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Dear Sir/Madam

ACCEPTANCE LETTER

With reference to your article titled: GENDER DIFFERENCES IN THE EFFECTIVENESS OF METACOGNITIVE INSTRUCTIONAL STRATEGY IN ARCHITECTURAL DRAWING

Submitted for review and publication in the International Journal of Industrial Technology, Engineering, Science and Education (IJITESED), I write to inform you that your article has been accepted for publication in the next edition of the Journal volume 3 Number 5 of JUNE, 2025

Yours Faithfully,

13/06/2025

PROF. Ibrahim Yakubu Umar
Managing Editor

Gender Differences in the Effectiveness of Metacognitive Instructional Strategy in Architectural Drawing

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Abstract

This study investigated gender differences in the effectiveness of metacognitive instructional strategies on students' academic achievement, retention, and attitudes in architectural drawing. A quasi-experimental design with post-intervention gender comparisons was employed, using a census approach involving 65 undergraduate students (10 females and 55 males) from the Department of Industrial and Technology Education, Federal University of Technology, Minna and Department of Technology Education, Benue State University, Makurdi, Nigeria. Instruction was delivered exclusively through a metacognitive teaching strategy without exposure to other instructional methods. Data were collected using Architectural Drawing Achievement Test (ADAT) and an Attitude Towards Architectural Drawing Inventory (ATADI). Analysis involved descriptive statistics, independent samples t-test at a 0.05 significance level and effect size calculations. The results indicated no significant gender differences in academic achievement ($p = 0.987$) and retention ($p = 0.945$) among students taught using the metacognitive instructional strategy. Although female students demonstrated a slightly more positive attitude than male students, the difference was not statistically significant ($p = 0.088$). These findings suggest that the metacognitive instructional strategy is equally effective for both male and female students in enhancing academic achievement, retention, and fostering positive attitudes in architectural drawing. The study recommends the broader adoption of metacognitive instructional strategies in architectural drawing and technical drawing to promote equitable learning outcomes across genders.

Keywords: Metacognitive Instructional Strategies, Academic Achievement, Retention, Attitudes, Architectural Drawing

Introduction

Education plays a key role in national development by equipping individuals with the knowledge and skills necessary for societal progress. In the field of building technology education, students are expected to acquire both theoretical and practical competencies to meet industrial demands and educational needs. However, students often struggle with conceptual understanding, retention of knowledge, and the development of positive attitudes toward learning Marantika (2021). This

challenge necessitates the adoption of innovative teaching strategies such as metacognitive instructional strategy that can enhance students' academic achievement, retention, and attitudes.

Instruction in metacognitive strategy, often described as "thinking about thinking or higher thinking" involves students' ability to plan, aware, monitor, and evaluate their own learning in a targeted or specific direction (Yildirim and Ortak 2021). Metacognitive instructional strategy, emphasizes on self-regulation, reflection, and strategic learning processes (Hamzah et al., 2022). Hence, students who use self-regulated strategies are intrinsically self-motivated and prove to be autonomous learners (Saxena, 2020). These types of learners are metacognitively, motivationally and behaviorally active participants in their own learning process (Alamri et al., 2020). Such learners according to Alawode et al. (2025), successfully make use of cognitive and meta-cognitive strategies and they are always engaged in self-regulated learning to knowing what to do, how to do and when to do in order to achieve academic success. Unlike instructional methods that focus on passive knowledge acquisition, metacognitive instruction strategy empowers students to take control of their learning processes, leading to improved academic performance and deeper understanding.

Academic achievement reflects the outcome of teaching-learning process in terms of marks, grades and means scores and the skills possesses during instruction (Alburaidi and Ambusaidi, 2019). The extent to which a student, teacher or institution has achieved their short-term or long-term educational goal can be referred to academic achievement. Marantika (2021) explained that when students are taught metacognitive skills, they become more effective learners, exhibit better problem-solving abilities, and retain information for longer periods without gender bias. As a result, it is possible to attain, retain or sustain metacognitive knowledge for academic success in

different subjects including architectural drawing to individual student without gender bias (Eze, et al., 2015).

Despite the known benefits of metacognitive strategies, there is a need to examine their effectiveness in architectural drawing, particularly in the context of gender differences. Research has indicated that male and female students may respond differently to instructional strategies due to cognitive, motivational, and social factors. Rivas et al. (2022) in their studies observed that female students tend to be more reflective and organized in their learning approaches, while male students benefit more from self-directed learning strategies. These differences raise critical questions about whether metacognitive strategies are equally effective for both genders in enhancing academic achievement, retention, and attitudes in architectural drawing.

Architectural drawing comprises of presentation of drawing, projection, sections and model with the use of drawing instruments, tools and equipment (Dobre, 2020). The drawing requires motor skills that involve the manipulation of drawing instruments to construct jointed lines, skills that can navigate thinking from concrete knowledge into abstract knowledge towards a memorable and interesting one, and that change students' perception concerning the feeling or attitudes. It is of a necessity that a skillful teacher needs to be conversant with various instructional strategies which may be applied to subjects at different class situations or step involves in a problem-solving. Therefore, integrating metacognitive instructional strategies could provide a more inclusive and effective approach to teaching and learning architectural drawing, ensuring that both male and female students achieve optimal learning outcomes. Given the critical role of gender in learning experiences and outcomes particularly in architectural drawing, this study seeks to investigate the gender differences in the effectiveness of metacognitive instructional strategy in architectural drawing.

Statement of the Problem

Persistent gender disparities in academic achievement, retention, and attitudes among students in technical education disciplines raise important pedagogical concerns (Eze et al., 2015). Architectural drawing remains a cognitively demanding course essential to the training of future professionals in building technology education and building industries (Alawode et al., 2025). While metacognitive instructional strategies have been shown to foster self-regulated learning and deeper cognitive engagement, their application in architectural drawing, and their differential impact on male and female learners, is yet to be adequately investigated.

Gender differences in learning styles, motivation, and academic behavior may influence how students respond to metacognitive interventions (Ukochovwera, 2021). It is obvious that technology education is of more male dominant in nature and without empirical insights into these dynamics, instructional designs risk reinforcing existing disparities rather than mitigating them. The paucity of research addressing how metacognitive strategies affect students' achievement, retention, and attitudes in architectural drawing based on gender represents a critical gap. This study, therefore, investigates the gender differences in the effectiveness of metacognitive instructional strategy in architectural drawing.

Purpose of the Study

The purpose of this study is to determine the gender differences in the effectiveness of metacognitive instructional strategy in architectural drawing. Specifically, the study seeks to:

1. examine the effect of metacognitive instructional strategy on students' academic achievement in architectural drawing based on gender.
2. ascertain the effect of metacognitive instructional strategy on students' retention in architectural drawing based on gender.

3. analyze the effect of metacognitive instructional strategy on students' attitudes in architectural drawing based on gender.

Research Questions

The following research questions were in order to achieve the objectives of the study.

1. What is the effect of metacognitive instructional strategy on students' academic achievement in architectural drawing based on gender?
2. What is the effect of metacognitive instructional strategy on students' retention in architectural drawing based on gender?
3. What is the effect of metacognitive instructional strategy on students' attitudes in architectural drawing based on gender?

Research Hypotheses

Based on the research questions drawn for the conduct of this study, the following null hypotheses were formulated and tested at 0.05 significance levels:

H_{01}: There is no significant effect in the academic achievement of female and male building technology education students taught architectural drawing using metacognitive instructional strategy.

H_{02}: There is no significant effect in the retention of female and male building technology education students taught architectural drawing using metacognitive instructional strategy.

H_{03}: There is no significant effect in the attitude of female and male building technology education students taught architectural drawing using metacognitive instructional strategy.

Methodology

The study adopted a quasi-experimental design. The quasi-experimental design was used since the classes of students were already organized into intact classes which provide stability and allow

integration of the experiment into the regular class lesson and arrangement. The design focused on the effectiveness of a metacognitive instructional strategy on students' academic achievement, retention, and attitude in architectural drawing, with specific attention to gender differences. The population for the study comprised all 65 - building technology education final year undergraduate students (10 females and 55 males) in the Department of Industrial and Technology Education (ITE) at the Federal University of Technology, Minna (FUTMINNA) with a total number of 34 (7 females and 27 males) and Department of Technology Education Benue State University, Makurdi (BSU) with a total number of 26 (5 females and 21 males). Since the population size was manageable, no sampling technique was applied. The students received instruction exclusively through a metacognitive teaching strategy (MTS), without exposure to any other teaching method. Both universities involved were treated as a single unit under the same treatment procedures.

Data were collected using two instruments: Architectural Drawing Achievement Test (ADAT) and Attitude Towards Architectural Drawing Inventory (ATADI) respectively. ADAT was employed to measure students' achievement in architectural drawing. The test comprised of four theory questions covering the contents of floor plan, elevations, cross - section and roof plan. While Attitudes scale which established psychometric properties was utilised to measure attitudes of building students toward architectural drawing. The Attitudes Toward Mathematics Inventory (ATMI) designed by Tapia and Marsh was adapted and modified to create the Attitude Towards Architectural Drawing Inventory (ATADI) with 4 components of a total number of 46 items (self-confidence = 13 items, enjoyment = 12 items, motivation = 12 items and value = 9 items). The pre-test was used to assess students' prior knowledge for baseline purposes which was not included in the research questions. Students' prior knowledge for baseline in architectural drawing was not significant which means that students from the two universities had the same baseline knowledge.

Post-test data were collected through the ADAT and ATADI to measure academic achievement, retention and attitudes after the treatment. The face and content validity were employed along with theoretical alignment for the instrument involved 3 experts. To establish reliability, the ADAT and ATADI were trial-tested with 15-building final year undergraduate students (13 males and 2 females) of Ado - Ekiti State University. Cronbach's alpha was used to determine the internal consistency of the instruments, yielding reliability coefficients of 0.84 for the ADAT and 0.87 for the ATADI, which indicate high reliability.

The data collected were analyzed using descriptive (means and standard deviations) and inferential statistics (independent samples t-tests) to determine gender-based differences in academic achievement, retention, and attitudes. Independent samples t-tests were conducted to examine gender differences across the dependent variables at a 0.05 level of significance. Additionally, effect sizes were calculated to determine the magnitude of the observed differences.

Results

Research Questions 1: What is the effect of metacognitive instructional strategies on students' academic achievement in architectural drawing based on gender?

Table 1: Descriptive Statistic of the Effect of Metacognitive Instructional Strategy on Building Technology Education Students' Academic Achievement based on Gender.

Variable	Group	N	$\bar{x}$	σ	Mean Effect
Post-test	Female	10	67.40	5.016	0.04
	Male	55	67.36	6.519	
	Total	**65**			

Note: N= Number of Respondents, $\bar{x}$ = Mean, σ = Standard Deviation

Descriptive statistics in Table 1 revealed that female students achieved a mean post-test score of 67.40 (SD = 5.02), while male students recorded a mean of 67.36 (SD = 6.52). The mean effect of 0.04 indicates a negligible variation in academic achievement between genders. Although male students exhibited slightly greater variability in scores, as reflected by a higher standard deviation,

this did not translate into a meaningful difference in overall performance. These findings suggest that the metacognitive instructional strategy was equally effective for both male and female students in architectural drawing.

Research Questions 2: What is the effect of metacognitive instructional strategies on students' retention in architectural drawing based on gender?

Table 8: Descriptive Statistic of the Effect of Metacognitive Instructional Strategy on Building Technology Education Students' Retention based on Gender.

Variable	Group	N	$\bar{x}$	σ	Mean Effect
Retention	Female	10	73.60	7.260	0.18
	Male	55	73.78	7.764	
	Total	**65**			

Note: N= Number of Respondents, $\bar{x}$ = Mean, σ = Standard Deviation

Descriptive statistics from the retention test in Table 2 indicates that female students achieved a mean score of 73.60 (SD = 7.26), while male students recorded a mean of 73.78 (SD = 7.76). The marginal mean effect of 0.18 suggests an almost negligible variation in retention between genders. Although male students exhibited slightly higher variability, as reflected by a greater standard deviation, this did not result in any meaningful difference in overall retention. These findings imply that the metacognitive instructional strategy was equally effective for both male and female students in promoting retention of knowledge in architectural drawing.

Research Questions 3: What is the effect of metacognitive instructional strategies on students' attitudes in architectural drawing based on gender?

Table 3: Descriptive Statistic of the Effect of Metacognitive Instructional Strategy on Building Technology Education Students' Attitude based on Gender.

Variable	Group	N	$\bar{x}$	σ	Mean Effect
Attitude	Female	10	1.40	.516	0.24
	Male	55	1.16	.373	
	Total	**65**			

Note: N= Number of Respondents, $\bar{x}$ = Mean, σ = Standard Deviation

Descriptive analysis in Table 3 revealed that female students reported a slightly higher mean attitude score (M = 1.40, SD = 0.52) compared to their male counterparts (M = 1.16, SD = 0.37), indicating a marginally more positive disposition toward the metacognitive instructional strategy. While female students showed slightly more variability in their responses, the overall mean effect of 0.24 suggests only a minor gender-based effect in attitude. These findings indicate that the metacognitive strategy was effective in fostering positive attitudes toward learning in both male and female students, with no substantial disparity in its impact across genders.

Hypothesis 1: There is no significant effect in the academic achievement of female and male **building** technology education students taught architectural drawing using metacognitive instructional strategy.

Table 4: Independent Samples t-test for Effect in the Academic Achievement of Female and Male Building Technology Education Students taught Architectural Drawing using Metacognitive Instructional Strategy.

			Levene's Test for Equality of Variances					
Variable	Groups	N	F	Sig.	t-value	Mean ($\bar{x}$)	SD (σ)	Sig. (2-tailed)
Post-test	Female	10	.270	.605	.017	67.40	5.016	.987
	Male	55				67.36	6.519	

An independent samples t-test in Table 4 was conducted to determine whether there was a significant difference in academic achievement between female and male students exposed to the metacognitive instructional strategy in architectural drawing. Levene's test for equality of variances was not significant (F = 0.270, p = 0.605), indicating that the assumption of equal variances was satisfied. The mean post-test score for female students was 67.40 (SD = 5.02), and for male students, 67.36 (SD = 6.52). The resulting t-value was 0.017 with a p-value of 0.987, which is well above the 0.05 threshold for significance. Consequently, the null hypothesis of no difference in academic achievement between genders was retained. These results indicate that the

metacognitive instructional strategy had a comparable effect on the academic achievement of both male and female students in architectural drawing.

Hypothesis 2: There is no significant effect in the retention of female and male building technology education students taught architectural drawing using metacognitive instructional strategy.

Table 5: Independent Samples t-test for Effect in the Retention of Female and Male Building Technology Education Students taught Architectural Drawing using Metacognitive Instructional Strategy.

		Levene's Test for Equality of Variances						
Variable	Groups	N	F	Sig.	t-value	Mean ($\bar{x}$)	SD (σ)	Sig. (2-tailed)
Retention	Female	10	.061	.805	-.069	73.60	7.260	.945
	Male	55				73.78	7.764	

An independent samples t-test in Table 5 was conducted to examine gender differences in retention among students taught architectural drawing using the metacognitive instructional strategy. Levene's test for equality of variances was not significant ($F = 0.061$, $p = 0.805$), confirming that the assumption of equal variances was met. The mean retention score for female students was 73.60 (SD = 7.26), while male students scored slightly higher at 73.78 (SD = 7.76). The computed t-value was -0.069 with a corresponding p-value of 0.945. Since the p-value exceeds the 0.05 level of significance, the null hypothesis is retained. This indicates that there is no statistically significant difference in retention between male and female students. Thus, the metacognitive instructional strategy appears to be equally effective in supporting knowledge retention across genders in architectural drawing.

Hypothesis 3: There is no significant effect in the attitude of female and male building technology education students taught architectural drawing using metacognitive instructional strategy.

Table 6: Independent Samples t-test for Effect in the Attitude of Female and Male Building Technology Education Students taught Architectural Drawing using Metacognitive Instructional Strategy.

			Levene's Test for Equality of Variances					
Variable	Groups	N	F	Sig.	t-value	Mean ($\bar{x}$)	SD (σ)	Sig. (2-tailed)
Attitude	Female	10	6.476	.013	1.732	1.40	.516	.088
	Male	55				1.16	.373	

An independent samples t-test in Table 6 was carried out to assess gender differences in student attitudes toward the metacognitive instructional strategy in architectural drawing. Levene's test for equality of variances was significant ($F = 6.476$, $p = 0.013$), indicating a violation of the assumption of equal variances and suggesting differing variability in attitude scores between male and female students. Female students had a higher mean attitude score of 1.40 ($SD = 0.52$) compared to 1.16 ($SD = 0.37$) for male students. Despite this observed difference, the t-test yielded a t-value of 1.732 with a two-tailed p-value of 0.088, which exceeds the 0.05 level of significance. Therefore, the null hypothesis was not rejected, indicating no statistically significant effect in attitude between genders. These findings suggest that, while female students showed a slightly more positive attitude, the metacognitive instructional strategy was similarly effective in shaping positive attitudes toward architectural drawing in both male and female students.

Effect size

The study analyzed the effect sizes for 3 research questions (RQs) using Cohen's d, Glass's delta, and Hedges' g to determine the magnitude of differences observed between gender. The interpretation of these effect sizes follows conventional benchmarks: small effect: $0.2 \leq d < 0.5$, medium effect: $0.5 \leq d < 0.8$ and large effect: $d \geq 0.8$.

The results of effect size, its interpretation and hypothesis implication are below:

Research question one (RQ 1):

The results of effect size, its interpretation and hypothesis implication are below:

Cohen's d = 0.006877, Glass's delta = 0.007974, Hedges' g = 0.006323 are the results of effect size of RQ 1. These values indicate a negligible effect, suggesting no meaningful difference between the groups. This implies that, the hypothesis predicting a difference would likely be rejected.

Research question two (RQ 2):

The results of effect size, its interpretation and hypothesis implication are below:

Cohen's d = 0.023948, Glass's delta = 0.024793, Hedges' g = 0.023395 are the results of effect size of RQ 2. These values show a negligible effect, indicating an insignificant difference. This implies that, the hypothesis would likely be rejected if it suggested a meaningful difference.

Research question three (RQ 3):

The results of effect size, its interpretation and hypothesis implication are below:

Cohen's d = 0.53308, Glass's delta = 0.465116, Hedges' g = 0.605147 are the results of effect size of RQ 3. These values suggest a moderate effect, indicating a noticeable difference between groups. This implies that, if the hypothesis predicted a difference, it would be supported with a moderate impact.

Summary of the Findings

This section highlights the summary of the major findings of research questions and hypotheses as follows:

1. The female and male students taught with metacognitive instructional strategies shows a similar level of achievement. The hypothesis affirmed that both female and male students have no significant disparity in academic performance towards architectural drawing using metacognitive instructional strategy.

2. The female and male students taught with metacognitive instructional strategies shows that there is almost no difference in their retention. The hypothesis revealed that there is no meaningful difference in overall retention of female and male students who were taught architectural drawing using metacognitive instructional strategy.

3. The female and male students taught with metacognitive instructional strategies shows that female students displayed a marginally more positive attitude compared to male students when taught architectural drawings using metacognitive instructional strategy. The hypothesis revealed that there is no significant difference in the attitude of female and male students taught architectural drawing using the metacognitive instructional strategy, even though females had a slightly higher mean score. This suggests that the strategy is similarly effective for both genders in influencing attitude towards architectural drawing.

Summary of the Effect Size

The interpretation helps determine the practical significance of the findings and guides decision-making on the hypotheses for each research question.

1. Negligible Effects: RQ1, and RQ2 suggest no meaningful differences, likely leading to the rejection of related hypotheses.
2. Moderate Effects: RQ3 show moderate differences, offering modest support for related hypotheses.

Discussion of the Findings

The findings of research question one and the test of its null hypothesis indicated that the metacognitive instructional strategy was equally effective for both male and female students in enhancing their academic achievement in architectural drawing. This suggests that the strategy is gender-friendly and supports learning outcomes across both genders. These findings align with

Eşref and Cevat (2021), the effect of learning activities conducted in accordance with the phenomenon-based learning approach on the metacognitive awareness level of students, confirming that such strategies benefit all learners regardless of gender. Similarly, the study corroborates Aliyu's (2016) investigation on the impact of metacognitive strategies on attitude, retention, and performance in calculus among college of education students and Marantika (2021) on metacognitive ability and autonomous learning strategy in improving learning outcomes. In their studies, gender differences were also examined, and no significant difference in the mean performance scores between male and female students was found in the method. These consistent findings across multiple studies confirm the inclusive nature of metacognitive instructional strategies in improving academic performance across genders.

The findings from research question two and its corresponding null hypothesis revealed that the metacognitive instructional strategy was equally effective for both male and female students in enhancing retention abilities in architectural drawing. This indicates that the strategy promotes learning retention without gender bias. These results are consistent with the findings of Eze et al. (2015), who explored the effects of age and gender on academic achievement of vocational and technical education (VTE) students of a Nigerian university and Alburaidi and Ambusaidi, (2019) who investigated on the impact of using activities based on the montessori approach in science in the academic achievement of fourth grade students. Both studies found that metacognitive strategies significantly improved learning retention across genders, with no significant differences in retention abilities among participants in the experimental groups. Furthermore, Eze et al. (2019) examined the relative effectiveness of constructivist and meta-learning teaching methods on academic achievement and retention in basic electricity among technical college students. Their findings aligned with the present study, confirming that meta-learning methods significantly

enhance students' retention abilities. Similarly, the study by Hamzah et al. (2022), supported these findings. They concluded that when learners are both visually and physically engaged in the learning process, male and female students demonstrate equal retention of learned concepts.

The findings of research question three and the test of its null hypothesis revealed that metacognitive instructional strategy was effective for both genders in terms of attitude in architectural drawings. Therefore, there is no significant difference in the attitude of female and male students taught architectural drawing using metacognitive instructional strategy, even though females had a slightly higher mean score. This suggests that the strategy is similarly effective for both genders in influencing attitude towards architectural drawing. The findings of this study agreed with the findings of Ozdemir and Sahal (2018) who examined the effects of teaching integers through the problem posing approach on sixth grade students' academic achievement and mathematics attitudes. There were no significant differences between female and male with respect to the attitudes towards mathematics taught using metacognitive strategy. Similarly, Saxena, (2020) investigated on impact of metacognitive strategies on self-regulated learning and intrinsic motivation. Equally, Yildirim and Ortak (2021) studied the effects of the authentic learning approach in social studies on academic achievement, retention of knowledge, and attitude used gender as moderate variables. The result showed that there was no significant difference in the attitude of male and female of 6th grade students. It should be noted that authentic learning approach is based on the same philosophical paradigm as metacognitive strategy, that is, constructivism. The studies are in line with the present study as significant difference was not found between the gender.

Conclusion

The findings of this study demonstrated that the metacognitive instructional strategy is equally effective for both male and female students in architectural drawing. No significant differences were observed between genders in academic achievement, retention, or attitude following the treatment. Although slight variations in mean scores were noted, these differences were not statistically meaningful. This suggests that metacognitive strategies can foster equitable learning outcomes, supporting both male and female students in developing higher levels of academic performance, retaining knowledge over time, and cultivating positive attitudes toward architectural drawing. The results highlight the potential of metacognitive approaches as inclusive and effective teaching strategies within technical and vocational education. Based on these findings, it is recommended that educators adopt and integrate metacognitive instructional strategies more widely in building technology and architectural drawing courses to enhance students' learning experiences and outcomes irrespective of gender.

Recommendations

In view of the results of these findings and conclusions reached in the study, the following recommendations are hereby presented:

1. Both female and male students of building technology education should always use the components of metacognitive instructional strategy to oversee his/her own learning process by planning, monitoring ongoing cognitive activities (learning), and compare cognitive outcomes with internal or external standards (evaluation).
2. Lecturers should endeavour to enhance the following learner-related aspects: understanding of students' strengths and weaknesses in drawing; knowledge of what kind of information is the most important to learn architectural drawing; ability to remember drawing techniques and

principles; ability to control how well they learn architectural drawing and ability to judge how well they understand different section of drawings.

3. Technology education lecturers need to be aware of and attentive to students' metacognition. They need to appreciate metacognitive activities and develop ways to foster it within all students, so as to improve the learners' learning abilities for academic success.
4. Government and other relevant bodies should be implored to give enough grants to equip technology/technical drawing studios. Involving technology education lecturers on-the-job training opportunities such as short-term courses, seminars and workshop to enable the teachers to update their knowledge with the ever-changing scientific knowledge and various modern methods of teaching technology education courses and trade subjects. Metacognitive teaching strategy cannot be effectively carried out in ill-equipped drawing studios.

REFERENCES

Alamri, H., Lowell, V., Watson, W. & Watson, S. L. (2020). Using personalized learning as an instructional approach to motivate learners in online higher education: Learner self-determination and intrinsic motivation. *Journal of Research on Technology in Education*, *52*(3), 322-352.

Alawode O. D., Yaduma P, S., Bello H. & Deba A. (2025). Effect of metacognition on achievement and retention in building drawings among university students. *International Journal of Student Performance and Educational Research (IJSPER), 2(1). 1-8.*

Alburaidi, A. & Ambusaidi, A. (2019). The Impact of Using Activities Based on the Montessori Approach in Science in the Academic Achievement of Fourth Grade Students. *International Journal of Instruction*, *12(2),* 695-708.

Aliyu. A. Z. (2016). Impact of metacognitive strategy on attitude, retention and performance in calculus among colleges of education students in north-central zone, Nigeria. A PhD thesis submitted to the school of postgraduate studies, Ahmadu Bello University, Zaria in the Department of Science Education, Faculty of Education

Dobre, D. (2020). The use of axonometric and perspective projections for the representation of stairs in architectural constructions. *Journal of Industrial Design and Engineering Graphics*, *15*(2), 13-16.

Eşref, A. & Cevat, E. (2021). The effect of phenomenon-based learning approach on students' metacognitive awareness. *Academic Journal of Educational Research and Reviews. Vol. 16(5), pp. 181-188.*

Eze, T. I., Ezenwafor, J. I. & Obi, M. N. (2015). Effects of age and gender on academic achievement of vocational and technical education (VTE) students of a Nigerian university. *J. Emerg. Trends Educ. Res.Policy Stud. 6(1)*, 96-101.

Eze, T. I., Obidile, J. I. & Akamobi, O. G. (2019). Relative effectiveness of constructivism and meta-learning teaching methods on male and female students' academic achievement and retention in basic electricity in technical colleges. *Journal of Education and practice, 10(33),* 34-42.

Hamzah, H., Hamzah, M. I., & Zulkifli, H. (2022). Systematic literature review on the elements of metacognition-based higher order thinking skills (HOTS) teaching and learning modules. *Journal of Sustainability*, *14*(2), 813-821; https://doi.org/10.3390/su14020813

Marantika, J. E. R. (2021). Metacognitive ability and autonomous learning strategy in improving learning outcomes. *Journal of Education and Learning (EduLearn), 15(1),* 88-96.

Ozdemir, A. S. & Sahal, M. (2018). The Effect of Teaching Integers through the Problem Posing Approach on Students' Academic Achievement and Mathematics Attitudes. *Eurasian Journal of Educational Research 13(78)- 117-138.*

Rivas, S. F., Saiz, C., & Ossa, C. (2022). Metacognitive strategies and development of critical thinking in higher education. *Frontiers in psychology*, *13*, 913219.

Saxena, A. S. (2020). Impact of metacognitive strategies on self-regulated learning and intrinsic motivation. *Journal of Psychosocial Research*, *15*(1), 35-46.

Ukochovwera, O. E. (2021). Gender inequality and development of women in Ekiti state, Nigeria. *Educational Research (IJMCER)*, *3*(5), 128-170.

Yildirim, R. & Ortak, Ş. (2021). The effects of authentic learning approach on academic achievement and attitudes in social studies course. *International Journal of Psychology and Educational Studies, 8(3), 193-208.*