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Growth Mindset Intervention and Academic Achievement: Examining Effects on Underachieving Secondary School Students with Gender Considerations

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Abstract

This study examines the impact of a structured growth mindset intervention on the academic achievement of underachieving secondary school students in Anambra State. A quasi-experimental pretest-posttest control group design was used, involving 70 academically underachieving secondary school students who were assigned to either an experimental group (N = 37) or a control group (N = 33). The experimental group participated in a 13-week growth mindset intervention, incorporating sessions on neuroplasticity, effort-based learning, and academic resilience, while the control group received no intervention programme. Academic achievement was measured using teacher-made test scores, and ANCOVA was used to test the hypotheses. The experimental group (M = 71.76, SD = 9.78) demonstrated significantly higher post-test academic achievement than the control group (M = 58.50, SD = 10.08), $F(1, 65) = 1206.71$, $p < .001$, partial $\eta^2 = .949$, indicating a substantial intervention effect. Additionally, a significant gender difference was found, with female students achieving higher post-test scores than their male counterparts. The intervention was effective across all students, reinforcing the role of growth mindset programmes in enhancing academic outcomes. It was concluded that growth mindset interventions can significantly improve the academic performance of underachieving students, offering a practical, evidence-based strategy for addressing academic challenges.

Keywords: Growth mindset, academic achievement, underachievement, intervention, secondary education, Nigeria

Introduction

Academic underachievement represents a persistent challenge within educational systems worldwide, defined as a significant discrepancy between students' intellectual capabilities and their actual academic performance (Alexopoulou, Batsou, & Drigas, 2019; Alinsunurin, 2021). This phenomenon affects approximately 15-40% of potentially high-achieving students across various educational contexts (White, Graham & Blaas, 2018). The consequences of underachievement extend beyond immediate academic outcomes, impacting students' future educational trajectories, career opportunities, and psychological wellbeing (Borkowski & Thorpe, 2023; Thelen, 2023). Despite numerous intervention approaches, including counseling programmes, motivational strategies, and instructional modifications, underachievement remains prevalent and challenging to address effectively (Desmet, 2020; Mazrekaj, Witte & Triebs, 2022; Snyder et al., 2019).

Research indicates that underachieving students often demonstrate maladaptive beliefs about intelligence, viewing it as a fixed trait rather than a malleable quality (Mofield & Peters, 2019; Yeager & Dweck, 2020). This fixed mindset contributes to decreased motivation, reduced effort, and avoidance of challenges—all factors that perpetuate underachievement patterns (Burnette et al., 2023; Török, Szabó & Orosz, 2022). While growth mindset interventions have shown promise in general student populations, their specific effectiveness for addressing underachievement remains insufficiently explored (Macnamara & Burgoyne, 2023). Furthermore, potential gender differences in intervention responsiveness represent a significant knowledge gap, with some studies suggesting that male and female students may respond differently to academic interventions (Degol, Wang, Zhang & Allerton, 2018; Malespina, Schunn & Singh, 2022). This study addresses these gaps by examining the effects of a structured growth mindset intervention on underachieving students' academic performance while also investigating gender as a potential moderating factor.

Growth Mindset and Academic Achievement

Carol Dweck's Growth Mindset Theory posits that individuals hold implicit beliefs about intelligence, which shape their approach to learning and achievement (Dweck, 2006). Students with a fixed mindset believe that intelligence is an inherent trait that cannot be changed, leading to avoidance of challenges, fear of failure, and reduced academic effort. In contrast, those with a

growth mindset view intelligence as developable through effort and learning, fostering greater motivation, persistence, and adaptability in academic settings (Yeager et al., 2019).

Empirical studies have consistently demonstrated the positive impact of growth mindset interventions on student achievement. Altikulaç, Janssen, Yu, Nieuwenhuis, and Van Atteveldt (2024) found that growth-mindset students with low or moderate performance goals exhibited better academic achievement, motivation, and lower school burnout symptoms compared to fixed-mindset students with high performance goals. A meta-analysis by Sisk et al. (2018) found that growth mindset programs were particularly effective for academically at-risk students, leading to measurable improvements in grades, motivation, and resilience. Similarly, Paunesku et al. (2015) conducted a large-scale intervention involving over 1,500 students and found that those who received growth mindset training showed significantly higher academic performance compared to control groups. These findings suggest that fostering a growth-oriented belief system may be a low-cost yet impactful strategy for addressing underachievement, particularly in resource-constrained educational settings.

Mindset interventions are also linked to enhanced learning behaviors such as increased engagement, willingness to embrace challenges, and improved self-efficacy (Burnette et al., 2013). For instance, a study by Yeager and Dweck (2020) demonstrated that students who underwent a brief mindset intervention were more likely to persist in difficult tasks, recover from failure, and demonstrate long-term academic improvement. Given this compelling body of evidence, the present study explores how a structured growth mindset program can serve as an effective tool for enhancing academic outcomes among underachieving students in Nigerian secondary schools.

Growth Mindset in Diverse Educational Contexts

Although growth mindset interventions have shown promising results in Western educational systems, their effectiveness in non-Western contexts remains an area of ongoing research. Large-scale studies conducted in the United States and Europe have demonstrated that even brief mindset interventions can produce long-term gains in academic motivation and performance (Claro, Paunesku, & Dweck, 2016). However, research in low- and middle-income countries suggests that cultural factors may moderate the effectiveness of these interventions (King & Trinidad, 2021).

For example, Qin et al. (2021) found that mindset interventions were most effective in schools with moderate resources, where students had some access to academic support but still faced structural learning challenges. In contrast, a study by Sun, Nancekivell, Gelman and Shah (2021) reported that growth mindset programs required substantial adaptation in countries with strong hierarchical educational systems, where students are less accustomed to autonomous learning and self-directed goal-setting. In African contexts, Mohamoud (2024) found that mindset interventions enhanced motivation and resilience among Somali secondary school students, but challenges such as limited teacher training and resource constraints affected long-term implementation.

Given these findings, it is essential to examine how mindset interventions function within Nigeria's unique educational landscape. Nigerian secondary schools often operate under resource-limited conditions, with many students facing psychological barriers to academic success, such as low self-efficacy, negative peer influence, and a lack of academic encouragement (Adeoye, Shogbesan, Jolaoye & Hassanat Jimoh, 2024). This study seeks to determine whether a structured growth mindset program can effectively enhance academic achievement among underachieving Nigerian students and provide insights into context-specific adaptations required for optimal impact.

The Current Study

Despite the growing body of research on growth mindset interventions, their effectiveness for underachieving students in Nigeria remains largely unexplored. While studies in Western contexts have shown that growth mindset programs enhance motivation, resilience, and academic performance (Sisk et al., 2018; Yeager & Dweck, 2020), little research has examined their applicability in African educational systems. Additionally, much of the existing literature focuses on high-performing or general student populations, with fewer studies specifically targeting academically struggling students (King & Trinidad, 2021). This gap is particularly concerning, as underachieving students often experience low academic self-concept, reduced motivation, and avoidance of academic challenges—factors that make them prime candidates for mindset-based interventions (Burnette et al., 2013).

The educational landscape in Anambra has faced significant challenges in recent years, particularly concerning student performance on standardized assessments. Many students encounter difficulties that hinder their academic success, leading to widespread underachievement. This is

evident in the results of the 2024 West African Senior School Certificate Examination (WASSCE), which indicate a decline in student performance, with only 72% of candidates achieving credits in at least five subjects, including English and Mathematics. This marks a drop from the 79.81% achievement rate recorded in 2023 (Nnaike, 2024). Such declining trends in academic performance underscore the urgent need for effective interventions to address these challenges and improve educational outcomes.

Most research in Nigerian educational psychology has focused on systemic barriers to achievement, such as teacher quality, school funding, and curriculum design (Owan, Ukam, & Egame, 2023). While these structural factors are critical, the role of psychological interventions, particularly those aimed at changing students' beliefs about intelligence, has received far less empirical attention. Given that students' perceptions of intelligence influence their learning behaviors and long-term academic success, investigating whether structured mindset programs can improve achievement outcomes in Nigerian schools is essential.

To address these gaps, this study implements and evaluates a structured growth mindset intervention for underachieving secondary school students. The intervention integrates neuroplasticity education, effort-based learning strategies, and resilience training to help students shift from a fixed to a malleable view of intelligence. By comparing pretest and posttest academic achievement scores of an experimental and control group, this study seeks to determine whether mindset training can significantly improve the academic performance of students struggling with persistent underachievement.

While previous studies have explored gender differences in mindset-related outcomes, this study does not primarily focus on gender effects. However, given the documented gender disparities in Nigerian secondary school achievement (UNICEF, 2022), the study will examine whether male and female students respond differently to the intervention. If significant gender differences emerge, the findings may provide insights into how mindset interventions can be tailored to address gender-specific learning needs.

Thus, the present study seeks to answer the following research questions:

1. What is the effect of a growth mindset intervention on the academic achievement of underachieving secondary school students?

2. Does the intervention have a differential impact based on gender?
3. Does gender moderate the effectiveness of the intervention on academic achievement?

Furthermore, the following null hypotheses were tested

1. Students in the experimental group will exhibit significantly higher post-test academic achievement scores than those in the control group, after adjusting for pre-test scores.
2. There will be a significant main effect of gender on academic achievement, with male and female students performing differently post-intervention.
3. The interaction effect between gender and intervention condition will be non-significant, indicating that the growth mindset program is equally effective across genders.

Method

This study employed a quasi-experimental pretest-posttest control group design to investigate the effects of a structured growth mindset intervention on the academic achievement of underachieving secondary school students. Participants were drawn from secondary schools in Anambra State, Nigeria, and comprised 70 academically underachieving students aged between 12 and 16 years. These students were selected from two intact classes, with 37 assigned to the experimental group and 33 to the control group.

A two-step process was employed to identify underachieving students. First, teachers conducted subjective evaluations, identifying students who displayed characteristics of underachievement, such as low motivation, inconsistent effort, and struggles in academic performance despite evident potential. This initial selection was followed by an objective assessment using the discrepancy method, in which students' admission aptitude test scores (Common Entrance Examination) were compared with their current Grade Point Averages (GPAs) in Mathematics and English. A discrepancy score was calculated as the difference between the converted aptitude test GPA and the current GPA. Students with a discrepancy score greater than 0.5 were classified as underachievers. The experimental group comprised 19 males and 18 females, while the control group consisted of 12 males and 21 females.

Approval for the study was obtained from school administrators, and a preliminary briefing was held with teachers, and students. The study's objectives, procedures, and ethical considerations, including confidentiality and voluntary participation, were explained. Written informed consent was secured from students and their guardians before the intervention commenced.

The 13-week intervention consisted of structured weekly sessions lasting 45 to 60 minutes, conducted during counselling section periods to minimize disruptions. The programme was designed to instill growth mindset principles through neuroplasticity education, goal-setting activities, and resilience training. Hands-on activities, problem-solving exercises, guided reflections, and collaborative learning strategies were incorporated to enhance engagement. To foster motivation, the researchers collaborated with school authorities to establish "The Resilience and Growth Club," where students received membership IDs, reinforcing their sense of belonging and commitment.

Students participated in activities such as planting maize seeds to symbolize intellectual growth, engaging in problem-solving case studies, and maintaining personal growth journals. Peer mentoring and collaborative learning were emphasized, with accountability partnerships formed to track progress. Facilitators used real-life storytelling and role-playing scenarios to reinforce key intervention concepts, ensuring students internalized the principles of effort-based learning and resilience. The control group followed their regular academic routine without exposure to the mindset training. The table below outlines the core lessons and activities delivered during the intervention:

Table 1: Experimental Procedure/Intervention Script

Lesson No.	Lesson Title	Activities	Key Concepts
1	Planting Maize Seeds (Illustrating Growth Potential & Effort Over Time)	- Preparation: Each student brought an empty can or container from home. The researcher provided soil from the school garden. - Planting Activity: Students filled their cans with soil, received maize seeds, planted them, and watered them. - Discussion: Students discussed what plants need to grow and how this relates to their own growth (effort, care, patience). - Monitoring & Reflection: Each student was responsible for their plant, checking on its progress daily. If a plant failed to sprout, they were encouraged to try again. - Lesson Takeaway: Just like plants need time and care to grow, intelligence and skills develop through consistent effort and resilience.	Effort-based growth, perseverance, patience, resilience.
2	Neuroplasticity – The Brain's Ability to Grow	- Interactive Brain Models: Researchers used plastic brain models and animations to demonstrate how the brain forms new connections when we learn. - Personal Reflection: Students wrote about a subject or skill they once struggled with but later improved upon. - Reframing Struggles: Students were guided through discussions on how mistakes are part of the learning process. - Growth Mindset Affirmations: Each student selected or created a personal affirmation (e.g., *"I am improving every day through effort"*) and shared it with a partner.	Intelligence is malleable, effort leads to growth, rewiring the brain through learning.

3	Problem-Solving and Reframing Challenges	- Storytelling Exercise: The researcher shared real-life examples of people who overcame failure (e.g., Thomas Edison's 1,000 failed attempts before inventing the light bulb). - Group Discussion: Students analyzed the challenges these individuals faced and discussed how their persistence led to success. - Role-Playing Scenarios: Students acted out situations where they encountered failure (e.g., failing a test, struggling with a math problem) and brainstormed alternative responses. - Personal Stories: Each student shared a personal struggle and, with peer input, reframed it as an opportunity for growth.	Resilience, learning from failure, shifting perspectives, hope through perseverance.
4	Effort Journals & Growth Mindset Quizzes	- Introduction to Journaling: Each student received a "Growth Journal" and was guided on how to document their learning experiences, challenges, and how they overcame them. - Daily Reflection Activity: Students wrote about a time they persisted in a task and how they felt afterward. - Self-Assessment Quizzes: Students completed short quizzes that tested their understanding of the effort-based learning model. - Peer Feedback: Students swapped journals with a partner to share feedback and encouragement.	Self-reflection, persistence, reinforcement of key concepts.
5	Setting SMART Goals – Structured Future Planning	- Explaining SMART Goals: Researchers provided a breakdown of SMART goals (Specific, Measurable, Achievable, Relevant, Time-bound). - Goal-Setting Activity: Students set a personal academic goal and a non-academic goal, writing them down in their journals. - Breaking Down Goals: Each student outlined small, actionable steps to achieve their goals (e.g., "To improve in math, I will practice 5 extra questions daily"). - Accountability Partners: Students paired up and agreed to check in on each other's progress weekly.	Goal setting, structured planning, accountability, hope for the future, vision for success.
6	Peer Mentoring & Collaborative Learning	- Buddy System: Higher-achieving students were paired with struggling students for peer mentoring sessions. - Growth Story Sharing Circles: Students gathered in small groups to share real-life experiences of how they applied growth mindset strategies. - Guided Discussions: Students discussed challenges they faced in applying these principles and brainstormed solutions together. - Confidence-Building Exercises: Role-playing scenarios where students practiced encouraging themselves and others during setbacks.	Peer learning, mentorship, confidence-building, collaboration.
7	Reflection & Practical Application of Lessons	- Personal Growth Reflection: Students reviewed their journals and identified key moments where they applied growth mindset concepts. - Testimony Sharing: Volunteers shared how the program had changed their perspective on effort and failure. - Letter to Future Self: Each student wrote a letter detailing what they had learned and how they planned to apply these lessons in the future. - Group Discussion: Students identified challenges they might still face and strategies for overcoming them.	Self-awareness, resilience, long-term motivation, hope for a better future, planning for success.
8	Mini-Graduation & Recognition of Achievements	- Graduation Ceremony: Each student received a certificate recognizing their commitment and progress. - Student Presentations: Volunteers shared their biggest takeaways from the program. - Future Commitment Pledge: Students wrote personal commitments to continue applying growth mindset principles. - Encouragement from Teachers & Researchers: Educators reinforced the idea that personal growth is an ongoing journey.	Achievement recognition, motivation, continuous learning.

To ensure the consistency and quality of the intervention, facilitators adhered to a structured manual outlining the objectives and procedures for each session. Independent observers conducted session evaluations to monitor the fidelity of implementation. Additionally, video recordings of selected sessions were reviewed to assess adherence to intervention principles and identify areas for refinement. Facilitator self-reports and observer feedback provided an ongoing mechanism for adjusting instructional strategies where necessary. Observations revealed that clarifying complex concepts, such as neuroplasticity, with relatable analogies improved student understanding and engagement. The monitoring framework ensured that the intervention was delivered as intended, reinforcing the reliability of the study findings.

Academic achievement was measured using students' pre-test and post-test scores, assessed through a teacher-made achievement test. The pre-test was administered before the intervention, establishing baseline performance levels, while the post-test was conducted immediately after the intervention to evaluate its impact. Descriptive statistics, including means and standard deviations, were computed to summarize student performance across both groups. To determine the effectiveness of the intervention, an analysis of covariance (ANCOVA) was conducted, controlling for baseline differences in pre-test scores. This analysis allowed for a more precise estimation of the intervention's effect while accounting for potential confounding variables. Additionally, ANCOVA was performed to examine gender differences in intervention responsiveness. A significance level of $p < .05$ was set for all statistical tests.

This study adhered to ethical guidelines for research involving minors. Informed consent was obtained from participants and their guardians, and all students were assured of confidentiality and their right to withdraw from the study at any stage without consequences. The researchers ensured that the intervention did not disrupt regular academic activities.

Results

Table 2: Descriptive Statistics for Achievement Pre-test and Post-test Scores by Group

Group	***N***	**Pretest Mean**	**Pretest *SD***	**Posttest Mean**	**Posttest *SD***	**Mean Gain**
Experimental	37	57.86	10.64	71.76	9.78	13.90
Control	33	57.79	10.05	58.50	10.08	0.71

Table 2 revealed that the experimental group (n = 37) improved from 57.86 (SD = 10.64) at pretest to 71.76 (SD = 9.78) at posttest (mean gain = 13.90). The control group (n = 33) had a smaller increase from 57.79 (SD = 10.05) to 58.50 (SD = 10.08) (mean gain = 0.71), indicating greater improvement in the experimental group.

Table 3: Descriptive Statistics for Achievement Pre-test and Post-test Scores by Gender

Group	Gender	N	Achievement				
			Pretest		Posttest		$\overline{x}$ gain
			$\overline{x}$	*SD*	$\overline{x}$	*SD*	
Growth Intervention	Male	19	57.84	10.98	71.05	10.21	13.21
	Female	18	57.89	10.60	72.50	9.55	14.61
Cont. Group	Male	12	54.63	11.45	55.25	11.74	0.62
	Female	21	59.60	8.95	60.36	8.77	0.76

In Table 4, the academic achievement of male and female students was presented. Female students in the experimental group had higher mean gains than male and female students in both control and experimental groups. Male students in the experimental group had higher mean gains than male and female students in the control group.

Table 4: ANCOVA Results for Post-test Achievement Scores

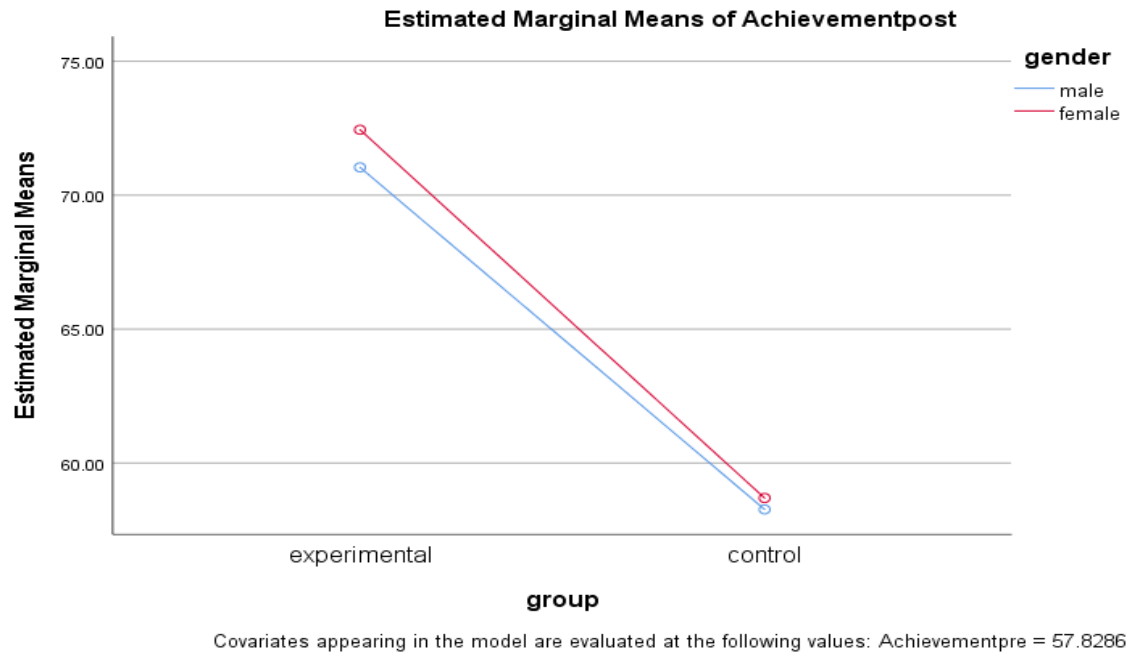
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	9604.010[a]	4	2401.002	986.276	.000	.984
Intercept	236.592	1	236.592	97.186	.000	.599
Achievementpre	6320.032	1	6320.032	2596.122	.000	.976
group	2937.634	1	2937.634	1206.712	.000	.949
gender	13.787	1	13.787	5.663	.020	.080
group * gender	3.940	1	3.940	1.618	.208	.024
Error	158.237	65	2.434			

Total	310145.250	70
Corrected Total	9762.246	69

a. R Squared = .984 (Adjusted R Squared = .983)

Table 4 showed the analysis of covariance (ANCOVA) conducted to examine the effect of the growth mindset intervention on students' post-test academic achievement, controlling for pre-test scores. The results indicate a significant main effect of the intervention on post-test achievement scores, $F(1,69)=1206.71$, $p<.001$, $\eta^2 =.949$. This large effect size suggests that the growth mindset intervention had a substantial impact on students' academic achievement.

Furthermore, potential gender differences in achievement gains were examined. The analysis revealed a significant main effect of gender ($p = .020$, partial $\eta^2 = .080$), indicating that female students had higher post-test achievement scores than male students. However, the interaction effect between gender and intervention condition was not significant ($F(1,65) = 1.62$, $p = .208$, $\eta^2 = .024$), meaning the intervention did not have a differential impact based on gender. This means that the growth mindset intervention was equally effective for both males and females, with no evidence that it worked better for one gender over the other. The gender interact effect with the method is presented in figure 1 below:



Discussion

The findings indicate that the growth mindset intervention had a strong positive effect on students' academic achievement. This supports the idea proposed by Dweck (2006) that students who view intelligence as adaptable are more likely to develop learning-oriented behaviors, persist through difficulties, and ultimately improve their academic performance. The significant improvement observed aligns with theories suggesting that fostering a growth mindset encourages students to embrace effort and challenges rather than viewing their abilities as fixed (Claro, Paunesku, & Dweck, 2016; Yeager et al., 2019).

These results are consistent with previous studies demonstrating that growth mindset interventions can lead to meaningful academic gains. For instance, Yeager et al. (2019) found that students who received mindset training were more likely to persist in their studies and achieve higher academic outcomes. Similarly, Sisk et al. (2018) reported that growth mindset programmes were particularly effective for academically at-risk students, further emphasizing the potential of such interventions to address underachievement. This study contributes to the existing body of knowledge by demonstrating that structured mindset training can be effective in the Nigerian secondary school context, where socio-economic challenges often contribute to persistent underachievement (Nwosu, Okoyoe & Onah, 2018; Isiguzo & Isukwem, 2024). However, findings exist in the literature that demonstrates that the impact of growth mindset programmes could be mediated by other factors within the learning environment. Macnamara and Burgoyne (2023) conducted a meta-analysis of mindset interventions and found that their impact on academic achievement was modest, with effect sizes diminishing when publication bias was accounted for. They argued that mindset alone may not be sufficient for academic improvement and that additional factors, such as instructional quality and student support systems, may play a more substantial role. This suggests that while growth mindset interventions can be beneficial, their effectiveness may vary depending on the broader educational context and implementation fidelity.

The results also indicate gender-related differences in academic achievement, with female students outperforming their male counterparts. This finding is consistent with studies such as Reilly et al. (2019), which reported that female students generally exhibit stronger self-regulation and learning behaviors, which may enhance their academic performance in response to mindset interventions. Similarly, Porter et al. (2022) found that females tend to internalize growth mindset

messages more readily and apply them effectively in their studies. However, contrasting research by Schmidt and Shumow (2020) found that while females benefit from mindset interventions, males showed greater academic resilience in response to challenges, suggesting that gender differences in mindset responsiveness may not always favor females.

Despite the gender differences in overall post-test achievement scores, the growth mindset intervention was found to be equally effective for both males and females. This conclusion is supported by the non-significant interaction effect, indicating that while females had slightly higher scores, the intervention benefited both genders similarly. These results align with Sisk et al. (2018) and Yeager & Dweck (2020), who found that growth mindset interventions can be widely implemented across different student populations with consistent positive effects. Rattan and Georgeac (2017) found that while mindset interventions work across genders, their effects are sometimes more pronounced in males, particularly in subjects where they initially lacked confidence, such as language learning. However, Burnette et al. (2018) found that in some contexts, gender differences in intervention effectiveness emerge due to variations in motivational beliefs and prior experiences with academic failure. This suggests that while mindset programs may generally be effective across genders, their impact could be influenced by contextual factors such as student motivation, teacher expectations, and cultural attitudes toward learning and persistence.

These findings contribute to the ongoing debate regarding gender differences in response to mindset interventions. While some studies suggest that females benefit more due to better self-regulation and study habits (Reilly et al., 2019), others find that interventions are equally effective for both genders (Montagna et al., 2021). Additionally, some research, such as that by King and Trinidad (2021), suggests that gender differences in mindset adoption may be influenced by cultural and societal expectations rather than inherent cognitive differences. This underscores the need for further research exploring how socio-cultural factors interact with mindset interventions, particularly in non-Western, resource-constrained educational settings.

Implications and limitations of the findings

This study contributes to the growing body of research on growth mindset interventions by demonstrating their effectiveness in a Nigerian secondary school setting. The findings support

Dweck's (2006) implicit theories of intelligence while also highlighting the importance of cultural and contextual adaptations. Previous studies have focused primarily on Western educational systems; this study provides empirical evidence that mindset training can be effective in resource-constrained settings. While the study provides valuable insights, several limitations should be acknowledged. First, the issue of small sample size could limit the generalizability of the findings. Future research should include larger and more diverse student populations. Second, the fact that there was no randomization in the study could result to bias. There is need that future studies attempt to employ a randomized experiment.

Conclusion

This study provides compelling evidence that a structured growth mindset intervention can significantly enhance the academic achievement of underachieving secondary school students. The findings indicate that both male and female students benefited equally, supporting the broad applicability of mindset programmes in educational settings. It could be concluded that growth mindset programme could be beneficial to students who are underachieving.

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