# A Quasi-Experimental Study of Cognitive and Counselling-Informed Stem Pedagogies: Effects on Academic Achievement, Engagement, Equity, and Learner Well-Being in Inclusive Secondary School Classrooms

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***Abstract***
*This study examined the effect of Cognitive and Counselling-Informed STEM Pedagogies on secondary school science students' academic achievement, classroom engagement, equity, and learner well-being in Owerri Metropolis, Imo State. A quasi-experimental pretest-posttest control-group design was adopted. Student population was 171 science students and teachers in 2 public secondary schools in Owerri Metropolis, a sample of 120 participants involving 100 students, 20 teachers were selected using purposive sampling technique and determined using Taro Yamane's formula at a 5% error margin. The experimental group (n=60) underwent an 8-week CC-SP intervention, while the control group (n=60) received conventional STEM instruction. Data were collected using a researcher-developed instrument titled: Academic Disengagement and Cognitive Barriers Scale (ADCBS), STEM Equity and Learner Well-being Scale (SELWS) and were analyzed using mean, standard deviation, and Analysis of Covariance (ANCOVA) at the .05 significance level, with a 2.50 benchmark mean. Results showed substantial reduction in cognitive barriers in the experimental group, with mean scores decreasing from 99.48 (SD=10.12) to 65.73 (SD=7.84), compared to 99.98 (SD=10.05) to 89.29 (SD=9.14) in the control group ($F(1,117) = 195.11$, $p < .001$, $\eta^2p = .624$). Equity and well-being scores significantly improved in the experimental group from 79.96 (SD=8.45) to 105.01 (SD=6.92) versus 78.35 (SD=8.60) to 87.08 (SD=7.85) in the control group ($F(1,117) = 172.72$, $p < .001$, $\eta^2p = .596$). The study concludes that Cognitive and Counselling-Informed STEM Pedagogies significantly enhances achievement, engagement, equity, and well-being in inclusive science classrooms.*

***Keywords:*** *Cognitive pedagogy; Counselling-informed instruction; Inclusive STEM education; Academic achievement; Equity; Learner well-being*

## Introduction

Science, Technology, Engineering, and Mathematics stand for STEM. STEM education is the fundamental driver of scientifical and technological advancement, economic development, and

sustainable innovation that the advanced economies and developing nations of the world are celebrating globally (UNESCO, 2020; World Bank, 2022). No nation can rise above the level of its educational standard. Even though a child's educational foundation must b lied at the primary school level, the secondary education is nonetheless, a very critical stage to be overlooked. In secondary education systems, cultivating problem-solving competence, analytical thinking, and scientific literacy is vital for preparing students for a rapidly evolving, knowledge-based economy (National Research Council, 2018; OECD, 2023). However, traditional STEM instructional frameworks in Nigeria is predominantly teacher-centred, lecture-driven, and memory-oriented (Eze et al., 2021; Nwosu & Okeke, 2022). Such pedagogical approaches isolate cognitive skill acquisition from affective and psychological domains support, leaving learners prone to cognitive overload, subject-related anxiety, low self-efficacy, and passive disengagement (Akinlye & Adebayo, 2023; Bandura, 1986). In inclusive classrooms, learners present diverse academic skill backgrounds, cognitive capacities, and socio-emotional profiles, therefore using standard uniform instruction in such classrooms will create learning disparities (Ames et al., 2021; Florian, 2019). This is because inclusive education mandates that teaching practices cater to diverse student profiles while promoting equity, active participation, and psychological safety (UNESCO, 2020). Modern educational psychology has identified that cognitive processing and emotional regulation are deeply intertwined (Durlak et al., 2021; Sweller, 1988). When learners encounter heightened evaluative anxiety, gender stereotyping, or lack psychological safety, their working memory capacity for complex STEM reasoning is compromised (Paas & van Merriënboer, 2020). To address these systemic challenges of STEM education in Nigeria, Cognitive and Counselling-Informed STEM Pedagogies is proposed. As newly developed teaching method, Cognitive and Counselling-Informed STEM Pedagogies provides an integrative instructional model for inclusive classrooms. Cognitive and Counselling-Informed STEM Pedagogies intentionally embeds metacognitive scaffolding (such as structured heuristic problem breakdown, cognitive modeling, and self-monitoring prompts) alongside evidence-based counselling practices (including active listening, growth-mindset feedback, cognitive restructuring of failure attributions, and psychological safety protocols) into daily subject delivery (Dweck, 2017; Mbaji et al., 2024; Obi & Anyanwu, 2022). Therefore, by aligning STEM instruction with cognitive load principles while providing a supportive emotional environment, leanding will be improved and students will perform better. Therefore, Cognitive and Counselling-Informed STEM Pedagogies aims to enhance cognitive mastery, active classroom engagement, gender equity, and overall learner well-being.

**Statement of the Problem**

Despite educational policy reforms aimed at improving STEM educational outcomes in Nigeria, science and technology secondary school students in Owerri Metropolis of Imo State have continued to exhibit sub-optimal level academic performance. This problem is partly because of disengagement of interest in learning by student. Science, technology, engineering, and mathematical subjects are not always smooth sells for students. Studies have shown that, in mathematics alone, high number of students have reported phobia to the subject. This anxiety issue is partly the reason why performance in science and technology by students in Owerri Metropolis has continued to be low. Another critical problem that has continued to challenge improvement is the isolation of guidance and counselling services from classroom teaching. In Owerri Metropolis, guidance and counselling services in secondary schools operate largely in isolation from classroom teaching, functioning primarily as administrative or disciplinary

consultations rather than pedagogical assets embedded directly within instruction thereby denying students from receiving the instructional counselling services, they need for learning improvement.

**Objectives of the Study**

The general purpose of this study was to examine the effect of Cognitive and Counselling-Informed STEM Pedagogies on secondary school science students' academic achievement, classroom engagement, equity, and learner well-being. Specifically, the study sought to:

1) Determine the effects of Cognitive and Counselling-Informed STEM Pedagogies on reduction of academic disengagement and cognitive learning barriers among secondary school students in Owerri Metropolis.
2) Examine the effects of Cognitive and Counselling-Informed STEM Pedagogies on promotion of classroom equity and enhancement of learner psychological well-being among secondary school students in Owerri Metropolis.
3) Assess the difference in post-test achievement, engagement, equity, and well-being scores between students exposed to intervention (experimental group), and those exposed to conventional STEM instruction (control group).

**Research Questions**

The following research questions answered the specific objectives of the study:

1) What is the difference in the pretest and post-test mean scores of academic disengagement and cognitive barriers between secondary school science students exposed to Cognitive and Counselling-Informed STEM Pedagogies and those exposed to conventional instruction?
2) What is the difference in the pretest and post-test mean scores of equity and learner well-being between secondary school science students exposed to Cognitive and Counselling-Informed STEM Pedagogies and those exposed to conventional instruction?
3) What is the comparative effectiveness of Cognitive and Counselling-Informed STEM Pedagogies versus conventional STEM instruction on overall student outcomes in inclusive secondary school science classrooms?

**Hypotheses**

The following null hypotheses correspond to the research questions and were tested at the .05 level of significance:

**$HO_1$:** There is no statistically significant effect of Cognitive and Counselling-Informed STEM Pedagogies on secondary school science students' post-test academic disengagement and cognitive barrier scores when controlling for pretest baseline scores.

**$HO_2$:** There is no statistically significant effect of Cognitive and Counselling-Informed STEM Pedagogies on secondary school science students' post-test equity and learner well-being scores when controlling for pretest baseline scores.

**$HO_3$:** There is no statistically significant difference in overall post-test performance indicators in achievement, engagement, equity, and well-being between students in the experimental group and those in the control group.

## Conceptual Framework

The conceptual framework posits that instructional methodology acts as the primary independent variable influencing both cognitive and affective student outcomes in inclusive secondary STEM classrooms. Figure 1 illustrates the conceptual model detailing the structural interaction between Cognitive and Counselling-Informed STEM Pedagogies mediating psychological processes, and resultant educational outcomes.




*Figure 1: Conceptual Framework of Cognitive and Counselling-Informed STEM Pedagogies*
*Source: The Researcher (2026)*

## Cognitive Pedagogy and Metacognitive Scaffolding

Cognitive pedagogy centres on structuring instructional tasks to align with human working memory limits (Obi & Anyanwu, 2022). Subjects, solving mathematical formulations and abstract conceptual models place significant demands on working memory. Metacognitive scaffolding involves explicitly teaching learners to monitor, evaluate, and regulate their thinking during complex problem solving (Nwachukwu, 2023). By using step-by-step problem decomposition, cognitive modeling, and self-checking prompts, cognitive pedagogy reduces extraneous cognitive load, enabling working memory to focus on schema acquisition (Eze et al., 2021).

## Counselling-Informed Classroom Pedagogy

Counselling-informed pedagogy incorporates foundational counselling psychology principles directly into daily classroom teaching (Rogers, 1957; Obi & Anyanwu, 2022). It comprises four core practices: (a) cognitive restructuring, which guides students to reframe mistakes as feedback rather than indicators of low intelligence (Dweck, 2017); (b) empathic communication, which fosters mutual respect and validates student feelings; (c) psychological safety, creating an environment where asking questions or admitting confusion is welcomed without risk of embarrassment (Edmondson, 2019); and (d) positive reinforcement, which builds academic resilience and self-efficacy (Bandura, 1997).

## Classroom Equity and Inclusive Student Engagement

Classroom equity in inclusive STEM settings requires ensuring equal learning opportunities, balanced participation, and equal access to instructional resources regardless of student gender, academic background, or learning needs (UNESCO, 2020). In conventional STEM classrooms, unexamined gender stereotypes and teacher dynamics often result in male students dominating hands-on experiments and verbal discussions (Ames et al., 2021). Cognitive and Counselling-Informed STEM Pedagogies promote equity by implementing structured cooperative learning groups, rotating leadership roles, and actively encouraging participation across all student demographics.

**Learner Well-being and Affective Outcomes**

Learner well-being encompasses psychological safety, self-efficacy, emotional stability, and a sense of school belonging (OECD, 2023). High stakes evaluative pressure and cognitive friction in STEM subjects can trigger subject anxiety and helplessness (Pekrun, 2019). Integrating counselling-informed practices into STEM instruction buffers against performance anxiety, strengthens academic self-concept, and supports overall emotional wellbeing.

**Theoretical Framework**

This study is anchored on cognitive load theory and the social cognitive theory as developed by Sweller in (1988), and Bandura, in (1986)

**Cognitive Load Theory as developed by Sweller, (1988)**

This theory explains how human cognitive architecture processes, stores, and retrieves information during learning. It posits that working memory has strict capacity and duration limitations when handling novel information, whereas long-term memory has virtually unlimited capacity for storing complex cognitive schemas (Sweller, 1988, 2010). Cognitive load is classified into three components: intrinsic load (inherent complexity of the material), extraneous load (unnecessary mental effort caused by poor instructional design), and germane load (productive cognitive processing directed toward schema acquisition). Applied to this study, conventional unguided STEM classrooms instruction imposes high extraneous cognitive load through unstructured problem solving and high evaluative pressure, overwhelming working memory. The Cognitive and Counselling-Informed STEM Pedagogies intervention applies principles by providing structured metacognitive scaffolding, worked examples, and step-by-step problem breakdown. This lowers extraneous load and optimizes working memory capacity, directly reducing cognitive friction, learning difficulty, and student disengagement.

**Social Cognitive Theory as developed by Bandura (1986)**

This theory explains human functioning through triadic reciprocal determinism. It asserts that personal factors (cognitive and emotional events), behavioral patterns, and environmental influences continuously interact. Key constructs of Social Cognitive Theory include self-efficacy which the belief in one's capabilities to execute actions required to achieve goals, observational learning which is the modeling of behaviors observed in others, and social persuasion which is verbal encouragement and affective feedback. Applied to this study, in the context of inclusive STEM classrooms, student engagement and emotional responses are shaped by social interactions, teacher feedback, and perceived classroom equity. The counselling-informed component of STEM classrooms instruction operationalizes Social Cognitive Theory by providing structured modeling, growth-mindset feedback, and cognitive restructuring of failure attributions. These mechanisms strengthen academic self-efficacy, foster psychological safety, and challenge discriminatory gender stereotypes, supporting an inclusive learning environment that enhances student achievement, equity, and well-being.

**Methodology**

**Design of the Study**

A quasi-experimental pretest-post-test control-group design was adopted for this study. The structural representation of the design is as follows:

Experimental Group (E): O1 X O2

Control Group (C): O3 -- O4
Where:
O1 and O3 represent baseline pretest measurements,
X represents the 8-week Cognitive and Counselling-Informed STEM Pedagogies intervention,
-- represents conventional STEM instruction, and
O2 and O4 represent post-test measurements.

**Population of the Study**

The population of the study comprised 171 science students and teachers in two public secondary schools in Owerri Metropolitan city of Imo State.

**Sample and Sampling Technique**

A sample size of 120 participants, comprising of 100 science students and 20 science teachers was used and determined using Taro Yamane's formula for sample size determination at a 5% margin of error (e = 0.05). The technique involved in the selection of participants was a purposive random sampling technique. The study had a two equal groups. The experimental Group (n = 60) involved 50 science students and 10 science teachers exposed to the 8-week Cognitive and Counselling-Informed STEM Pedagogies intervention, and the Control Group (n = 60): 50 science students and 10 science teachers exposed to conventional STEM instruction.

**Instrumentation and Method of Data Collection**

Two researcher-developed instruments titled: Academic Disengagement and Cognitive Barriers Scale (ADCBS) specifically designed to evaluate cognitive learning barriers, science learning anxiety, mental fatigue, and academic disengagement behaviors among secondary school science students, and STEM Equity and Learner Well-being Scale (SELWS) specifically designed to evaluate students' perceptions of classroom equity, psychological safety, emotional resilience, active participation, and overall learner well-being. Both instruments were structured on a 4-point Likert rating scale (4 = Strongly Agree [SA], 3 = Agree [A], 2 = Disagree [D], 1 = Strongly Disagree [SD]) = (4 + 3 + 2 + 1) / 4 = 10 / 4 = 2.50. A benchmark decision mean of 2.50 was used for data interpretation. This means that Mean Score < 2.50 indicates Rejection / Low Level / Disagreement.

**Validation and Reliability**

The instruments were face- and content-validated. Internal consistency was determined through a pilot test on 30 non-participating science students and teachers using Cronbach's Alpha (α), yielding reliability coefficients of .86 for the ADCBS and .89 for the SELWS, establishing high reliability.

**Method of Data Analysis**

Descriptive statistics (Mean [X] and Standard Deviation [SD]) were used to answer Research Questions 1, 2, and 3, using the 2.50 decision mean as the acceptance baseline. Inferential statistics specifically Analysis of Covariance (ANCOVA), were used to test Null Hypotheses 1, 2, and 3 at the $\alpha = .05$ level of significance ($p < .05$), using pretest scores as covariates to control for baseline variance.

## Results

### Research Question 1 & Hypothesis 1

What is the difference in the pretest and post-test mean scores of academic disengagement and cognitive barriers between secondary school science students exposed to Cognitive and Counselling-Informed STEM Pedagogies and those exposed to conventional instruction?

**Table 1: Pretest and Post-test Mean and Standard Deviation Scores on Academic Disengagement and Cognitive Barriers (ADCBS)**

| Group | N | Pretest (X1) | Pretest SD | Post-test Mean (X2) | Post-test SD | Mean Reduction |
|---|---|---|---|---|---|---|
| Experimental Group | 60 | 99.48 | 10.12 | 65.73 | 7.84 | 33.75 |
| Control Group | 60 | 99.98 | 10.05 | 89.29 | 9.14 | 10.69 |
| Difference | - | -0.50 | - | -23.56 | - | 23.06 |

Table 1 shows that the experimental group experienced a substantial reduction in academic disengagement and cognitive barrier scores from a pretest mean of 99.48 (SD = 10.12) to a post-test mean of 65.73 (SD = 7.84), representing a mean decrease of 33.75. In contrast, the control group showed a smaller decrease from 99.98 (SD = 10.05) to 89.29 (SD = 9.14), a mean decrease of 10.69. Lower scores on ADCBS indicate successful reduction of cognitive learning barriers.

**Table 2: Summary of Analysis of Covariance (ANCOVA) for Test of Hypothesis 1 (HO1)**

| Source of Variation | Sum of Squares | df | Mean Square | F-value | p-value ($\alpha = .05$) | Partial $\eta^2$ | Decision |
|---|---|---|---|---|---|---|---|
| Corrected Model | 17045.32 | 2 | 8522.66 | 118.43 | < .001 | .669 | - |
| Intercept | 1205.45 | 1 | 1205.45 | 16.75 | < .001 | .125 | - |
| Pretest (Covariate) | 2314.12 | 1 | 2314.12 | 32.16 | < .001 | .216 | - |
| Group (Intervention) | 14041.20 | 1 | 14041.20 | 195.11 | < .001 | .624 | Rejected $HO_1$ |
| Error | 8419.68 | 117 | 71.96 | - | - | - | - |
| Total | 754210.00 | 120 | - | - | - | - | - |
| Corrected Total | 25465.00 | 119 | - | - | - | - | - |

Hypothesis 1 Test ($HO_1$): Tested at $\alpha = .05$ significance level. As shown in Table 2, the ANCOVA yields $F(1, 117) = 195.11$, $p < .001$. Because $p < .05$, the null hypothesis $HO_1$ is rejected. The partial eta squared ($\eta^2p = .624$) indicates that 62.4% of the reduction in post-test academic disengagement and cognitive barriers is directly accounted for by the Counselling-Informed STEM Pedagogies intervention.

**Research Question 2 and Hypothesis 2**

What is the difference in the pretest and post-test mean scores of equity and learner well-being between secondary school science students exposed to Cognitive and Counselling-Informed STEM Pedagogies and those exposed to conventional instruction?

**Table 3: Pretest and Post-test Mean and Standard Deviation Scores on Equity and Learner Well-being (SELWS)**

| Group | N | Pretest Mean (X1) | Pretest SD | Posttest Mean (X2) | Posttest SD | Mean Gain |
|---|---|---|---|---|---|---|
| Experimental Group | 60 | 79.96 | 8.45 | 105.01 | 6.92 | 25.05 |
| Control Group | 60 | 78.35 | 8.60 | 87.08 | 7.85 | 8.73 |
| Difference | - | 1.61 | - | 17.93 | - | 16.32 |

Table 3 shows that the experimental group's mean equity and well-being score increased from 79.96 (SD = 8.45) at pretest to 105.01 (SD = 6.92) at post-test, yielding a mean gain of 25.05. The control group mean score increased from 78.35 (SD = 8.60) to 87.08 (SD = 7.85), showing a smaller gain of 8.73.

**Table 4: Summary of Analysis of Covariance (ANCOVA) for Test of Hypothesis 2 (HO2)**

| **Source of Variation** | **Sum of Squares** | **df** | **Mean Square** | **F-value** | **p-value ($\alpha$ = .05)** | **Partial $\eta^2$** | **Decision** |
|---|---|---|---|---|---|---|---|
| Corrected Model | 11420.15 | 2 | 5710.08 | 104.29 | < .001 | .641 | - |
| Intercept | 980.30 | 1 | 980.30 | 17.91 | < .001 | .133 | - |
| Pretest (Covariate) | 1950.40 | 1 | 1950.40 | 35.62 | < .001 | .233 | - |
| Group (Intervention) | 9456.80 | 1 | 9456.80 | 172.72 | < .001 | .596 | Rejected $HO_2$ |
| Error | 6405.85 | 117 | 54.75 | - | - | - | - |
| Total | 1124500.00 | 120 | - | - | - | - | - |
| Corrected Total | 17826.00 | 119 | - | - | - | - | - |

Hypothesis 2 Test (HO2): Tested at $\alpha = .05$ significance level. Table 4 displays $F(1, 117) = 172.72$, $p < .001$. Because $p < .05$, the null hypothesis HO2 is rejected. The partial eta squared ($\eta^2p = .596$) demonstrates that 59.6% of the improvement in participant equity and well-being scores is directly attributable to the Cognitive and Counselling-Informed STEM Pedagogies programmes

**Research Question 3 & Hypothesis 3**

Research Question 3: What is the comparative effectiveness of Cognitive and Counselling-Informed STEM Pedagogies versus conventional STEM instruction on overall student outcomes

in inclusive secondary school science classrooms?

**Table 5: Post-Intervention Item-Level Descriptive Analysis of Achievement, Engagement, Equity, and Well-being in Experimental Group (n = 60)**

| S/N | Item Indicator Statement | Mean (X) | SD | Decision (Benchmark = 2.50) |
|---|---|---|---|---|
| 1 | I feel psychologically safe and supported to ask questions during science lessons. | 3.52 | 0.54 | Accepted (≥ 2.50) |
| 2 | Cognitive restructuring techniques helped me manage science learning anxiety. | 3.40 | 0.61 | Accepted (≥ 2.50) |
| 3 | All students receive equal encouragement and resources in science tasks regardless of background. | 3.65 | 0.48 | Accepted (≥ 2.50) |
| 4 | Counselling-informed discussions enhanced my active engagement in science activities. | 3.48 | 0.58 | Accepted (≥ 2.50) |
| 5 | My conceptual understanding and academic achievement in science improved significantly. | 3.60 | 0.50 | Accepted (≥ 2.50) |
| | Overall Cluster Grand Mean / SD | 3.53 | 0.54 | Accepted (High Overall Effectiveness) |

Table 5 shows that all post-intervention indicator item means exceeded the benchmark decision criterion of 2.50, yielding an overall grand mean of 3.53 (SD = 0.54) for the experimental group. In contrast, the control group recorded an overall grand mean of 2.18 (SD = 0.62), falling below the 2.50 decision threshold.

**Hypothesis 3 Test (HO3):** Tested at $\alpha = .05$ significance level. A independent-samples t-test comparing the post-test overall performance indicators between the experimental group ($X = 3.53$, $SD = 0.54$) and control group ($X = 2.18$, $SD = 0.62$) yielded $t(118) = 12.75$, $p < .001$. Because $p < .05$ and the experimental mean significantly exceeds the 2.50 decision criterion, HO3 is rejected. CC-SP instruction leads to statistically superior overall student outcomes compared to conventional STEM instruction.

**Discussion of Findings**

**Effect of Cognitive and Counselling-Informed STEM Pedagogies on Cognitive Learning Barriers and Academic Disengagement**

The rejection of Hypothesis 1 ($F(1, 117) = 195.11$, $p < .001$, $\eta^2p = .624$) confirms that Cognitive and Counselling-Informed STEM Pedagogies produce a statistically significant reduction in academic disengagement and cognitive barriers among secondary school science students. The mean cognitive barrier score in the experimental group dropped from 99.48 to 65.73. This outcome aligns with Bandura's (1986) Social Cognitive Theory, demonstrating that vicarious modeling and cognitive restructuring weaken negative cognitive barriers while raising student self-efficacy. By removing mental blocks and lowering STEM anxiety, students become more actively engaged in classroom learning.

**Effect of Cognitive and Counselling-Informed STEM Pedagogies on Equity and Learner Well-being**

The rejection of Hypothesis 2 ($F(1, 117) = 172.72$, $p < .001$, $\eta^2p = .596$) demonstrates that CC-SP significantly promotes classroom equity and learner well-being (mean score increased from 79.96 to 105.01). This finding reinforces Ellis's (1962) REBT Theory. By disputing (D) irrational beliefs regarding science difficulty and learning entitlement, students adopt a rational, growth-oriented mindset (E). Empathy and psychological safety provided by counselling-informed strategies allow students to feel supported, promoting fair participation and emotional resilience.

**Comparative Overall Effectiveness and Benchmark Decision Criterion**

The empirical findings for Research Question 3 and Hypothesis 3 show an overall post-intervention grand mean of 3.53 in the experimental group, substantially exceeding the established decision benchmark of 2.50 (where scores ≥ 2.50 indicate acceptance). Rejection of HO3 confirms that integrating cognitive reframing with psychological counselling creates an optimal learning environment superior to traditional didactic teaching.

**Recommendations**

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

1) **Curriculum Integration of Cognitive and Counselling-Informed STEM Pedagogies Frameworks:** Educational policy makers and school boards in Imo State should formally incorporate cognitive restructuring and counselling-informed strategies into secondary school science curricula.
2) **In-Service Teacher Training:** Professional development workshops should be established to train secondary school STEM teachers on basic guidance techniques, cognitive barrier reframing, and inclusive classroom management.
3) **Guidance & Counselling Collaboration:** School guidance counsellors should work alongside science educators to offer psycho-educational support, address STEM anxiety, and enhance learner well-being.
4) **Equitable Classroom Scaffolding:** School administrators should mandate inclusive teaching practices, ensuring equal distribution of learning resources and active participation for all students.

**Conclusion**

Traditional secondary school STEM instruction often fails to address cognitive barriers, academic disengagement, and socio-emotional anxiety. This study confirms that Cognitive and Counselling-Informed STEM Pedagogies (CC-SP) provide an effective solution. By significantly reducing cognitive learning barriers ($F = 195.11$, $p < .001$) and improving equity and well-being ($F = 172.72$, $p < .001$), CC-SP achieves superior overall student outcomes (grand mean 3.53 vs 2.50 benchmark). Implementing CC-SP ensures inclusive, high-achieving, and psychologically safe secondary science classrooms.

**References**

Akinlye, O. O., & Adebayo, T. E. (2023). Gender equity and affective learning environments in secondary school STEM classrooms: An intervention study. Journal of Educational Psychology in Practice, 39(2), 142–159.

Ames, K. R., Smith, J. L., & Perez, A. (2021). Reducing stereotype threat in secondary science through growth-mindset and collaborative scaffolding. Contemporary Educational Psychology, 65, 101960.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman and Company.

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2021). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development*, 82(1), 405–432.

Dweck, C. S. (2017). *Mindset: Changing the way you think to fulfil your potential* (Updated ed.). Robinson.

Edmondson, A. C. (2019). The fearless organization: Creating psychological safety in the workplace for learning, innovation, and growth. John Wiley & Sons.

Ellis, A. (1962). *Reason and emotion in psychotherapy.* Lyle Stuart.

Eze, C. U., Nnamani, S. C., & Ugwu, C. N. (2021). Pedagogical shifting from passive to active learning in secondary school STEM education in South-Eastern Nigeria. *African Journal of STEM Education*, 7(1), 88–104.

Florian, L. (2019). On the evidence to support inclusion in education: Challenges and possibilities. *European Journal of Special Needs Education*, 34(5), 691–704.

Mbaji, I. N., Okon, E. E., & Chukwu, U. C. (2024). Cognitive scaffolding and student mastery in secondary school physics: A randomized trial. *Journal of Educational and Cognitive Psychology*, 12(1), 45–63.

National Research Council. (2018). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. The National Academies Press.

Nwachukwu, C. O. (2023). Promoting female participation in secondary school physical sciences: Evaluating counselling-informed instructional strategies. *Nigerian Journal of Guidance and Counselling*, 28(2), 115–131.

Nwosu, A. A., & Okeke, O. M. (2022). Effects of metacognitive self-regulatory instruction on secondary school students' achievement in chemistry. *Journal of the Science Teachers Association of Nigeria* (JSTAN), 57(1), 34–48.

Obi, J. S., & Anyanwu, C. E. (2022). Integrating guidance and counselling techniques into classroom teaching: A paradigm shift for secondary school teachers. Journal of Counselling Psychology and Educational Foundations, 18(3), 201–216.

OECD. (2023). *PISA 2022 results: Exceling in science, mathematics, and learner well-being.* OECD Publishing.

Paas, F., & van Merriënboer, J. J. G. (2020). Cognitive load theory: Methods to manage working memory load in learning and instruction. *Educational Psychologist*, 55(4), 259–275.

Pekrun, R. (2019). Achievement emotions and academic performance: Longitudinal and experimental evidence. *Educational Psychologist*, 54(3), 145–163.

Rogers, C. R. (1957). The necessary and sufficient conditions of therapeutic personality change. Journal of Consulting Psychology, 21(2), 95–103.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive*

*Science*, 12(2), 257–285.

Sweller, J. (2010). Element interactivity and intrinsic, extraneous, and germane cognitive load. *Educational Psychology Review*, 22(2), 123–138.

UNESCO. (2020). *Global education monitoring report 2020: Inclusion and education - All means all.* UNESCO Publishing.

World Bank. (2022). *STEM education for economic transformation in sub-Saharan Africa*. World Bank Group.