities in the regular classroom	3.68	.62	Agree
2	I am willing to adapt the curriculum to meet the individual needs of all students regardless of their ability	3.52	.71	Agree
3	I am willing to include students with a severe disability in the regular classroom with the necessary support	3.25	.84	Disagree
4	I am willing to modify the physical environment to include students with a disability in the regular classroom	3.40	.77	Disagree
5	I am willing to adapt my communication technique to ensure that all students with emotional and behavioural disorders can be successfully included in the regular classroom	3.58	.68	Agree

6	I am willing to adapt to the assessment of individual students for inclusive STEM education to take place.	3.30	.80	Disagree
	Weighted Mean and SD	**3.46**	**.74**	

N = 304

When compared with the weighted mean score of 3.46, the result in Table 4 shows that PSTs in Anambra State are willing to encourage students with disabilities (M = 3.68), adapt the curriculum (M = 3.52) and their communication techniques (M = 3.30) to meet the individual needs of all students, regardless of their ability. On the other hand, the result shows that the PSTs are unwilling to include students with a severe disability in the regular classroom, even with the necessary support (M = 3.25), unwilling to modify the physical learning environment (3.40), and unwilling to adapt assessment methods (M = 3.30) to include students with a disability in the regular classroom. Also, the low weighted standard deviation score of .74 indicates that the PSTs did not deviate much in their perceptions of willingness to provide SNS with emotional and adaptive support.

Research Question 4: Are male and female preservice science teachers in Anambra State willing to provide emotional and adaptive support to special needs students in regular classrooms?

Table 5: Mean and Standard Deviation Score of PSTs' Willingness to Provide Emotional and Adaptive to SNS by Gender

S/N	Gender	N	Mean	Std. Deviation
1	Male	111	3.35	0.53
2	Female	193	3.54	0.49
	Weighted Mean and SD		**3.47**	**0.51**

N = 304

When compared with the weighted mean score of 3.47, the result in Table 5 indicates that female PSTs in Anambra State are more willing to provide emotional and adaptive support to special needs students (M = 3.54), compared to their male counterparts (M = 3.35). Also, the weighted standard deviation scores of 0.51 indicate that the male and female PSTs did not deviate much in their perceptions of providing emotional and adaptive support to SNS in regular classrooms in Anambra State.

Test of Hypotheses

Hypothesis One: There is no significant difference between male and female PSTs' willingness to teach special needs students in regular classrooms in Anambra State.

Table 6: ANOVA for Gender Difference in PSTs' Willingness to Teach SNS

Source of Variation	Sum of Squares	Df	Mean Square	F	Sig. (p-value)
Between Groups	8.327	1	8.327	4.721	0.031
Within Groups	532.441	302	1.763		
	540.768	303			

The result inTable 6 shows that the p-value (0.031) is less than the 0.05 alpha level. Therefore, the null hypothesis (Ho_1) was rejected, indicating that a statistically significant difference exists between male and female PSTs' willingness to teach special needs students in regular classrooms in Anambra State, with female PSTs showing significantly greater willingness.

Hypothesis Two: There is no significant difference between male and female PSTs' willingness to provide emotional and adaptive support to special needs students in regular classrooms in Anambra State.

Table 7: ANOVA for Gender Difference in Willingness to Provide Support

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. (p-value)
Between Groups	6.891	1	6.891	5.123	0.024
Within Groups	405.998	302	1.345		
	412.889	303			

The result in Table 7 shows that the p-value (0.024) is less than the 0.05 alpha level. Therefore, the null hypothesis was rejected, indicating a statistically significant difference exists between male and female PSTs' willingness to provide emotional and adaptive support to special needs students, with female PSTs demonstrating significantly greater willingness.

4.0 DISCUSSION OF FINDINGS

The findings of the study revealed that PSTs in Anambra State were more willing to teach academically weak and at-risk students but less willing to teach behaviourally challenging learners. This finding may be because managing behaviourally challenging students could be disruptive to the learning environment, and may require more specialized skills, support, or resources that PSTs feel they do not possess or have access to. This PSTs' perceived lack of training or preparedness to manage behavioural issues could be attributed to the current teacher education programs in Nigeria that prepare PSTs to manage academic difficulties as opposed to behavioural issues. Thus, PSTs may feel reluctant to accommodate behaviourally challenging students in regular classrooms. The finding of this study aligns with those of Nwune et al. (2024), who observed that Nigerian PSTs possessed strong knowledge and positive beliefs about pedagogies for inclusive STEM education, but needed more training to manage classroom challenges. Similarly, Hopkins et al. (2024) reported that while Australian PSTs held positive attitudes toward students with intellectual disabilities, their endorsement of inclusion weakened

when faced with the realities of behavioural and instructional challenges, for which they may lack the necessary training. Contrariwise, Jacob and Pillay (2022) observed that preservice teachers in Oyo State were trained to address the challenges associated with implementing inclusive education.

Also, the findings of the study revealed that PSTs in Anambra State were more willing to encourage students with disabilities, adapt the curriculum and their communication techniques to meet the individual learning needs of all students, regardless of their ability. On the other hand, the finding also shows that even with the necessary support, PSTs were less willing to include students with a severe disability in the regular classroom, modify the physical learning environment and adapt assessment methods to include students with a disability in regular classrooms. This finding could stem from PSTs' lack of confidence in their ability to manage the more complex needs associated with severe disabilities. Also, adjusting the physical learning environment and adapting assessment methods often requires specialized training, resources, institutional support, and practical experiences, which PSTs may feel unprepared or unequipped to handle. Thus, PSTs may demonstrate pedagogical willingness to implement inclusive STEM education, but may be unwilling to implement the more demanding aspects. The findings of this study agree with Jacob and Pillay (2022) and Bouwoye and Adesokan (2024), who found that preservice teachers reported positive perceptions, attitudes, and awareness about inclusive education. Nevertheless, these perceptions, when negative as in the case of perceived lack of confidence observed among PSTs in the present study, can negatively influence their willingness to implement inclusive STEM education practices. This assertion is in agreement with Nwosu et al. (2021). Thus, PSTs' perceptions about their competence is critical to their willingness to implement inclusive STEM education in regular classrooms (Yakut & Akgül, 2022) Furthermore, the study's findings aligned with Gilor and Katz (2019), who observed that willingness to provide support to students with disabilities is largely explained by preservice teachers' attitudes, perceived norms, and competence.

Furthermore, the study found that female PSTs in Anambra State demonstrated significantly higher willingness to teach and provide emotional and adaptive support to special needs students in regular classrooms compared to their male counterparts. This finding could be attributed to societal stereotyping that has unconsciously made women more nurturing, empathetic, and responsive to the emotional and developmental needs of others, making them more willing, unlike men, to adapt their classroom practices to meet the learning needs of all students, including those with special needs. These traits that society has attributed to the female gender are often essential for the successful implementation of inclusive education practices. This finding exposes the danger of social conditioning or stereotyping, and its impacts on job roles and work ethics in any career. The findings of this study are consistent with Adigun (2021), who revealed significant gender differences among Nigerian and South African preservice

teachers, with females reporting higher openness to inclusive education. Likewise, Nwosu et al. (2021) reported that socio-demographic factors, including gender, influence willingness to teach learners with special needs. In contrast, Varcoe and Boyle (2014) and Jugan et al. (2024) found no significant gender differences in the willingness for inclusion among Australian PSTs and Philippines teachers, respectively. The findings suggest that training and placement experiences played a more decisive role than gender in influencing PSTs' willingness to implement inclusive STEM education in regular classrooms in Anambra State.

5.0 CONCLUSION

Based on the findings, the study concluded that PSTs in Anambra State hold a positive disposition towards inclusive STEM education, particularly in terms of teaching academically weak and at-risk students, and providing emotional and adaptive support to students with special needs. However, their relatively low willingness to teach behaviourally challenging students highlights a gap that requires targeted intervention, such as providing specialized training and resources to help PSTs deal effectively with disruptive behaviours of special needs students in regular classrooms. Gender differences were evident, as female PSTs consistently reported higher willingness than their male counterparts, suggesting that sociocultural expectations and teacher preparation contexts may shape PSTs' willingness for inclusion in regular classrooms.

6.0 IMPLICATIONS OF FINDINGS

The findings of this study have important educational implications for curriculum developers, teacher training institutions educators, and the government.

To curriculum developers, the willingness of PSTs to implement inclusive STEM education suggests that inclusive practices can be successfully integrated into STEM teacher preparation programs. Nevertheless, the gaps in handling behavioural challenges imply that curriculum developers should introduce courses and practicum experiences specifically addressing classroom management in inclusive contexts.

To teacher training institutions and teacher educators, the significant gender differences in PSTs' willingness, in favour of female PSTs, to implement inclusive STEM education call for strategies to encourage male PSTs to develop empathy and be amenable to inclusion practices as their female peers. These strategies can involve mentorship, exposure to inclusive classrooms, and targeted training

For the government, the findings highlight the importance of policies that strengthen inclusive education within STEM fields. The findings imply that special emphasis should be

given to practical training and resource provision in teacher education institutions to translate willingness into effective practice.

7.0 RECOMMENDATIONS

Based on the findings of the study, the following recommendations are made:

1. Teacher education institutions should incorporate specialized modules on behavioural management in inclusive classrooms to address PSTs' unwillingness to handle challenging behaviours
2. PSTs should be provided with teaching practice experiences in inclusive classrooms to boost their confidence and readiness
3. Training programs in teacher training institutions should deliberately target male PSTs to reduce gender gaps in the willingness to implement inclusive STEM education practices.
4. The government and other relevant education authorities should ensure that inclusive STEM education principles, supported by adequate resources, are factored into the curricula of teacher education programs.

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