EFFICACY OF THE PROTÉGÉ-EFFECT ON METACOGNITIVE SKILLS AMONG PRIMARY SCHOOL PUPILS IN ASA LOCAL GOVERNMENT AREA OF KWARA STATE, NIGERIA

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Abstract

This study investigated the efficacy of the Protégé Effect on metacognitive skills among primary school pupils in the Asa Local Government Area of Kwara State, Nigeria. The research used a classical experimental design of a randomised Solomon Four-Group experimental design, ensuring minimisation of bias. The study used a 2×2 factorial matrix to examine the influence of peer teaching on pupils' metacognitive development. The study examined the impact of the Protégé Effect and gender on pupils' metacognitive skills. The population consisted of 17,875 primary school pupils targeting primary 4 and 6 pupils in Asa Local Government Area. Simple Random Sampling Technique was used to select the participants with the use of balloting. The data were collected using the Metacognitive Skills Scale (MSS), an observational checklist with a validated structure and a Cronbach's alpha reliability coefficient of 0.83. Data was analysed using frquency counts, percentages, mean and ANCOVA. The results showed a low level of metacognitive skills among pupils, also, a significant effect of the Protégé-Effect strategy on metacognitive skills ($p = 0.000$, Partial Eta Squared = 0.793), accounting for approximately 80% of the variance in pupils' metacognitive skills with interaction effect revealed no significant influence ($p = 0.10$ and $p = 0.53$, respectively), indicating the strategy equal efficacy across male and female pupils. The study concluded that Protégé-Effect significantly improves the metacognitive skills of primary school pupils regardless of gender. The study recommended for teachers embed Protégé-Effect into lesson plans to promote metacognition among pupils.

Keywords: Efficacy, Metacognitive Skills, Protégé-Effect, Primary School Pupils.

Introduction

In recent years, educational research has increasingly emphasised the need for active learning strategies that place pupils at the centre of their cognitive development. Among these strategies is Protégé-Effect. Protégé-Effect Strategy, where pupils deepen their understanding by teaching their peers (Effectiviology, 2025). The strategy has gained significant attention due to its potential to enhance comprehension, retention, and metacognitive awareness. As education

systems shift from traditional rote memorisation to learner-centred approaches, understanding how peer teaching strategies can foster higher-order thinking and self-regulation is crucial. This is especially important in primary education, where foundational cognitive and metacognitive skills are being developed.

The Protégé-Effect Strategy capitalises on the act of teaching that promotes deeper cognitive engagement, critical thinking, and long-term retention of knowledge. When pupils are placed in the position of teaching their peers, they are required to process information more thoroughly, reorganise their thoughts coherently, and verbalise their understanding meaningfully. This cognitive effort significantly boosts metacognitive awareness, allowing pupils to monitor and regulate their learning more effectively (Chase et al., 2019). Moreover, assuming the role of the teacher fosters a sense of academic responsibility and ownership, which contributes to increased motivation, self-efficacy, and engagement with learning tasks (Afolayan & Okeowo, 2021). This approach is rooted in constructivist learning theory, which asserts that meaningful learning occurs through reflection, inquiry, and social interaction (Okonkwo & Adedayo, 2020).

Additionally, the Protégé-Effect is deeply rooted in Vygotsky's Social Constructivism, particularly his concept of the Zone of Proximal Development (ZPD). Vygotsky posited that learners progress more effectively when guided through social interactions, and peer teaching serves as a scaffold that enhances learners' understanding and metacognitive abilities (Okonkwo & Adedayo, 2020). When pupils engage in teaching, they not only reinforce their knowledge but also assist others in reaching higher levels of comprehension, which emphasises that while preparing to teach enhances learning, the act of teaching itself leads to significantly greater learning gains (Cloke, 2024). This reciprocal learning process fosters metacognition, critical thinking, and self-regulation, as explaining concepts requires learners to organise and restructure their knowledge.

Recent studies affirm that peer teaching within the ZPD significantly enhances motivation, retention, and cognitive development, demonstrating the practicality of the Protégé-Effect Strategy in promoting social constructivist learning principles (Turing College, 2022). Metacognitive skills are essential for pupils to understand, control, and regulate their cognitive processes, including planning, monitoring, and reflecting on their learning. These skills empower pupils to become more self-directed and effective in achieving academic goals. In primary education, where cognitive and metacognitive skills are still being developed, teaching these strategies has been shown to improve academic performance, motivation, and problem-solving abilities (Oladipo & Adebayo, 2022). Metacognition, or the ability to monitor and regulate one's learning, is another key factor in academic success. Metacognitive skills, including planning, self-assessment, and adjusting learning strategies, enable pupils to enhance their understanding and retention of information (Turing College, 2022).

Metacognitive skills refer to the ability of learners to consciously plan, monitor, and evaluate their learning processes, which play a fundamental role in fostering independent and self-regulated learning. Recent studies highlight that metacognition enhances pupils' ability to

reflect on what they know, identify knowledge gaps, and select effective learning strategies (Cloke, 2024). These skills are critical in helping learners assess their progress, modify approaches when facing challenges, and ultimately improve academic performance across subjects, especially in reading, writing, and problem-solving tasks (Nováková, 2022). The metacognitive skills include planning, goal-setting, self-monitoring, self-reflection, strategy use, evaluation, self-assessment, decision-making, error correction, and self-regulation.

By promoting metacognitive awareness in the classroom, educators can help pupils become more independent, equipped with the skills necessary for lifelong academic achievement (Chase et al., 2019). Metacognitive skills, planning, enable pupils to organise tasks before execution, while monitoring allows them to track their progress during learning. Evaluating and debugging are essential for assessing learning outcomes and correcting errors, respectively (Efklides, 2008). Teachers who integrate metacognitive instruction into the classroom enable pupils to reflect on how they learn and how to regulate their learning behaviours effectively (Eze & Afolabi, 2022). Research has shown that metacognitive skills are not only teachable but are also predictive of improved academic outcomes, particularly in reading, problem-solving, and mathematics (Dignath & Büttner, 2008).

International research has continued to underscore the significance of metacognitive skills in the academic development of primary school pupils across various contexts. For instance, Nováková (2022) conducted a study in the Czech Republic involving 311 pupils, examining their "offline" metacognitive abilities, namely, prediction and self-evaluation, during mathematical problem-solving. The study revealed that pupils who performed better in mathematics also demonstrated higher levels of metacognitive awareness, particularly in accurately predicting their success and reflecting on their performance. Similarly, in Indonesia, Werdiningsih et al (2022) developed and validated a metacognitive strategy-based language learning module aimed at promoting autonomous learning among primary pupils. The study found a significant improvement in learning outcomes following the implementation of the module, as indicated by a notable difference between pre-test and post-test results ($t = -7.267$, $p < 0.05$).

Furthermore, Teng and Zhang (2021) conducted a longitudinal study in which 420 students were tracked from Grade 1 to Grade 6 to assess the development of their metacognitive knowledge with reading and writing proficiency in English as a foreign language. Their findings indicated that pupils with initially strong metacognitive skills not only progressed more rapidly in reading and writing but also exhibited metacognitive knowledge as a reliable predictor of literacy success over time. Collectively, these studies reinforce the pivotal role of metacognitive development in improving cognitive performance and academic achievement among young learners globally. More so, emerging research continues to affirm the efficacy of the Protégé-Effect and peer teaching strategies in enhancing learning outcomes and metacognitive development. Cloke (2024) reported that students who actively delivered instruction in groups outperformed those who merely prepared to teach, affirming earlier findings. He cited a 1984 study which showed that the expectation to teach boosted intrinsic motivation more than preparing for an assessment, a 2014 study which reported increased

learning efficiency both at home and in school when teaching was anticipated, and a 2016 study indicating that learners preparing to teach used 1.3 times more metacognitive strategies than those who did not.

Complementing Cloke (2024), Kobayashi (2019) investigated how interactivity influences the effectiveness of learning through teaching. His findings revealed that learners who prepared for direct, face-to-face teaching achieved more substantial learning gains than those who prepared for indirect methods such as videos or written materials. Additionally, direct teaching was found to be more effective than self-explanation or indirect teaching, particularly when preceded by focused preparation. In the Nigerian context, Awofala and Agbolade (2024) evaluated the impact of peer-tutoring on mathematics achievement among senior secondary school students using a quasi-experimental design with 210 participants. Their study revealed that peer tutoring significantly enhanced students' mathematics achievement, while gender had no statistically significant influence. Collectively, these findings reinforce the value of interactive peer-teaching strategies in boosting academic achievement and metacognitive engagement across different educational settings.

The Protégé-Effect Strategy offers a dynamic opportunity to enhance metacognitive skills among primary school pupils by engaging them as active participants in the teaching-learning process. By teaching their peers, pupils reinforce their understanding, monitor their learning, and develop strategic approaches to problem-solving, key components of metacognition. Despite increasing recognition of the importance of metacognitive skills in fostering independent and self-regulated learners, many teachers continue to struggle with implementing effective strategies that promote these skills. Moreover, pupils are known to play and believe not to be organised without their instructor, if research has proven that the Protégé-Effect Strategy has shown promise in enhancing cognitive and social aspects of the children.

Kobayashi (2019) explored the impact of interactivity in the context of learning through teaching and preparing to teach. The study proposed that the degree of teacher-student interaction, whether direct (face-to-face) or indirect (such as via videos or written explanations), significantly influenced the effectiveness of the learning process. By synthesising and reanalysing findings from previous studies, the author found that learners who prepared for direct teaching demonstrated greater learning outcomes than those who engaged in indirect teaching or self-explanation. The research suggested three possible mechanisms to explain this effect: (1) opportunities for real-time questioning and answering, (2) access to additional learner-specific information, and (3) increased motivation and deeper cognitive processing while preparing to teach or during teaching.

Teach-back and peer explanation are evidence-based instructional strategies that enhance comprehension and retention by actively involving learners in the teaching process. Teach-back, often used in health education and clinical settings, involves asking learners to restate or demonstrate what they have learned in their own words to confirm understanding (Ha Dinh et al., 2020). The Protégé Effect strategy, which includes this, not only checks for comprehension but also reinforces learning by requiring active retrieval and reorganisation of knowledge.

Similarly, peer explanation, where students explain concepts to one another, promotes deeper cognitive processing by encouraging learners to verbalise and elaborate on information, which enhances conceptual understanding (Fiorella & Mayer, 2016). Both methods align with the "learning by teaching" framework, which posits that the act of teaching improves the teacher's own understanding through processes such as elaboration, error correction, and metacognition (Kobayashi, 2019).

This strategy not only promotes deeper cognitive engagement but also nurtures autonomous, motivated, and reflective pupils. This, in turn, cultivates a learning environment that supports academic excellence and lifelong learning. Some studies have shown the efficacy of the Protégé-Effect Strategy on children's cognitive development. However, existing studies have paid limited attention to its impact on metacognitive skill development, particularly among primary school pupils. Therefore, this study aims to investigate the efficacy of the Protégé-Effect on metacognitive skills among primary school pupils in Asa Local Government Area of Kwara State, Nigeria.

Objectives of the Study

1. To assess the level of metacognitive skills of primary school pupils in Asa local government area of Kwara State.
2. To examine whether the Protégé-Effect Strategy affects the metacognitive skills of primary school pupils in Asa local government area of Kwara state.
3. To assess the interaction effect of gender, Protégé-Effect Strategy and metacognitive skills among primary school pupils in Asa local government area of Kwara state.

Research Questions

1. What is the level of metacognitive skills of primary school pupils in Asa local government area of Kwara state?
2. What is the Protégé-Effect Strategy on the metacognitive skills of primary school pupils in Asa local government area of Kwara state?

Hypotheses

H_{01}: There is no significant difference in the metacognitive skills of primary school pupils who engage in the Protégé-Effect Strategy and those who did not in Asa local government area of Kwara state.

H_{02}: There is no significant interaction effect of gender, Protégé-Effect strategy and metacognitive skills of primary school pupils in Asa local government area of Kwara state.

Methodology

The research used a classical experimental research design of Solomon's Four-Group design. This design enables the study to investigate the efficacy of the Protégé-Effect Strategy on the metacognitive skills of primary school pupils, while also accounting for the influence of

gender. A factorial 2 × 2 design was used for the study, the first 2 Protégé-Effect and the second 2 factor are Gender (Male or Female). The population for this study consists of 17,875 primary school pupils in Asa local government area, Kwara state, Nigeria. The study targeted primary 4 and 6 pupils using a simple random sampling technique through balloting and volunteering of the pupils' parents. 44 participants were selected for the study. These pupil participants comprise 10 primary 4 pupils (5 males and 5 females) in four different groups and 4 primary 6 pupils (2 males and 2 females) who taught the primary 4 pupils participants. This is to allow peer teaching, review of metacognitive tasks and randomisation to help control for selection bias, ensuring that the groups are representative of the population and minimising confounding variables. The Solomon-four group factorial matrix is shown below:

Table 1: Factorial Matrix using Solomon-Four Experimental Research Design

Group	Participants	Pre-test	Protégé-Effect Treatment	Post-test
1	11	O_1	X	O_2
2	11	O_1		O_2
3	11		X	O_2
4	11			O_2

Table 1 shows how the pupils were divided into four groups to test how the Protégé-Effect helps improve metacognitive skills. Each group had 11 pupils. Group 1 took a test before and after the treatment, which included the teaching. Group 2 took the test before and after, but did not receive the treatment. Group 3 did not take the first test but received the treatment and took the final test. Group 4 took only the final test and did not receive the treatment.

The Metacognitive Skills Scale (MSS) is an observational tool designed to record the metacognitive skills of primary school pupils. MSS is divided into two sections: the demographic data section, and the second section consists of 10 items with Yes (2) and No (1) options on metacognitive skills of the pupils. These items format allows for clear, quantifiable data collection during classroom observation. The instrument is used during classroom activities where pupils engage in the Protégé-Effect Strategy. The observer notes each pupil's behaviour based on the checklist items, marking either "Yes" or "No" for each statement. After each observation session, the responses are tallied for the Metacognitive skills, such as awareness of cognition, goal setting, self-reflection, strategy adjustment, comprehension monitoring, self-evaluation, progress monitoring, strategic planning, strategy shifting, and self-regulation. The instrument was validated using face content validity by the experts in Early Childhood and Primary Education Studies and Measurement and Evaluation. The reliability of the instruments was established with the use of internal consistency reliability, which yielded a value of 0.83 with Cronbach's Alpha. Parents of the participants were contacted. Descriptive statistics of frequency count and percentage to answer the research question, while inferential statistics, ANCOVA, provided a comprehensive and robust analysis of the data, ensuring

effects and interaction effects related to the Protégé-Effect and gender on metacognitive skills of primary school pupils.

Results

Research Question One: What is the level of metacognitive skills of primary school pupils in Asa local government area of Kwara state?

Table 2: Frequency and Percentage of primary pupils' metacognitive skills

	Frequency	Percentage (%)	Valid Percent
Low	40	90.9%	90.9
High	4	9.1%	9.1
Total	**44**	**100.0%**	**100.0**

The table above shows 90.9% of pupils falling into the low category, while only 9.1% demonstrate a high level of metacognitive skills. Hence, the majority of primary school pupils in Asa local government area of Kwara state exhibit a low level of metacognitive skills.

Research Hypothesis One: There is no significant difference in the metacognitive skills of primary school pupils who engage in the Protégé-Effect Strategy and those who do not, in Asa local government area of Kwara state.

Table 3: Summary of ANCOVA table indicates the efficacy of Protégé-Effect on the metacognition of pupils

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	208.90[a]	4	52.23	44.38	0.00	0.82
Intercept	327.79	1	327.79	278.55	0.00	0.88
Pretest	1.92	1	1.92	1.64	0.21	0.04
Treatment	180.67	1	180.67	153.53	0.00	0.80
PretestGiven	3.51	1	3.513	2.99	0.09	0.07
Treatment * PretestGiven	.05	1	0.05	0.04	0.84	0.00
Error	45.90	39	1.18			
Total	1803.00	44				
Corrected Total	254.80	43				

a. R Squared = .820 (Adjusted R Squared = .801)

The table above indicates that the Protégé-Effect strategy had a significant effect on metacognitive skill development among pupils (F = 153.53, p = 0.000). Hence, the null hypothesis, which states that "there is no significant difference in the metacognitive skills of primary school pupils who engage in the Protégé-Effect strategy and those who do not", is rejected. The findings clearly show that the Protégé-Effect strategy has a statistically significant positive impact on pupils' metacognitive development in Asa Local Government Area.

Research Question Two: What is the Protégé-Effect Strategy on the metacognitive skills of primary school pupils in Asa local government area of Kwara state?

Table 4: Mean difference between the groups on Protégé Effect

Group	Pre-test	Treatment	Post-test	Pre-test	N	Pretest		Posttest		Mean Difference
						Mean	SD	Mean	SD	
Group 1	O_1	X	O_2	O_1	11	3.73	1.19	7.91	1.38	**4.18**
Group 2	O_1		O_2	O_1	11	2.73	1.49	3.55	0.82	**0.82**
Group 3		X	O_2		11	0.00	0.00	8.27	1.35	**8.27**
Group 4			O_2		11	0.00	0.00	4.00	0.63	**4.00**
Total						**1.61**	**1.91**	**5.93**	**2.43**	**4.32**

The mean difference table reveals that pupils exposed to the Protégé-Effect strategy demonstrated notable improvements in their metacognitive skills compared to those who were not. Group 1, which received both pretest and treatment, showed a mean increase of 4.18, while Group 3, which received only the treatment without pretesting, recorded the highest improvement with a mean difference of 8.27, suggesting the strategy's strong impact even in the absence of prior assessment. In contrast, Group 2, which had a pretest but no treatment, showed a minimal improvement of 0.82, and Group 4, which had no pretest and no treatment, recorded a modest gain of 4.00. The overall average increase across all groups was 4.32, indicating that the groups exposed to the Protégé-Effect (especially Groups 1 and 3) significantly outperformed the control groups in posttest metacognitive performance. These results revealed that the Protégé-Effect strategy is effective in enhancing metacognitive skills among primary school pupils.

Research Hypothesis Two: There is no significant interaction effect of gender, Protégé-Effect strategy and metacognitive skills of primary school pupils in Asa local government area of Kwara state.

Table 5: Summary of ANCOVA table indicates the efficacy of Protégé-Effect on the metacognition of pupils based on gender (male and female)

Source	Type III Sum of Squares	df	Mean Square	f	Sig.	Partial Eta Squared
Corrected Model	209.98[a]	4	52.494	45.68	0.00	0.82
Intercept	906.82	1	906.815	789.072	0.00	0.95
Pretest	0.2	1	0.271	.24	0.63	0.01
Treatment	203.47	1	203.470	177.05	0.00	0.82
Gender	2.81	1	2.810	2.45	0.13	0.06
Treatment * Gender	1.82	1	1.823	1.59	0.22	0.04
Error	44.82	39	1.149			
Total	1803.00	44				
Corrected Total	254.80	43				

a. R Squared = .824 (Adjusted R Squared = .806)

There is a statistically significant effect of the Protégé-Effect strategy on pupils' metacognitive skills with a huge effect size. Gender on its own did not significantly affect metacognitive skills ($F = 2.45$, $p = 0.13$). There is no significant interaction between treatment and gender ($F = 1.59$, $p = 0.22$). The hypothesis stated that there is no significant interaction effect between the Protégé-Effect strategy and gender on metacognitive skills is retained.

Discussion of Findings

The finding of this study reveals that the majority of primary school pupils in Asa Local Government Area of Kwara State exhibit a low level of metacognitive skills. This result suggests that many pupils in this area may lack the ability to effectively plan, monitor, and evaluate their learning processes, which are essential components of metacognitive functioning. A possible explanation for this could be the continued reliance on traditional teacher-centred instructional methods that do not actively engage learners in self-directed or reflective learning. As supported in the saved content, although metacognitive skills are teachable and play a critical role in academic success particularly in reading, writing, and problem-solving (Dignath & Büttner, 2008; Turing College, 2022) many Nigerian classrooms still struggle to incorporate instructional strategies that foster these skills (Eze & Afolabi, 2022). Furthermore, the saved content emphasises that metacognitive development is enhanced when learners are provided with opportunities for peer teaching, self-assessment, and reflection

(Chase et al., 2019). The absence of such structured metacognitive instruction may account for the low levels observed in the present study. This finding aligns with concerns raised by Oladipo and Adebayo (2022), who noted that without deliberate integration of metacognitive strategies in early education, pupils may struggle with independent learning and cognitive regulation.

The results of this study indicate that the Protégé-Effect strategy is effective in enhancing metacognitive skills among primary school pupils in Asa Local Government Area of Kwara State. This supports existing research that positions peer teaching as a powerful tool for fostering metacognitive awareness, as it requires learners to process information deeply, organise their thoughts, and reflect on their understanding while teaching others (Cloke, 2024). The finding aligns with Vygotsky's theory of the Zone of Proximal Development, which emphasises the role of social interaction in cognitive growth, and is further corroborated by Kobayashi (2019), who found that direct teaching significantly improves learning outcomes and metacognitive engagement. Moreover, as noted by Awofala and Agbolade (2024), peer tutoring promotes academic improvement, particularly when learners take active roles in the teaching-learning process. Thus, the observed effectiveness of the Protégé-Effect strategy highlights its potential as an impactful, learner-centred strategy for developing essential self-regulatory and reflective learning skills in primary school pupils.

The finding that there is no significant interaction effect between the Protégé-Effect strategy and gender on metacognitive skills indicates that the strategy is equally effective for both male and female pupils. This suggests that gender does not influence how pupils benefit from engaging in peer teaching to enhance their metacognitive abilities. This outcome is consistent with Awofala and Agbolade (2024), who found that while peer tutoring significantly improved academic performance, gender had no statistically significant effect on the outcome. The result reinforces the inclusive nature of the Protégé-Effect strategy, highlighting its applicability across diverse learner demographics and affirming its potential as a gender-neutral instructional approach in fostering metacognitive development among primary school pupils.

Conclusion

This study underscores a critical gap in metacognitive skill development among primary school pupils in Asa local government area of Kwara state, revealing that most learners struggle with essential self-regulatory processes such as planning, monitoring, and evaluation. The baseline findings revealed that most primary school pupils in Asa Local Government Area of Kwara State demonstrated a low level of metacognitive skills. The study established that the Protégé-Effect strategy significantly enhanced these skills regardless of gender. This suggests that structured peer-teaching approaches like the Protégé-Effect can serve as effective, inclusive interventions to improve pupils' metacognitive competence across diverse classroom settings.

Recommendations

The following recommendations were raised based on the findings of the study:

1. Curriculum developers and education stakeholders should integrate metacognitive skill development explicitly into primary education frameworks, drawing from international best practices to enhance pupils' planning, monitoring, and evaluation abilities from early learning stages.
2. Teachers should embed the Protégé-Effect into lesson plans as a means of promoting metacognitive development among pupils. Activities such as "teach-backs" and peer explanations should be included regularly to help pupils improve in planning, self-monitoring, and reflection.
3. School administrators and policy makers should promote the Protégé-Effect as a universal teaching strategy capable of building metacognitive skills across gender lines. Professional development programs for teachers should include training on how to implement peer-teaching models effectively to support pupils' self-regulated learning.

References

Afolayan, A., & Okeowo, A. (2021). The impact of the Protégé-Effect on pupil motivation in primary schools. *Journal of Educational Psychology, 56*(4), 312–328.

Awofala, A. O. A., & Agbolade, F. O. O. (2024). Effect of peer-tutoring strategy on senior secondary school students' achievement in mathematics. *Journal of Educational Science and Policy Review, 3*(1), 45–58.

Chase, C. C., Chin, D. B., Oppezzo, M. A., & Schwartz, D. L. (2019). Teachable Agents and the Protégé-Effect: Increasing the effort towards learning. *Journal of Science Education and Technology, 18*(4), 334–352.

Cloke, H. (2024, April 29). The Protégé-Effect: How to learn by teaching. *Growth Engineering*. https://www.growthengineering.co.uk/protege-effect/?utm_source=chatgpt.com

Daou, M., Lohse, K. R., & Miller, M. W. (2016). Expecting to teach enhances motor learning and information processing during practice. *Human Movement Science, 49*, 336–345.

Dignath, C., & Büttner, G. (2008). Components of fostering self-regulated learning among students: A meta-analysis on intervention studies at the primary and secondary school level. *Metacognition and Learning, 3*(3), 231–264. https://doi.org/10.1007/s11409-008-9029-x

Effectiviology. (2025). The Protégé-Effect: How you can learn by teaching others. *Effectiviology*. https://effectiviology.com/protege-effect-learn-by-teaching/

Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in self-regulation and co-regulation. *European Psychologist, 13*(4), 277–287. https://doi.org/10.1027/1016-9040.13.4.277

Eze, C. U., & Afolabi, O. M. (2022). Enhancing learning outcomes through structured peer tutoring in Nigerian primary schools. *Journal of Education and Practice, 18*(1), 88–96.

Fiorella, L., & Mayer, R. E. (2016). *Eight ways to promote generative learning*. *Educational Psychology Review*, 28(4), 717–741.

Ha Dinh, T. T., Bonner, A., Clark, R., Ramsbotham, J., & Hines, S. (2020). *The effectiveness of the teach-back method on adherence and self-management in health education for people with chronic disease: A systematic review*. *JBI Evidence Synthesis*, 18(11), 2104–2119.

Kobayashi, K. (2019). Interactivity: A potential determinant of learning by preparing to teach and teaching. *Frontiers in Psychology, 9*, 2755.

Nováková, E. (2022). *Metacognitive skills of pupils in primary mathematics education*. Research in Education and Innovation, 15(1). Okonkwo, P., & Adedayo, R. (2020). Constructivist learning theory and its application in educational practice. *Journal of Educational Theories, 16*(3), 101–118.

Oladipo, S., & Adebayo, I. (2022). Enhancing motivation in primary school learners: The role of the classroom environment. *Journal of Child Education and Psychology*, *29*(3), 201–213.

Teng, M. F., & Zhang, L. J. (2021). *Development of children's metacognitive knowledge, reading, and writing in English as a foreign language: Evidence from longitudinal data using multilevel models*. British Journal of Educational Psychology, 91(4), 1061–1081.

Turing College. (2022, November 21). The Protégé-Effect: Learn by teaching others. *Turing College Blog*. https://www.turingcollege.com/blog/the-protege-effect-learn-by-teaching-others

Werdiningsih, D., Al-Rashidi, A. H., & Azami, M. I. (2022). *The development of metacognitive models to support students' autonomous learning: Lessons from Indonesian primary schools*. Education Research International, 2022