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Memory Retention Strategies for Effective Learning in Nigeria Schools

Nwaelele Okezie Ph.D [1]*& Dr Emilia Andorshiye John[2]

Department of Foundation and Arts Education, Faculty of Education, Ignatius Ajuru University of Education.
Department of Curriculum Studies. Ignatius Ajuru University of Education.

***Corresponding Author**: Nwaelele Okezie Ph.D
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Abstract

Purpose: *The study attempted to outline the challenges that hamper the effective execution of memory retention interventions towards the promotion of sustainable learning outcomes in secondary schools in Nigeria. The problem that was being examined was the long-term instability in the academic performance of students, which was mainly attributed to the short-term memorisation, exam-based teaching, and lack of consolidation of the learnt content. The main objective was to examine systemic and instructional barriers and to suggest practical interventions to strengthen long-term retention.*

Method: *A qualitative research design was embraced. The sources of data included secondary sources, which included peer-reviewed journal articles, policy reports, textbooks, and examination reports. These papers were analyzed in a systematic way using content analysis to dig out common themes related to the instructional practice, assessment frameworks, infrastructural situations, and teacher readiness.*

Findings: *The results revealed that the access to digital retrieval tools and blended reinforcement systems was limited by infrastructural and technological differences. The excessive number of students in the classroom and the disproportionate number of students to teachers impeded the chances of formative assessment and prompt corrective feedback. The combination of examination pressure and curriculum overload predisposed students to cramming instead of spaced learning, and poor teacher training hindered the implementation of evidence-based memory strategies. The study was based on the Cognitive Load Theory and showed that these variables increased the extraneous cognitive load and impaired schema construction, which undermined long-term learning.*

Conclusion: *The research concluded that, despite the empirical validation of memory retention strategies, their effectiveness depends on a harmonious coordination of curriculum, assessment, teacher capacity and infrastructural provisions.*

Recommendation: *It is suggested that investment should be made in the area of improving digital and instructional infrastructure, restructuring assessment systems to promote cumulative retrieval, and maintaining professional growth based on cognitive science-informed pedagogy.*

Keywords: *Memory retention; Cognitive Load Theory; Sustainable learning; Secondary education; Retrieval practice.*

Introduction

Memory retention strategies are intentional instructional and cognitive abilities that increase the capacity of learners to encode, store and recall information with time. The learning process, on the other hand, when done successfully entails profound learning, useful application, and long term recollection of knowledge not just the performance in the examination in the short term. The relationship between rote learning and lasting learning in the Nigerian school

context where high-stakes tests and curriculum-saturated programs tend to be the main focus of classrooms has become more prominent. According to recent reforms, empirical research, instructional strategies including cooperative learning, experiential learning, and technology-enhanced pedagogy have the potential to considerably reinforce the retention ability of the students relative to the traditional lecture-based instructions. As an example, it was found by Yalo et al. (2025) that cooperative teaching strategies contributed greatly to academic success and knowledge retention among students of secondary school in Northwest Nigeria, which confirms the effectiveness of organized peer interaction in forming memories traces.

On the same note, Ramat (2025) proved that experiential learning methods in chemistry contributed to increased retention of concepts because they made an abstract concept relevant to practical experiences. The latter are consistent with the modern cognitive science that focuses on active processing, elaboration, and contextual learning as contributing to the long-term memory consolidation. The requirement to inculcate empirically established memory retention skills to the daily practice of the classroom setting has never been more acute in the changing educational environment of Nigeria, where curriculum reform and revived interest in competency-based learning have become the new reality.

Digital and cognitive engagement as one of the ways to better retention is also another essential idea that will support the current research. Multimedia instruction, digital learning tools, and extended reality technologies are becoming more and more integrated into CLTs in Nigeria, changing the nature of interaction between learners and content. In this model, retention of memories is enhanced when learners undergo multisensory involvement, repetitive opportunities of retrieval and interactive feedback systems. Ubabuike and Ojechi (2025) documented that digital learning tools have a significant positive impact on student engagement and retention in Anambra State in public secondary schools, thus indicating that the wise use of technology can support cognition encoding mechanisms.

Similarly, Ayanwoye et al. (2025) noted that multisensory experiences created through immersive technologies increased the rate of memory retention in Nigerian universities. Such studies support the principles of cognitive load theory and multimedia learning that state that properly organized visual and auditory representations may maximize the working memory and help to store information long-term. Nevertheless, these developments promise a lot but infrastructural differences and unequal teacher training still hinder extensive application. That is why it is important to learn how the digital strategies can be contextually adjusted to the context of the Nigerian schools, particularly, those characterised by limited resources. The incorporation of technology as an established cognitive scaffold, rather than a solution created to be used as a new tool, can be transformative to ensure improved retention results.

Moreover, the process of memory retention is tightly related to learning behaviors, mindfulness and brain-based learning practices. Study habits involve the practices of learners in terms of rehearsal, organization, self-testing, and metacognition is that of awareness and control of cognitive processes. In brain-based learning approaches, the areas of attention control, spacing, and meaningful association are used as foundations of long-term memory formation. Ubah and Nwokolo (2025) found the dimensions of study habits related to memory to be influential predictors of academic performance among senior secondary students in Nigeria, highlighting the relevance of self-regulated learning behavior.

To add to this point of view, Odebode and Omotehinse (2025) demonstrated that academic performance was enhanced with the help of brain-based study skills counselling which helped to deal with the attention span, memory consolidation and engagement with cognitive processes. These results can be echoed by the larger educational reforms proposing competency based learning avoiding memorization and moving toward applied learning (Adeoye et al., 2025). It is in this context that the research is conducted to conduct a systematic observation of memory retention instruction in effective learning among the Nigerian schools with a view to determining evidence based instructional approaches that can reinforce knowledge retention over long term in classrooms, lead to improved academic performance and sustainable learning development in various classroom settings.

Statement of the Problem

Regardless of the series of educational reforms and policy interventions in Nigeria, issues related to the ability of students to memorize and practice acquired information still exist. Memory retention which can be described as the ability to encode, store, and recall information in the long run is a pillar in the effectual study yet still in innumerable Nigerian schools, classroom activities are based on the notion of cramming than long-term learning. The teacher-centered philosophy, overworked curricular policies, and exam-oriented systems of assessment provide a culture of superficial learning methods that undermine the long-term cognitive consolidation process and thus impair the effectiveness of teaching and learning processes and intellectual growth of learners across the educational system in the country. With no intentional integration of

memory-enabling methods into the teaching process, the divide between learning and teaching is created, and both the confidence of the learner and national educational output are at stake.

The empirical data highlight the decisive position of the memory in academic performance and the general educational outcomes. According to Lawal and Turaki (2025), memory skills are very relevant to academic success in the students and they argue that low retention ability usually develops with poor examination performance among high schools in Nigeria. On the same note, Ubah and Nwokolo (2025) note that memory-based study habits are key indicators of success in English language lessons among senior secondary students where cognitive rehearsal and organizational plans stand out as the key ones. However, most learners do not receive well-organized support in achieving good retention strategies like spaced practice, retrieval rehearsal, elaboration, and metacognitive monitoring. As a result, what is learned in the process of instruction often dies away very quickly, thus creating cycles of re-teaching and superficial learning. This situation poses some basic questions on the efficacy of instruction and intellectual development in the long run at the Nigerian schools and hence the need to systematically research into the operationalization of memory-retention mechanisms to facilitate long-term intellectual gains.

Digital tools and innovative pedagogies that are rapidly adopted in the Nigerian classrooms have not necessarily resulted in the enhanced retention outcomes. Although technology has potential interactive engagement, its educational usefulness depends on the strategic application in accordance with cognitive issues. According to Ubabuike and Obele (2025), the use of digital learning tools has increased engagement and retention among students in public secondary schools in Anambra State, but infrastructural differences and lack of consistent competence in teachers hinder the single-impact across the regions.

Simultaneously, Yalo et.al. (2025) reveal that cooperative teaching techniques can help to enhance the ability to retain knowledge in biology among students in Northwest Nigeria and imply that guided peer engagement strengthens encoding and retrieval processes. Though these are encouraging results, adoption of such evidence based practices are still scattered with many teachers still using traditional lecture models which do not focus on cognitive reinforcement but syllabus coverage. In what way would the students be able to learn long-term when the teaching methods do not purposefully elicit the long-term memory processes? Is academic change truly meaningful when the assessment systems still depend on the ability to recall facts over the short term and not the conceptual control? These questions left unanswered serve to highlight systemic flaws in instruction planning, teacher preparation, and curriculum alignment and a sense of urgency in contextual inquiry to understand how in real practice in Nigeria, memory-retention strategies are being practiced.

Moreover, there are socio-cognitive and environmental issues that also make the task of ensuring a healthy memory upkeep to the schools of Nigeria even more challenging. The studies on brain based learning have placed much emphasis on controlling attention, managing emotions and participation in strengthening the memory consolidation. Odebode and Omotehinse (2025) show that brain-based study-skills counselling had a significant positive effect on the performance of senior secondary students, which is that the issues with attention span and memory consolidation processes were reduced and consequently, academic performance enhanced significantly.

However, such cognitive optimisation initiatives are often frustrated by overworking classrooms, lack of teaching materials and fear of exams. Numerous students end up cramming late and rehearsing meaninglessly, without any meaningful association, which studies continuously demonstrate speeds up the rate at which such learning is forgotten. The net effect is a series of poor retention rates, demotivation, and volatile academic performance. The fact that the learners repeatedly fail to recall what has been taught before reduces academic self-efficacy, which strengthens the disengagement. Outside the classroom setting, these forces pose a risk to national growth, because education systems which cannot teach lasting knowledge will end up with graduates with fractured knowledge and weak problem-solving skills. It is on this premise that the present research was carried out to investigate the memory-retention techniques to achieve successful learning in Nigerian schools. Based on the identified problems and gaps in instructional practice, the following three specific objectives are formulated:

1. examine the extent to which memory retention strategies influence students' academic performance in Nigerian secondary schools.
2. determine the effectiveness of selected instructional approaches (such as cooperative learning, digital learning tools, and brain-based study strategies) in enhancing long-term retention among students.
3. identify the challenges hindering the implementation of effective memory retention strategies in Nigerian schools and propose practical solutions for improving sustainable learning outcomes.

Literature Review

Memory retention

The retention of memories is at the center stage of modern educational psychology since it defines the success of learning experiences in converting to long-lasting knowledge or disappearing soon after the teaching. In pedagogical discussions, researchers are becoming more analytical of the temporary recall and longer-term retention, and focus on the cognitive processes of encoding, consolidation, storage and retrieval. Mosia and Egara (2024) define memory retention as the non-temporary maintenance of learned mathematical concepts across intervals of repeated application and suggest that retention is indicative of the permanence of cognitive residues developed in the course of learning.

Likewise, Music (2024) describes long-term memory retention as the capacity of the learner to remember and use previously learned educational material after an extended period, which is important in the context of meaningful engagement in enhancing the neural consolidation process. In their study of the digital media in museum education, Say et al. (2025) define memory retention as the ability to replicate learned material in immediate and delayed recall tests to establish the relationship between retention and short-term and long-term memories. In a learning technological setup, Samente et al. (2024) consider memory retention as the ability to perennially recount instructional information with the aid of organized repetition and mental reinforcement strategies. Moreover, Barcaui (2025) defines knowledge retention as the retention of learned information over time, and in that regard, the less effort was used to learn something, the less likely is to strengthen long-term memory. Together these scholars are brought together in the same point; that memory retention does not only entail recall; it entails the stability, availability and usability of knowledge stored over time and situations.

Even though these definitions enlighten cognitive durability, recall processes, and instructional reinforcement, they show a faint gap; most of the conceptualizations do not paying much attention to active self-regulation of knowledge and adaptation of retained knowledge to context in the learner. Available definitions prefer to highlight either neurological consolidation (Music, 2024) or technological and pedagogical supports (Samonte et al., 2024; Say et al., 2025) and the interplay between socio-emotional engagement, metacognitive awareness, and environmental relevance to promote retention in various educational contexts is rather underrepresented.

Furthermore, some of the studies frame retention solely in the form of delayed testing metrics (Barcaui, 2025), though being helpful, might not be as reflective of dynamic and reconstitutive memory in a real-life classroom setting. Hence, a more expansive integrative concept seems to be required, one that incorporates cognitive endurance, instructional mediation, learner agency, and the applicability to the context. In this respect, memory retention can be characterized as the permanent, retrievable and transferable retention of acquired information, which becomes possible through efficient encoding, meaningful involvement, strategic reinforcement and self-regulatory cognitive activities over time. This definition is not limited to delayed performance of recalls, but rather the ability of the learner to re-construct, apply and manipulate the stored knowledge in different academic and real-life situations. This integrative perspective and comprehension is consistent with recent educational requirements that focus on intensive learning, skill acquisition, and sustainable intellectual expansion over short-term test results.

Effective learning

Learning has become a core construct to the modern research on education, especially in a world where change in technology is fast, curriculums are undergoing change and greater pressure on transferability competencies is growing. It is noteworthy before the concept is defined that the concept of effective learning is not merely the acquisition of information, but it goes further to include meaningful acquisition, enduring acquisition, critical thinking, and the ability of the learner to implement the knowledge in different settings. Staneviciene and Zekiene (2025) define effective learning as a method that facilitates flexible, motivating and meaningful learning process that fosters better understanding and eventual practice of knowledge in their systematic review of the use of multimedia in higher education.

On the same note, Avila-Garzon and Bacca-Acosta (2025) define effective learning as curriculum and pedagogy as the coordination of teaching plans, evaluation techniques and student interaction to promote meaningful conceptual learning and practical skills. In the context of sustainability and transformative education, Robertson et al. (2025) consider creative and transformative engagement, which prepares learners with the ability to critically evaluate and act responsibly in complex real-world settings, to be effective learning. When it comes to digital and blended settings, Bashir and Lapshun (2025) claim that the purposeful application of technology can be considered effective learning to facilitate interaction, accessibility and learner autonomy, thus improving education results. In addition, in their review of the concept of AI literacy education, Yang et al. (2025) depict effective learning as an orderly acquisition of skills by competencies developed via elaborated instructional systems that facilitate

comprehension, the acquisition of skills, and flexibility. In all these academic views, successful learning is always linked with profundity and not superficiality, student-centered processing and not passive reception, and quantifiable development of mental and practical abilities.

Regardless of such strong definitions, there is still visible conceptual gap. Numerous academic definitions focus on instructional design, technological mediation, or transformative outcomes, but there is a relative lack of focus on the combination of cognitive durability, self-regulation of the learner, contextual relevance and long-term sustained performance within one unified definition. Although Staneviciene and Zekiene (2025) emphasize motivation and flexibility, and Avila-Garzon and Bacca-Acosta (2025) emphasize curricular alignment, fewer definitions combine retention, transferability, emotional engagement, and measurable improvement as mutually dependent aspects of effective learning.

Furthermore, transformative and digital approaches (Robertson et al., 2025; Bashir and Lapshun, 2025) are usually concerned with the pedagogical innovation without the formal explanation of how the effectiveness of learning may be measured with the help of the long-lasting cognitive consequences and behavioral implications. Thus, a more integrative conceptualization is required, which would unite instructional quality, learner agency, cognitive endurance and contextual adaptability. In this respect, an effective learning can be considered as a long-lasting, meaningful, and transferring process where learners actively build, internalize, retain and apply knowledge, skills and values within a diverse context with the help of corresponding pedagogy, purposeful involvement and reflective self-managed regulation. The definition has emphasized the short-term understanding as well as the long-term retention, the critical application or the adaptive competence-the elements that are crucial in the successful education of the day.

Theoretical Underpinning

The research is based on the Cognitive load theory (CLT) postulated by John Sweller in 1988, which determines the effect of the framework of the teaching materials on learning and memory retention. The Cognitive Load Theory assumes that the human working memory has a small capacity and learning can be most effective when the instructional design reduces redundant cognitive load as much as possible, and maximises schema formation in long-term memory. Sweller separated three types of cognitive load: intrinsic load (complexity of the task), extraneous load (ineffective instructional presentation), and germane load (mental work devoted to schema formation).

The current scholarship still testifies to the applicability of CLT in education. Ouwehand, Lespiau, et al. (2025) point out that instructional strategies based on CLT improve the efficiency of learning because they pay close attention to the cognitive demands during information processing. On the same note, Surbakti, Umboh and Pong (2024) prove that the digital classroom setting based on the principles of CLT enables better understanding and retention because it minimizes the extraneous load. The underlying hypothesis of the theory is that meaningful learning, and the retention of information over a long period of time requires optimally organized information that is compatible with the architecture of the human cognition. In the Nigerian school setting where overpopulated classes and content-intensive curricula frequently overwhelm students, CLT offers an excellent theoretical framework to understand how the memory retention techniques can be organized to ensure achievement of positive learning results.

In addition to this, the Cognitive Load Theory holds that the knowledge is being held in the long-term memory as organised schemas, and that the effectiveness of instruction lies in facilitating the acquisition and automation of the schemas. This means that repetition, worked examples, scaffolding and segmented instruction are vital processes of enhancing retention. According to Gkintoni, Antonopoulou and Sortwell (2025), despite the recent advances in neuroscience and artificial intelligence to enlarge the discussion of learning, the original principle of CLT, which is the effectively controlled working memory, will continue to play one of the key roles in enhancing the efficacy of learning.

Moreover, Twabu (2025) believes that incorporating multimedia learning models with CLT can improve the level of conceptual knowledge by organizing the information in the cognitively manageable units. These views support the fact that learning best occurs when the cognitive resources are channeled to the useful processing as opposed to their dissipation in the form of poorly constructed instructional materials. Cognitive Load Theory comes into the limelight in the Nigerian educational setting where learners often have to deal with syllabus that is heavily loaded and minimal scaffolds in the instructional task. It offers a theoretical explanation on of why certain teaching methods are ineffective when it comes to facilitating retention and why well-sequenced systematic strategies can be very fruitful in relation to long-term consolidation of knowledge.

Notably, CLT also presupposes that the minimization of extraneous load enhances the capacity of germane processing thus reinforces retention and transfer of knowledge. Baxter and Sachdeva (2025) emphasize that the implementation of educational programmes based on the

principles of CLT yields better behavioural and cognitive results as learners are able to concentrate on the vital aspects without being overloaded with thinking processes. This is a direct assumption when it comes to the exploration of the memory retention strategies within the Nigerian schools because it highlights the necessity of the instructional clarity, supervised practice, and the intentional reinforcement methods. Using CLT, this paper will conceptualise memory retention strategies, including chunking, scaffolding, retrieval practice and multimedia simplification, as examples of ways to optimize cognitive processing. The theory is thus both explanatory and practical: it explains why bad instructional design becomes an obstacle to retention and it provides quantifiable principles of enhancing the effectiveness of learning. The application of Cognitive Load Theory to anchor this study will guarantee that the investigation of the memory retention strategies will be anchored in one of the scientifically proven models of human cognition, which will be especially appropriate to conduct the study of the effective learning in the context of the Nigerian schools.

Method and Materials

The study adopted a qualitative research approach, which gives detailed insight into the strategies of remembering to learn. Only secondary sources were used to gather data, such as the appropriate textbooks, peer-reviewed journals, reliable newspapers, governmental publications, and reliable international news agencies. The variety of sources guaranteed the coverage of the academic views and policy debates. The data obtained was sorted and critically analysed through content analysis. This analytical process allowed revealing common themes and patterns, as well as some conceptual insights, and comparing them, thereby deriving useful conclusions in accordance with the study goals.

Results and Discussion

Memory retention strategies and students' academic performance in Nigerian secondary schools.

The recent baseline measures of academic performance of the Nigerian secondary schools indicate that there has been a consistent problem in terms of sustaining performance especially in the externally moderated examinations such as WAEC and NECO whereby changes in credit level passes are ever present concerns relating to the depth of learning and retention of subject contents (Ofozoba, 2025). These tendencies indicate that most of the students might be involved in temporary memorisation instead of long-term learning. It is against this background that modern cognitive studies have shown strong empirical evidence that proper memory retention plans have a great impact on quantifiable academic performances. A study with a large sample of secondary school students indicated that students who regularly used retrieval practice and spaced study methods had statistically better academic performance than those who used rereading strategies, and effect sizes showed statistically significant improvement in the examination outcomes (Ruiz-Martin et al., 2024). Sultana et al. (2025) also demonstrated that secondary science students who used deliberate recall, self-testing, and metacognitive monitoring strategies performed better than students who relied on passive revision techniques providing a direct correlation between active memory use and better performance.

Consistent with these results, Egara and Mosimege (2024) in their quasi experimental study design have shown that learners in blended learning environments who experienced structured reinforcement acquired a lot of improvement in mathematics achievement test and delayed retention tests than control groups. All of these empirical findings support the assumption that processing long-term memory as a retrieval and systematic revision promotes a state of examination preparedness and mastery of the subject. At the Nigerian setting where performance metrics were still showing the uneven patterns of achievement, incorporation of evidence-based memory retention interventions provides a viable avenue towards enhancing academic results and breaking the cycle of underperformance.

Additional results highlight the fact that even though one is not focused on the immediate test scores, the impact of the memory retention strategies is further applied to the long-term cognitive competence and self-regulated academic development. In their quantitative review study involving both primary and secondary students, Elhusseini et al. (2022) found that self-regulation interventions, comprising of rehearsal, strategic planning and reflective monitoring, had a significant positive impact on academic performances in subject domains. Their meta-analytic results suggest that executive and memory process enhancement can provide consistent results in student performance. Also, by conducting a scoping review of mnemonic-based serious games, Fung and Oyibo (2024) found that there was an increase in long-term recall and conceptual understanding in various learning environments, and learners showed better post-test and delayed-test results when mnemonic aids were incorporated in the educational process. The results are especially applicable in such settings as Nigeria when curriculum coverage may be overly cognitive on students. Through creating organised encoding, repetition of learning and structured reinforcement, memory retention strategies assist learners in consolidating information in a more effective way and lessening the need to cram at the last minute and encouraging long term academic stability. Considered together with the national anxieties about the

variable success rates on examinations (Ofozoba, 2025), the aggregate data indicates that the memory retention tactics have a significant and quantifiable impact on the academic achievement of students. They facilitate the accuracy of recall, increase the level of conceptual knowledge and transferable knowledge, and thus, provide a framework of the research-based approach to the improvement of secondary school performance in Nigeria.

The educational indicators in Nigeria on baseline education still indicate issues related to inconsistency and lack of evidence of profound and sustained learning in schools, especially within those subjects where cumulative learning and long-term memory is needed. Reports on national examinations in recent years have demonstrated inconsistent credit-level scores in core subjects, which implies that a large proportion of learners can hardly retain and put into practice what they have learned beyond the instant classroom instruction (Ofozoba, 2025). In this regard, scholarly studies concerning memory retention strategies offer empirical basis to the targeted instructional reform. In the meta-analytic review of self-regulation interventions facilitating academic achievement of primary and secondary students, Elhusseini et al. (2022) found that structured cognitive and metacognitive strategies had statistically significant beneficial effects on the academic performance of learners, as well as on the learning process and the retention process, which constitute the executive functioning of the mind. The results of their study is a quantitative confirmation that, in cases where students are taught in an explicit manner how to plan, organise, rehearse and retrieve information, academic gains can be measured. This is especially true in the Nigerian secondary schools where students are often subjected to syllabi that are rich in content and examinations that are high stakes and where students have to recall the content accurately with long intervals between examination. The implication is that the integration of structured retention strategies in teaching practice can directly problematize identified inconsistencies in the performance of learners because it enhances the ability of the learners to have the ability of maintaining the retention of the knowledge instead of the ability to memorise in the short term.

Additional empirical evidence shows the memory retention strategies lead to the long-term academic growth in addition to the short-term post-test gains. In a quasi-experimental study in secondary mathematics classrooms (Egara and Mosimege, 2024), the learners subjected to blended instruction methods including structured reinforcement and periodical review scored much higher in both immediate achievement and delayed retention tests that were conducted weeks after. This background data establishes the fact that the reinforcement-based approaches improve the long-term knowledge consolidation. Furthermore, Ruiz-Martin et al. (2024) have found that the beliefs of secondary students regarding effective study techniques were a major predictor of the academic performance of students, with the frequent practice of retrieval-based strategies found to be more effective than passive rereading in students. Their research offers behavioural facts that the deliberate involvement in memory procedures is associated with the enhanced academic achievements. In comparison with the recorded dependence regarding remaining of memory through memorisation and the cramming of examinations in the majority of the Nigerian classrooms (Ofozoba, 2025), the overall research data indicates that the retention methods based on scientific principles can significantly influence the accuracy of recall, conceptual grasp and the maintenance of testing outcomes on the long term. In response, the inclusion of the systematic memory retention strategies could be viewed as not solely an improvement of the pedagogical process, but a data-backed intervention that would be able to make the academic performance of Nigerian secondary schools stronger.

Effectiveness of selected instructional approaches (such as cooperative learning, digital learning tools, and brain-based study strategies) in enhancing long-term retention among students

Recent educational baseline data in various systems of secondary school show that there are consistent lapses in sustained performance, especially in the science and language areas that require cumulative knowledge to pass the exams. In Nigeria, as an example, repeated oscillations in credit-level success in national examinations like the Senior School Certificate Examination (SSCE) have been attributed, in scores of educational publications, to surface studying examples and a minimal ability to absorb the material of the subjects long-term (Aliyu, 2024). It is on this context that the efficacy of such instructional strategies as cooperative learning will require a basis in empirical retention information. The systematic review by Liu, Thurston and Ye (2024) included 54 studies on technology-enhanced cooperative learning and provided statistically significant positive outcomes of academic and knowledge retention; the effect sizes indicated a moderate to strong increase in the results when structured peer interaction and shared accountability were integrated into lessons. Their study revealed that students who participated in the cooperative structures recorded better delayed post-test scores than the students who were taught in individualistic or lecture-based systems. Similarly, Costa and Reis (2025), in their review of active learning methodologies used between 2018 and 2024, noted the similarity in the enhancement of conceptual understanding and retention results of the studied areas in the secondary and higher

education setting, especially where collaborative activities were to be explained, summarised, and discussed with peers. Such profits going beyond immediate evaluations to subsequent evaluations are indicative of the long-term cognitive consolidation.

Aliyu (2024) developed a quasi-experimental design to gather classroom-based baseline data on the Nigerian context, which involved secondary students of chemistry in Calabar Municipality. The learning results indicated that learners instructed through the jigsaw cooperative learning strategy scored much higher in mean achievement scores as compared to their non-experimental counterparts in the lecture groups and the retention test scores collected weeks later were significantly higher in the experimental group. This statistical divergence highlighted the fact that cooperative learning did not only help in short-term improvement of performance but also long-term memory. These results indicate that the instructional strategies that encourage dialogue, elaborative rehearsal and peer elaboration are a direct response to systemic retention issues when interpreted within the context of other issues in examination performance volatility. Together, international meta-analytic evidence (Liu et al., 2024), systematic reviews evidence (Costa and Reis, 2025), and classroom-based statistics in Nigeria (Aliyu, 2024) present a strong empirical point on the usefulness of cooperative learning to increase long-term retention. In the context of teaching and learning practices represented by examination stress and the rigorous curricula regulation, this type of baseline evidence makes cooperative learning a research-proven practice that can turn the temporarily based memorisation into a long-lasting academic mastery.

The assessment of educational baseline data over the last decade shows that the rate at which schools have embraced the use of digital tools in teaching has increased at a very fast pace, but the quantifiable returns on lasting learning require the pedagogical organization of such tools. Monitoring reports by international organizations indicate that educational technologies have become more popular in the classroom (science and mathematics), but changes in long-term retention are best observed when digital technology is based on structured retrieval and feedback (OECD, 2019; OECD, 2023). Chen et al. (2025) conducted a meta-analysis of human-machine collaborative learning settings over 10 years, synthesising the results of a series of experimental and quasi-experimental studies and showing statistically significant positive outcomes on the level of knowledge retention in science classes. Their review showed that virtual environments with adaptive feedback and repeated testing procedures created stronger delayed post-test results than non-interactive formats. Likewise, in a scoping review of the use of mnemonic serious games, Fung and Oyibo (2024) reported identical effects of performance and delayed recall at the secondary level, as indicated by the fact that gamified rehearsal enhanced long-term consolidation. The findings of these observations are consistent with the previous cognitive literature that has shown that retrieval-based digital interventions produce long-term learning benefits (Dunlosky et al., 2013; Carpenter et al., 2022). In Nigeria, which still demonstrates skewed trends in gender performance in STEM subjects in national examination data (WAEC, 2023), these data indicate that organized digital reinforcement has the potential to reduce inequality in retention in case it is adequately organized. The meeting of the world baseline statistics on technology adoption and experimental retention data is a positive indicator that digital learning tools only increase the long term memory when they are constructed in such a way that they trigger retrieval practice, spaced rehearsal and multimodal encoding and not passive content exposure.

Brain-based and inquiry-based strategies complementing digital innovations also present quantifiable results in relation to high-term academic performance. In a scoping review of co-operative and inquiry-based mathematics and science learning, Mogelvang and Nylehn (2023) discovered that the use of instructional design that incorporates structured reflection and guided discovery produced better retention results compared to the conventional lecture-based design. In their review, they found that learners who were exposed to reflective dialogue and scaffolded inquiry had higher scores on delayed assessment, which is a deeper conceptual encoding. These conclusions are consistent with mass analyses on the effective learning strategies that find elaborative interrogation, self-explanation and distributed practice to be high-utility strategies of enhancing long-term retention (Dunlosky et al., 2013; Weinstein et al., 2018).

Furthermore, the data of global education performance points to the systems that have been focusing on active learning and metacognitive training, which report more consistent longitudinal achievement patterns compared to those that have based their main focus on rote learning (OECD, 2019; OECD, 2023). These statistics support the empirical relevance of cognitively guided teaching frameworks within the context of secondary school settings that have been described in terms of examination intensity and curriculum density. In combination, meta-analyses (Chen et al., 2025), systematic reviews (Fung and Oyibo, 2024; Mogelvang and Nylehn, 2023) as well as international baseline data (OECD, 2019, 2023; WAEC, 2023) have proven that cooperative learning, digital reinforcement and brain-based study strategies are empirically tested methods of improving long-term retention. These strategies offer lasting solutions to

enhancing cognitive stamina and educational sustainability through encouraging elaboration, spaced retrieval, multimodal interaction and reflective consolidation in the context of secondary education.

Challenges hindering the implementation of effective memory retention strategies in Nigerian schools and propose practical solutions for improving sustainable learning outcomes.

Cognitive science corpus provides strong evidence that retrieval practice, spaced rehearsal, elaborative interrogation and metacognitive control are high-impact learning strategies; there is still a notable discrepancy between their application in a classroom setting. The literature shows that retrieval-based strategies are much more effective in warding off long-term retention and transfer of knowledge (Carpenter et al., 2022), however, students often revert to passive strategies, i.e. rereading and highlighting, without explicit instruction (Ruiz-Martin et al., 2024). In the Nigerian setting, this is further exacerbated by the fact that examination-oriented teaching is highly dominant. The reports by Chief Examiners invariably indicate defects in conceptual knowledge and practice in numerous of the core subjects, implying that a great number of learners participate in short-term memorisation as opposed to long-term learning (WAEC, 2023).

Infrastructural Disparities: Infrastructural inequality is one of the intrinsic hindrances to the systematic execution of proper memory retention methods in schools in Nigeria. Although blended instructional methods have shown significant gains in academic performance as well as delayed retention (Egara & Mosimege, 2024), they have been found to thrive on the availability of stable technological and organisational support systems. According to the baseline educational information, there are still viewable digital gaps throughout the sub-Saharan Africa, and UNESCO (2023) reveals that a substantial percentage of secondary schools does not have proper internet connectivity and does not have proper digital devices to be used in the instructional process. These limitations limit the opportunities of adaptive quizzes, intermittent digital rehearsal and feedback-motivated retrieval loops strategies that are empirically associated with improved long-term retention (Carpenter et al., 2022).

In addition, the results of PISA 2022 provided by OECD (2023) show that educational systems that are more integrated with digital learning tools and metacognitive practices of engagement have more stable longitudinal results of achievement than systems that are less integrated. The issue is also intensified by the large classes, as overcrowding makes teachers less able to apply formative low-stakes testing and give individualised feedback, both of which are key to long-term memory consolidation (Hattie, 2012). In cases of poor technological accessibility, poor management of classes and organized formative assessment, there are fewer retrieval opportunities and poorer cycles of reinforcement and this undermines schema forming and higher rates of forgetting with time. Therefore, the infrastructural differences have a direct effect of hindering the practical entrenchment of retention-oriented pedagogy.

Examination Pressure and Curriculum Overload: Examination-based teaching is another system issue that inhibits the application of organized strategies of memory retention. A case in point is seen in regular national examination reports that indicate a long-standing deficiency in students in their level of analytical thinking and ability to solve applied problems, which indicates shallow coverage of subject material (WAEC, 2023). Where high-stakes testing takes the place of teaching a curriculum, educators tend to increase the speed at which the syllabus is taught at the cost of spaced practice and cumulative review.

According to comparative data published by OECD (2019, 2023), the systems with an accent on applied reasoning and the cumulative assessment structure are more effective than the system with the foundation on the principles of memorisation-based testing, and it is necessary to highlight the necessity of the alignment of assessment with the principles of durable learning. The empirical classroom studies also have shown that learning through retrieval is much more effective than repeated exposure when it comes to long-term retention and transfer (Carpenter et al., 2022; Dunlosky et al., 2013). But with curriculum overload, students often engage in cramming which is a behavior that is linked to quick forgetting and poor consolidation. Ruiz-Martin et al. (2024) discovered that the rereading strategy is still popular among many secondary students, although they are proven to be of limited efficiency. A reassessment system to include cumulative testing and application-based questions would motivate teachers to include low-stake quizzes and spaced review activities to strengthen memory consolidation mechanisms and enhance sustainable learning experiences.

Scarcity of Teacher Training in Evidence-Based Strategies: Another obstacle is the lack of teacher training in cognitive science-based pedagogy. Even though the literature is very certain about retrieval practice, self-regulated learning, and managing cognitive load as high-impact strategies (Carpenter et al., 2022; Dunlosky et al., 2013), most teachers are not well trained in the techniques. Ruiz-Martin and colleagues (2024) have shown that the belief held by students regarding strategies they consider effective in studying can be a strong predictor of the academic performance in students and that teacher

instruction is a determining aspect to influencing retention practices.

In circumstances where professional growth lacks the focus on the evolving learning strategies, teaching is still largely lecture-based and eliminates the possibilities of elaborative rehearsal and reflection on cognition. Hattie (2012) found formative evaluation and feedback to have some of the greatest use in achievement, but the crowded nature of the classroom and insufficient training limits their implementation as systematic. UNESCO (2023) also documents any imbalance in the capacity-building of teachers in different regions, which has an impact on quality of instruction and innovation. Students will not be inclined to use effective retention strategies on their own without the long-term commitment to professional development that helps teachers design mentally challenging lessons, balance cognitive load and promote metacognitive learning. This means that a lack of teacher training does not only undermine classroom application of memory enhancing practices, but also leads to a sustained dependence on the low utility study habits which in turn discourages long term knowledge stability.

Infrastructural and Technological Constraints: Infrastructural and technological limitation has been a major hindrance to the successful application of memory retention strategies within the Nigerian schools. Even though it has been empirically demonstrated that blended learning models improve academic performance and delayed retention (Egara & Mosimege, 2024), their success is related to the regular availability of digital infrastructure. According to UNESCO (2023), in most of the low- and middle-income countries, including sub-Saharan regions, less than half of secondary schools are well-connected to the Internet, and the ratio of devices to students is dismal. These differences directly limit the adoption of adaptive quizzes, spaced digital rehearsal and automated feedback the tools which research has found to be core in enhancing long-term retention (Carpenter et al., 2022). The findings of OECD (2023) data provided by PISA 2022 also show that students who have access to digital learning tools to complete structured academic tasks perform more congruently on reading and science tests compared to other students with limited access.

Besides, the World Bank (2022) points out that digital inequity is one of the drivers of disparities in learning recovery and retention, especially in a post-pandemic recovery situation. Without reliable power, online connectivity and sufficient digital facilities, the chances to use retrieval-based e-learning systems and positive feedback loops are highly limited. Repetition and practice-important cognitive processes required in the consolidation of information into the long-term memory are reduced by this technological divide (Dunlosky et al, 2013). Infrastructural deficits, therefore, do not only impede innovation, they also undermine the effectiveness of students in interacting with planned memory enhancing tactics necessary to remain sustainable in academic performance.

Overcrowded Classrooms and Limited Feedback: Large student-teacher ratios only serve to weaken the uniformity in the use of retention-focused instructional practices. According to the baseline educational statistics, the average class size in some of the sub-Saharan African settings often exceeds the recommended ones, preventing the use of personalised feedback and formative assessment (UNESCO, 2023). Corrective feedback and formative assessment are also recognised as high-impact factors on student achievement and student retention (Hattie, 2012). The results of the OECD (2023) indicate that the systems that have a high formative assessment culture are characterized by more consistent longitudinal patterns of achievement, especially in reading and math. The teachers cannot administer low-stakes cumulative quizzes, allow detailed feedback or track the metacognitive progress of students, which is proven to be a highly effective method to retain students, when classes are crowded (Carpenter et al., 2022).

Moreover, Ruiz-Martin et al. (2024) discovered that the academic performance of students is positively linked to their knowledge and skills of using effective learning methods, but this kind of guidance demands a regular interaction with teachers and support. In congested learning settings, the time allocated to instruction is usually spent in classroom control and teaching syllabus material instead of retrieval practice and reflective consolidation. According to the World Bank (2022), the instructional support that teachers should provide and the volume of work they have is harmful to the quality of learning, especially in systems where enrolment growth is swift. Consequently, the overcrowded classes directly undermine the feedback loops that are required to reinforce the memory traces and rectify the misconceptions. In the absence of operational formative assessment and personalised reinforcement, the retention of the learnt materials among the students is weak, which results in the variability of student academic performance and poor long-term mastery.

The combination of all these problems undermines the systematic use of memory retention techniques. Nevertheless, curriculum reform, specific teacher training, investment in infrastructure and reorganization of assessment, can help eliminate retrieval-based practices and metacognitive practices as an institutionalized pedagogy of the Nigerian schools. These reforms offer a long term sustainable avenue on the increase of retention,

improvement on examination performance and creation of long-term intellectual competence.

Conclusion

The paper has discussed the issues which prevent effective memory retention practices in schools in Nigeria and provided a means through which success in the learning process amidst the challenges can be achieved. With empirical evidence, and baseline educational data, the results were found to be that systemic and classroom-based constraints were considered to restrict the steady use of retrieval-based, spaced and metacognitive learning strategies to a considerable degree. The difference in infrastructural and technological factors was identified to limit the access to adaptive digital instruments and organized reinforcement systems that facilitate repeated retrieval and feedback-guided rehearsal. Crowded classrooms and high student:teacher ratios minimised chances of formative assessment, corrective feedback and any personalised cognitive scaffolding-factors that have been well identified to play a vital role in long term memory consolidation. Moreover, the prevalence of examination-based teaching and overloading the curriculum promoted the importance of covering the syllabus as quickly as possible and of short-term memorisation as opposed to long-term retention and conceptual transfer.

The results were also found to suggest that the lack of professional development among teachers in the use of evidence-based learning strategies also helped to reinforce the low-utility study habits that were observed in students. In classrooms with teachers who did not have sufficient instruction in cognitive load management, retrieval practice and self-regulated learning models, classroom practices were still lecture-based. This teaching model undermined the prospects of elaborative rehearsal and progressive review resulting in weak knowledge systems and volatile academic achievements. All these impediments reduced the ability of students to effectively encode, consolidate and recall information, thus limiting long term academic development.

The study has been anchored in cognition load theory (Sweller, 1988) by interpreting the investigations based on the working-memory constraints and the schema-construction mechanisms. The hypothesis of the theoretical framework was that successful learning was possible when the design of instruction reduced the extraneous processing, and maximised the germane processing to the formation of long-term memory. Nevertheless, the pressure of examination, congestion and inability to offer instructional support were discovered to put additional extraneous pressure even though it restricted the dynamics of schema automation by using organized reinforcement. This commonly shifted cognitive resources among students making them engage in coping with an overload of information as opposed to meaningful consolidation.

Finally, the study determined that although memory retention strategies were empirically proven as an effective tool in enhancing academic performance, their outcome in the Nigerian schools was highly reliant on the systemic alignment of the curriculum design and teacher training with assessment structure and provision of infrastructures. The more instructional practices were deliberately based on spaced retrieval, formative feedback and metacognitive engagement within cognitively manageable learning environments, the more sustainable learning outcomes were to be achieved.

Recommendations

Based on the identified findings, the following recommendations were stated:

1) Enhance Digital and Instructional Infrastructure: The government and other stakeholders in the education sector should invest in equitable digital infrastructure, such as accessible internet connectivity, low-bandwidth learning platforms and device support in secondary schools. In schools, the use of scalable digital systems, which involve adaptive quizzes, spaced retrieval exercises, and automated feedback systems should be adopted. This type of investment would allow uniform application of blended and retrieval-based learning strategies and, thus, would enhance long-term memory retention and decrease differences in access to memory-enhancing instructional methods.
2) Reform Assessment and Curriculum Practices: Assessment structures need to be reformulated by exam bodies and curriculum planners to promote cumulative retrieval, analytical thinking and conceptual transfer over the isolated retrieval. A combination of low-stakes formative assessment, periodical cumulative tests and non-periodic structured revision cycles implemented in the classroom would discourage cramming and encourage spaced learning. Curriculum pacing would be synchronized with periods and time of consolidation, which would enhance the formation of schema and enhance sustainable performance in academic subjects.
3) Improve Teacher Professional Development: Intensive and ongoing teacher-professional development programmes must be introduced to educate the teachers on evidence-based memory retention techniques, such as retrieval practice,

cognitive load control and metacognitive training. Formative feedback and self-regulated learning equipment of teachers with practical classroom tools would enhance the quality of instruction. Enhanced teacher capacity would help to establish that the memory-enhancing strategies would become regularized pedagogical activities and not isolated interventions.

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