

**Journal of Advances in Mathematical & Computational Sciences**  
An International Pan-African Multidisciplinary Journal of the SMART Research Group  
International Centre for IT & Development (ICITD) USA  
© Creative Research Publishers  
Available online at <https://www.isteams.net/mathematics-computationaljournal.info>  
CrossREF Member Listing - <https://www.crossref.org/06members/50go-live.html>

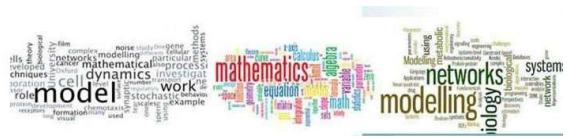
## Mathematics Teachers' Learning of Ambitious and Equitable Instruction in Schools in Delta State, Nigeria

Ekwue, N. L., Ajaegba, N. M., Umukoro, P., Okeke, M. & Amos-Emeaso, P. C.  
Department of Mathematics Education, School of Secondary Education (Science)  
Federal College of Education (Technical)  
Asaba, Delta State, Nigeria  
E-mail: amakacharles1@hotmail.com

### ABSTRACT

This study investigates the current state of research on mathematics teacher learning, with a specific focus on ambitious and equitable instruction in secondary schools. Ambitious and equitable instructions refer to pedagogical practices that promote high academic standards while addressing the diverse learning needs of students, thereby ensuring equitable opportunities for all. A descriptive survey design was employed for the study. The study is specifically focused on twenty (20) randomly selected secondary school mathematics teachers in the Delta North senatorial district of Delta State, Nigeria. The sample size for this study comprises 200 mathematics teachers, and they were selected using a purposive sampling technique. The survey instrument, QMTAE, consists of 30 items designed to gather insights into teachers' practices related to ambitious and equitable instruction in mathematics. The study also reports a high level of reliability, with a Cronbach's alpha coefficient of 0.908, indicating strong internal consistency of the questionnaire titled "Questionnaire on Mathematics Teachers' Ambitious and Equitable (QMTAE)." The findings of the study reveal implications for the design of professional learning opportunities aimed at fostering positive shifts in teachers' perceptions of their students' capabilities. The report highlights the significance of creating environments in which teachers are responsive to diverse student needs, establish high expectations, and promote equity in mathematics education. This insight underscores the importance of professional development initiatives that address these aspects to enhance the overall quality of mathematics instruction in secondary schools. Among other things, it was recommended that collaborative initiatives, such as workshops and seminars, be encouraged to share best practices among mathematics teachers. Mentorship programs should also be explored to enhance teacher confidence and effectiveness in implementing ambitious and equitable instruction.

**Keywords:** Mathematics, Teacher Learning, Ambitious Instruction and Equitable Instruction



## 1. INTRODUCTION

Teachers play a crucial role in student learning, particularly in mathematics. For students to develop conceptual understanding, higher-order thinking skills, and agency in mathematics, teachers must provide ambitious and equitable instruction that engages all students in meaningful learning (Andretti & Major, 2010). However, many secondary mathematics teachers struggle to provide this type of instruction. To support teachers in developing ambitious and equitable instructional practices, schools and educational boards must provide high-quality, sustained professional learning opportunities.

The mathematics classroom presents a unique opportunity to promote ambitious and equitable instruction for secondary school students. As a mathematics teacher, you have the chance to shape how your students view themselves as learners and problem solvers. With the right strategies and mindset, you can help all students develop a growth mindset towards mathematics and see themselves as capable mathematical thinkers. (Anthony & Hunter, 2012)

Ambitious instruction is an act teachers employ to support students as they engage in a problem-solving task that cognitively demands mathematical activities (Kazemil et al., 2015). This implies that deep learning is centered on each student's engagement and participation during instruction because of their previous knowledge, gender, environment, ethnicity, etc. To help support ambitious mathematics instruction, mathematics teachers need to analyze students' errors during evaluation or assessment, understand students' myths and misconceptions, and also provide remedial instruction. However, it is believed that all students can develop positive mathematical abilities and become powerful mathematical learners (Anthony & Walshaw, 2009).

Ambitious mathematics teaching involves skilled ways of making students learn mathematics in a meaningful and engaging way in order to see them as competent mathematicians. Thus, it requires a teaching practice in which teachers engage deeply with each student's thinking, adjusting their instruction accordingly to promote learning. This responsive form of teaching—both in a cultural and equitable sense—is necessary if we are to support meaningful participation for our diverse learners and work to disrupt longstanding assumptions about who can and cannot do mathematics (Averill, 2012).

Equitable instruction in mathematics aims to ensure that all students have equal access and opportunities to learn and excel, regardless of their backgrounds or prior achievements. This approach emphasizes several key principles. Firstly, teachers must maintain high expectations for all students and believe in their abilities, avoiding the practice of "tracking" students into different ability groups, which can perpetuate inequalities. Instead, all students should be presented with rigorous and challenging tasks to foster their growth and development. Moreover, instructional practices should cultivate a growth mindset among students, promoting the belief that abilities can be developed through dedication and effort. Students need to recognize that encountering challenges and making mistakes are integral parts of the learning journey. Therefore, teachers should commend students for their perseverance, application of strategies, and progress rather than solely focusing on innate intelligence.



Additionally, curriculum and lessons should incorporate culturally relevant examples and real-world connections to enhance student engagement and relevance. By relating mathematical concepts to students' lives and communities, educators can create inclusive learning environments where students from diverse backgrounds feel valued and connected to the subject matter. Equitable instruction in mathematics entails fostering high expectations, promoting a growth mindset, providing culturally relevant instruction, and acknowledging students' efforts and progress. By embracing these principles, educators can create an inclusive learning environment where all students have the opportunity to thrive and succeed in mathematics.

Mathematics education has increasingly focused on ambitious and equitable instructions that enhance learning for all students. However, there are still challenges to implementing such reforms successfully at the secondary school level.

## 2. THE RESEARCH FOCUS

### Statement of the problem

Mathematics education in secondary schools faces challenges in balancing ambitious and equitable instruction. Teachers aim to offer rigorous curriculum but struggle to address diverse learner needs. This leads to disparities in student achievement, particularly among marginalized groups. Insufficient professional development exacerbates the issue, limiting teachers' pedagogical skills. Addressing these gaps is crucial for ensuring equitable access to quality mathematics education and fostering inclusive learning environments for all students, ultimately improving academic outcomes.

### Purpose of the study

The purpose of this study would be to investigate factors that facilitate or inhibit secondary mathematics teachers' adoption of ambitious and equitable teaching practices. The specific objectives are to;

1. Identify the current levels of mathematics teachers' knowledge, skills, and beliefs regarding ambitious and equitable instruction in secondary schools.
2. Find out how mathematics teachers perceive the challenges and barriers to implementing ambitious and equitable instruction in their classrooms.
3. Investigate the effective professional development strategies and approaches that support mathematics teachers in learning and implementing ambitious and equitable instructional practices.

### Research questions

The study would seek to answer the following questions

1. What are the current levels of mathematics teachers' knowledge, skills, and beliefs regarding ambitious and equitable instruction in secondary schools?
2. How do mathematics teachers perceive the challenges and barriers to implementing Ambitious and equitable instruction in their classrooms?
3. What are the effective professional development strategies and approaches that support mathematics teachers in learning and implementing ambitious and equitable instructional practices?



### 3. RESEARCH METHODOLOGY

A descriptive survey design was employed. According to Bryman (2016), a descriptive survey is a type of survey that “aims to describe the incidence and distribution of certain phenomena in a population. The population of the study consists of all mathematics teachers in secondary education in the Delta North senatorial district of Delta State. Approximately 3650 teachers. The sample size consists of 200 mathematics teachers, selected through a purposive sampling technique. This method allows for the intentional selection of participants with expertise in the study's focus area. The study utilized a questionnaire titled "Questionnaire on Mathematics Teachers' Ambitious and Equitable (QMTAE)," consisting of 30 items. Respondents used a 4-point Likert scale (strongly agree, agree, disagree, strongly disagree) to express their opinions and perceptions regarding ambitious and equitable mathematics instruction. The reliability of the QMTAE questionnaire was established by 20 students who were not part of the sample size. Cronbach's alpha was used to test the statistical reliability, and the coefficient is 0.908. The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics, specifically the mean and standard deviation, were employed to answer the research questions. Mean scores indicate the average response, while the standard deviation measures the degree of variability in the responses. The benchmark of the remark was that a mean greater than or equal to 2.50 was tagged as agree, while a mean less than 2.50 was tagged as disagree.

### 4. RESULTS

**Research Question One:** What are the current levels of mathematics teachers' knowledge, skills, and beliefs regarding ambitious and equitable instruction in secondary schools?

**Table 1: Mean and Standard deviation on the current levels of mathematics teachers' knowledge, skills, and beliefs regarding ambitious and equitable instruction**

S/N	Statements	N	Mean	S.D	Remark
1	I believe in setting high goals and expectations for my students in mathematics (ambitious).	200	3.55	0.499	Agree
2	I make sure that all my students have an equal chance to succeed in math (equitable).	200	2.56	0.831	Agree
3	I feel well-prepared to use teaching strategies that challenge students to reach their full potential (ambitious).	200	2.27	0.923	Disagree
4	I actively use methods that ensure fairness and inclusion for all students in my mathematics classes (equitable).	200	2.91	0.947	Agree
5	I think it's important to create a classroom environment where every student feels valued and supported in learning math (equitable).	200	1.78	0.941	Disagree
6	I believe that setting high expectations and providing equal learning opportunities can improve students' math skills and understanding (ambitious and equitable).	200	2.20	1.176	Disagree
<b>Grand Mean</b>			<b>2.55</b>	<b>0.886</b>	<b>Agree</b>



Table 1 outlines mathematics teachers' current levels of knowledge, skills, and beliefs regarding ambitious and equitable instruction in secondary schools. Statements 1, 2, and 4 exceed the benchmark of 2.50, indicating agreement with setting high goals, ensuring equal opportunities, and using fair and inclusive methods. Conversely, Statements 3, 5, and 6 fall below the benchmark, suggesting less agreement with feeling well-prepared, creating a supportive environment, and believing in the positive impact of high expectations and equal opportunities. The grand mean of 2.55 reflects a moderate level of agreement overall, with stronger alignment observed for setting high goals and ensuring equal opportunities. However, less consensus exists regarding feeling well-prepared, creating supportive environments, and believing in positive outcomes from high expectations and equal opportunities.

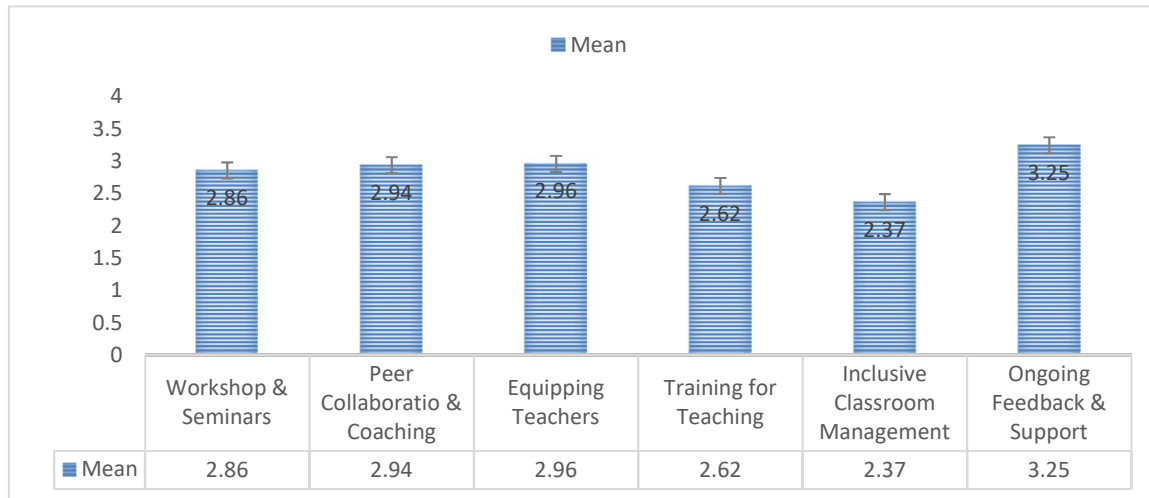
**Research Question Two:** How do mathematics teachers perceive the challenges and barriers to implementing Ambitious and equitable instruction in their classrooms?

**Table 2: Mean and Standard deviation on how mathematics teachers perceive the challenges and barriers to implementing Ambitious and equitable instruction**

S/N	Statements	N	Mean	S.D	Remark
7	I create a classroom environment where the mathematical needs of students are responded to (equitable)	200	3.18	0.686	Agree
8	Setting high expectations for every student, regardless of their background, is difficult.	200	2.18	0.971	Disagree
9	I find it challenging to provide personalized support to students with varying abilities and backgrounds in my math lessons.	200	2.11	1.278	Disagree
10	Overcoming obstacles such as limited resources and time is difficult when implementing equitable instruction.	200	2.81	1.004	Agree
11	Addressing diverse learning needs in a single classroom can be a complex task when trying to promote equity in math education.	200	2.00	1.119	Disagree
12	I experience barriers and challenges to achieving ambitious learning goals in my classroom, especially for students with diverse backgrounds and abilities.	200	1.80	1.024	Disagree
<b>Grand Mean</b>			<b>2.35</b>	<b>1.014</b>	<b>Disagree</b>

Table 2 presents mathematics teachers' perceptions of challenges and barriers to implementing ambitious and equitable instruction. While teachers generally agreed on creating responsive environments (Mean = 3.18), they disagreed with the difficulty of setting high expectations (Mean = 2.18) and providing personalized support (Mean = 2.11). Challenges acknowledged include limited resources and time (Mean = 2.81). Teachers disagreed with the complexity of addressing diverse needs (Mean = 2.00) and barriers to achieving ambitious goals (Mean = 1.80). The grand mean of 2.35 indicates a blend of confidence and recognition of challenges in fostering equity in mathematics education. These insights offer valuable understanding of teachers' attitudes toward equitable instruction.

**Research Question Three:** What are the effective professional development strategies and approaches that support mathematics teachers in learning and implementing ambitious and equitable instructional practices?

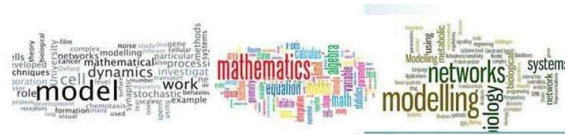


**Fig 1: Bar Chart on the Professional Development Strategies**

The bar chart illustrates effective professional development strategies for mathematics teachers in implementing ambitious and equitable instructional practices. Teachers positively perceive workshops and seminars (Mean = 2.86), emphasizing peer collaboration and coaching (Mean = 2.94). They feel equipped with interactive practices (Mean = 2.96) and recognize culturally responsive teaching (Mean = 2.62). However, disagreement exists regarding inclusive classroom management strategies (Mean = 2.37). Ongoing feedback and support are highly valued (Mean = 3.25). Overall, educators appreciate professional development but express concerns about addressing diversity and inclusive management, suggesting areas for improvement.

**Discussion of Results**

Table 1 presents insights into teachers' perceptions of ambitious and equitable instruction in mathematics. Strong agreement (mean = 3.55) is observed in Statement 1, aligning with Hill and Ball's research (2008) on setting ambitious goals. Statement 2 reflects moderate agreement (mean = 2.56) on providing equal opportunities, consistent with Shepard's work (2021). Statement 3 reveals areas for professional development, with teachers expressing disagreement (mean = 2.27), echoing Horn and Garner's insights (2022). Statement 4 (mean = 2.91) indicates agreement with methods ensuring fairness, supported by Anthony's literature (2015). Conversely, Statement 5 (mean = 1.78) shows disagreement regarding the importance of a supportive environment, contrasting with Shepard's emphasis. Statement 6 (mean = 2.20) raises questions about teachers' perceptions, echoing Horn and Garner's approach (2022). The grand mean of 2.55 suggests an overall positive disposition towards ambitious and equitable practices, in line with Boaler's perspective (2016).



In Table 2, participants generally agree (mean = 3.18, SD = 0.686) on their ability to create responsive classroom environments (Statement 7), aligning with equity in education (Jones & Carter, 2019). Conversely, teachers express disagreement (mean = 2.18, SD = 0.971) with the perceived difficulty of setting high expectations (Statement 8), contrary to existing literature (Gallagher et al., 2020). Participants disagree (mean = 2.11, SD = 1.278) with finding it challenging to provide personalized support (Statement 9), challenging prevailing notions about personalized instruction (Boaler, 2016). Teachers acknowledge difficulties (mean = 2.81, SD = 1.004) in overcoming obstacles like limited resources (Statement 10), consistent with research (Ladson-Billings, 2006). Participants disagree (mean = 2.00, SD = 1.119) with the complexity of addressing diverse needs (Statement 11), challenging assumptions (Gay, 2018). Statement 12 (mean = 1.80, SD = 1.024) highlights disagreement with experiencing barriers to achieving ambitious goals, contradicting perspectives (Darling-Hammond et al., 2019). The grand mean of 2.35 (SD = 1.014) indicates overall disagreement, contrasting with Ball and Bass's perspective (2009).

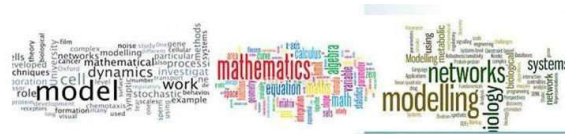
The bar chart analysis reveals insights into professional development. Workshops and seminars are highly valued (mean = 2.86, SD = 1.063), emphasizing their integration (Darling-Hammond et al., 2017). Strong agreement (mean = 2.94, SD = 1.026) is observed regarding peer collaboration (Little, 2012). Professional development initiatives equip teachers (mean = 2.96, SD = 1.1), but there's a gap in addressing inclusive classroom management (mean = 2.37, SD = 0.989). Ongoing support (mean = 3.25, SD = 0.842) underscores its importance (Guskey & Yoon, 2009). The grand mean of 2.83 (SD = 1.034) indicates overall agreement on the effectiveness of professional development.

## 5. CONCLUSION

Research on mathematics teacher learning with a focus on ambitious and equitable instruction in secondary schools has illuminated critical aspects of professional development. Findings underscore the significance of cultivating environments where teachers respond to diverse student needs, set high expectations, and promote equity in mathematics education. The conclusion highlights the positive impact of professional development on teacher practices, emphasizing the need for ongoing support and feedback.

## 6. RECOMMENDATIONS

1. Advocate for sustained professional development programs emphasizing ambitious and equitable teaching practices.
2. Encourage collaborative initiatives, such as workshops and seminars, to share best practices among mathematics teachers.
3. Support the integration of culturally responsive teaching strategies into mathematics instruction.
4. Explore mentorship programs to enhance teacher confidence and effectiveness in implementing ambitious and equitable instruction.



## REFERENCES

- Andreotti, V., & Major, J. (2010). Shifting conceptualisations of knowledge and learning in initial teacher education in Aotearoa/New Zealand. *Journal of Education for Teaching*, 36(4), 441–459.
- Anthony, G. (2015). How ambitious is “ambitious mathematics teaching”? Set: Research Information for Teachers, 3, 15–21. <https://www.nzcer.org.nz/nzcerpress/set/articles/how-ambitious-ambitious-mathematics-teaching>
- Anthony, G., & Hunter, R. (2012). (Re) thinking and (re)forming initial mathematics teacher education. *New Zealand Journal of Educational Studies*, 47(1), 145–151.
- Anthony, G., & Walshaw, M. (2007). *Effective pedagogy in mathematics/pāngarau: Best evidence synthesis iteration [BES]*. Wellington: Ministry of Education.
- Averill, R. (2012). Caring teaching practices in multiethnic mathematics classroom: Attending to health and well-being. *Mathematics Education Research Journal*, 24(2), 105–128.
- Ball, D. L., & Bass, H. (2009). "With an eye on the mathematical horizon: Knowing mathematics for teaching to learners' mathematical futures." In R. Even & D. L. Ball (Eds.), "The professional education and development of teachers of mathematics" (pp. 49-78). Springer.
- Boaler, J. (2019). *Limitless Mind: Learn, Lead, and Live without Barriers*. HarperOne
- Boaler, J. (2016). *Mathematical Mindsets: Unleashing Students' Potential through Creative Math, Inspiring Messages and Innovative Teaching*. Wiley.
- Bryman, A. (2016). *Social Research Methods*. Oxford University Press.
- Darling-Hammond, L., et al. (2009). *Professional Learning in the Learning Profession: A Status Report on Teacher Development in the United States and Abroad*. National Staff
- Gallagher, D. J., et al. (2020). *Equity in Mathematics Education: Addressing a Changing World*. National Council of Teachers of Mathematics.
- Gay, G. (2018). *Culturally Responsive Teaching: Theory, Research, and Practice* (Multicultural Education Series). Teachers College Press.
- Guskey, T. R., & Yoon, K. S. (2009). What Works in Professional Development? *Phi Delta Kappan*, 90(7), 495-500.
- Horn I. & Garner, B (2022) *Teacher Learning of Ambitious and Equitable Mathematics Instruction*. USA: Routledge publisher
- Johnson, M., & Smith, L. (2020). "Transformative Professional Development: Impact on Teaching Practices." *Journal of Education Research*, 25(3), 112-130
- Jones, M., & Carter, F. (2019). *Reimagining the Mathematics Classroom: Creating and Sustaining Productive Learning Environments*. Routledge.
- Kazemi, E., Megan, F. & Lampert, M. (2015) *What is Ambitious Teaching?* Retrieved on 7<sup>th</sup> July, 2022 from <http://davidwees.com/>
- Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32(3), 465-491.
- Little, J. W. (2012). *Professional Community and Professional Development in the Learning-Centered School*. In A. Lieberman & L. Miller (Eds.), *Teachers Caught in the Action: Professional Development That Matters* (pp. 1-18). Teachers College Press.
- Shepard, L. A. (2021). Ambitious Teaching and Equitable Assessment. *American Educator*, Fall 2021. <https://www.aft.org/ae/fall2021/shepard>