



Self-Regulated Learning in Senior Secondary Education: Theory, Evidence, and Educational Implications

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Abstract: Self-regulated learning (SRL) is a topic of considerable scholarly interest because of its high correlation with autonomous learning, academic achievement, metacognition, motivation, and emotion regulation. This narrative review examines theoretical, empirical and methodological developments in the field of research concerning self-regulated learning published between 2015 and 2025 on senior secondary students. This paper aims to fill a research gap related to the analysis of the issue in question in senior secondary educational settings. Articles were identified through Scopus, ERIC, Web of Science, and Google Scholar databases. Following a screening process, 40 articles were selected for interpretive synthesis after meeting the inclusion criteria. Three SRL models, namely the cyclical phases model of Zimmerman, the COPES model of Winne and Hadwin and the metacognitive and affective model of self-regulated learning (MASRL) by Efklides, are reviewed. The findings demonstrate that SRL among senior secondary students is determined by the degree of congruence between motivational beliefs, metacognitive abilities, emotion regulation skills, teacher scaffolding, peer interactions, digital learning environment, and context of classroom teaching. An increasing tendency to use mixed methods, trace-based methods, think aloud approach, reflective diaries, and technology-based measurement of SRL. Overall, the review indicates that late adolescence is certainly a distinctive developmental phase with three major characteristics: examination pressure, identity formation, and emotional instability as well as readiness to change. The current SRL review provides a developmentally informed perspective on self-regulated learning and offers important recommendations for curriculum planning, assessing SRL in classrooms, and teacher education.

Keywords: Self-Regulated Learning, Senior Secondary Education, Metacognition, Motivation, Adolescent Learning, Educational Psychology.

1. Introduction

1.1 Background and Rationale

As cognition, motivation, emotions, and behavior can be controlled in the process of learning, SRL has been one of the leading theories in educational psychology, explaining the role played by active management of cognition, motivation, emotion and behaviour in the learning process. Self-regulated learning (SRL) is a learner-controlled process where individuals take part in planning, monitoring, and evaluating their learning, through planning of learning, monitoring the progress and reflecting upon his or her performance. SRL becomes increasingly important under the growing relevance of autonomous learners, digital learning and competency-based curriculum, characteristic of secondary education in recent years. Wu *et al.* (2023) reported the significant increase in senior secondary learners' achievements in chemistry through the effective use of SRL.

Senior secondary education is a vital phase for SRL learning due to several factors including increasing academic pressure, exam stress, and identity issues. It includes examination pressures as well as concerns associated with their identities as the adolescent moves into senior secondary education. Adolescents who develop positive beliefs regarding their malleability and ability to develop SRL skills will likely rate higher on their adaptive SRL skills and metacognitive regulation processes (Hertel and Karlen, 2021). It is expected at the late adolescent period that individuals should be able to learn through self-direction, adjust psychologically towards school competition as well as the adoption of technology-based learning practices.



The study conducted by Nieva and Prudente (2022) indicates that the academic performance as well as the well-being of senior high school students will be positively mediated by the online SRL process. Similarly, according to Ni and Cheung (2023), the use of the AI tutor system among students would be significantly influenced by individual student's self-regulation practices.

SRL is known to positively influence students' learning achievement, motivation, perseverance, and engagement. Senior secondary school students employ different lines of self-regulatory strategies based on the learning context and motives (Kesuma *et al.*, 2021). For example, according to Zhang *et al.* (2023), there is evidence of reciprocity between intrinsic and extrinsic motivations and cognitive engagement among senior secondary mathematics students in China.

With the evolution of educational technology integration in education, the ways in which students regulate their learning at school have changed. For example, Banda and Nzabahimana (2023) that simulation-based learning positively influenced the motivation and achievement of secondary physics students. Similarly, Tashtoush *et al.* (2023) that ICT-based learning positively influenced student excitement while learning mathematics.

Recent developments in SRL theory consider the influence of a wider range of influences beyond cognitive processes. These include emotion, environment, and cultural background. The effect of culturally responsive classrooms in promoting adolescents' engagement and SRL behavior is discussed by Anyichie *et al.* (2023). The interaction between affective experience and learning regulation is also evident in research linking enjoyment and anxiety with academic achievement (Dewaele and Li, 2022).

1.2 Scope and Purpose of the Review

The present study uses a narrative review approach to investigate developments within the field of SRL studies among senior secondary school students. Unlike reviews that focus on university settings, workplace and adult learning since it focuses only on adolescent learners enrolled in senior secondary school education. It was observed by Ayilimba *et al.* (2024) that senior high school students consider scientific knowledge to be objective and absolute; however, their perspective shows that the theories developed in sciences are based on prior beliefs, experiences, and knowledge structures, thus emphasizing the theory-laden aspect of science. The review extensively covers three major areas. Firstly, the review analyses the theoretical perspectives that govern the conduct of SRL studies among adolescents and are widely used. Secondly, factors affecting SRL development at individual, class environment and technology-mediated levels are examined. Thirdly, methodology employed in researching SRL processes and SRL itself is reviewed.

Moreover, the review also addresses issues that emerge from late adolescence including exam anxiety, emotional instability, peer comparison, identity development and preparation for academic transition.

1.3 Research Gap

Despite substantial developments in the research on SRL, several gaps remain in research focused specifically on senior secondary school learners. First, there is a lack of systematic synthesis of SRL research concerning late adolescence since most studies have been conducted on university students or younger learners. The SRL demands placed on senior secondary learners differ substantially from those experienced by other groups as mentioned by Wu *et al.* (2023). This difference arises from the academic complexity of their educational institutions and their tendency towards examination-based education systems.

Second, previous literature reviews focused on motivational, cognitive, affective, or contextual factors, but not all of them at once. As revealed by the findings of Andrianie *et al.* (2025), there is a connection between emotion regulation, motivation, and context that affects the SRL of high school learners. Based on the study of Dignath and Veenman (2021), it can be stated that the combination of direct instruction of learning strategies and indirect support in the classroom can effectively foster secondary students' self-regulated learning, in order to develop their learning strategies of cognitive and metacognitive types, in addition to motivational types.

Another limitation concerns the methodology used in SRL research. For instance, many studies rely on survey or questionnaire items based on self-report, which cannot fully explain the dynamic nature of SRL. Process-oriented



approaches, including online learning profiles and digital learning data, can provide more detailed insight into how learners regulate their learning processes (van Alten *et al.*, 2021).

Third, the introduction of new technologies in educational institutions has not always been aligned with evidence from SRL research about the importance of these technologies in developing this skill among learners. The recent recommendations made by Ng *et al.* (2023) highlight the need for AI literacy and digital regulation skills among secondary school students. Nevertheless, only a few studies have explored integrating the use of AI-assisted learning environments in terms of SRL theory on a large scale.

1.4 Research Objectives

The objectives of the study include the following:

- To conduct a critical review of the major theories and models of Self-Regulated Learning (SRL) used in senior secondary school settings.
- To review the main cognitive, motivational, affective, and contextual factors that influence SRL in senior secondary school students.
- To explore the recent methodological approaches to SRL studies, especially those focusing on process-oriented and technologically enhanced approaches.
- To derive the educational significance of current SRL research and provide recommendations based on the evidence reviewed.

1.5. Summary

The introduction defines SRL as a multidimensional construct, which is essential for adolescents' achievements in their learning process. The introduction further emphasizes that a developmentally informed review of senior secondary education is needed.

2. Methodology of the Narrative Review

2.1 Search Strategy

The literature was searched in four major academic databases: Scopus, ERIC, Web of Science, and Google Scholar. The search was conducted from December 2024 to March 2026, and the retrieved literature consisted of peer-reviewed publications from 2015 to 2025. Boolean operators and relevant keywords were used to improve the search process. The principal keywords included "self-regulated learning" "SRL" "senior secondary students" "adolescents" "self-efficacy" "teacher support" "learning environment" "To explain the motivational aspects of teaching and learning." The search strings are adapted a little for each database, based on the index functionality of that database. The database-specific search strings, dates, and screening totals are summarized in Table 1.

Table 1. Search Strategy

Database	Search Strings	Date of Search	The records that are retrieved	Records that are screened	Sources that are included
Scopus	"self-regulated learning" AND "senior secondary students"	12 January 2026	148	54	16
ERIC	"SRL" AND "adolescent learning"	18 January 2026	96	37	10
Web of Science	"self-regulated learning" AND "secondary education"	02 February 2026	121	43	4
Google Scholar	"self-efficacy" AND "high school learners"	11 February 2026	214	62	10



2.2 Search and Screening Process

The literature matrix developed from the included studies provides an organized summary of 40 studies pertaining to the fields of SRL, motivation, metacognition, digital learning, and classroom engagement in the senior secondary and associated educational settings. The literature matrix reveals that SRL research in senior secondary education involves a strong multidisciplinary approach involving cognitive, motivational, technological, emotional, and contextual dimensions. While most studies utilized a quantitative and experimental methodology, others opted for a mixed methods approach, while few studies applied qualitative, phenomenological, and review approaches. In addition, the literature matrix indicates that the most popular themes include the regulation of motivation, metacognitive skills, technology usage, and classroom intervention. Several studies discussed the role played by ICT, AI-assisted learning, flipped classroom, simulation, and learning analytics in facilitating learner engagement and learner autonomy. Other relevant themes included emotional and contextual issues such as resilience, anxiety, social media, cultural responsiveness, and leadership support. Notably, it is observed from the matrix that SRL in senior secondary education is gradually gaining a developmental perspective, especially considering issues of examinations, identity, and preparedness for transition into adulthood. The overall matrix of literature serves as a basis for analyzing theoretical and methodological issues associated with SRL research. The study-selection process is summarized in Figure 1.

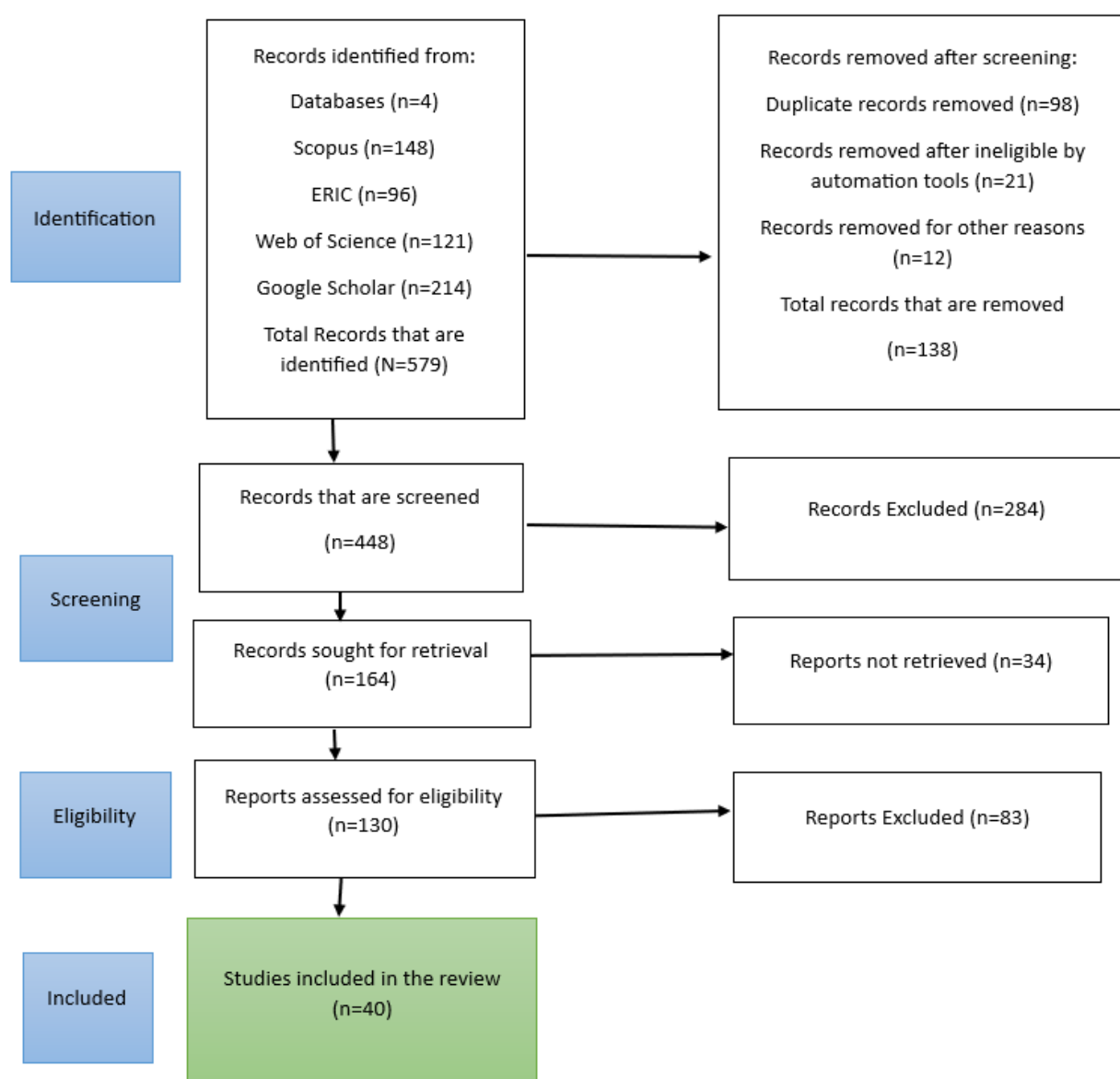


Figure 1. PRISMA Model.

The literature matrix consists of all 40 articles included after applying the inclusion criteria to the articles selected for full-text analysis. In other words, the literature matrix corresponds to the exact figure indicated in the PRISMA flow diagram of articles that serves as the evidence base for the current review.

2.3. Inclusion and exclusion criteria

Using the inclusion and exclusion criteria, 40 articles were selected because these articles were highly relevant to self-regulated learning (SRL) in senior secondary learning contexts and they offered relevant theoretical, empirical, or methodological contributions concerning SRL in senior secondary contexts. The selected studies were published from 2015-2025 and appeared in peer-reviewed, English-language journals, thus meeting the requirement of both being recent and having academic credibility. The authors singled out the following matters related to those of SRL which includes metacognition, motivation, self-efficacy, emotional regulation, classroom engagement, digital learning, and learning autonomy, when the adolescents are around 15–18 years in age. Moreover, the articles revealed multiple methodological designs such as quantitative, qualitative, mixed methods, experimental, and phenomenological designs, enhancing the interpretive synthesis of the concept of SRL in the context of senior secondary schools.

2.3.1 Inclusion Criteria

The review was contextualized within senior secondary education. Studies on classroom scaffolding, culturally responsive pedagogy, integrated use of ICTs, the use of AI in education, flipped classroom, assessment in teaching and learning, and emotional resilience are included because they are directly related to the understanding of SRL development in late-adolescent students. Articles directly related to self-regulated learning, especially among the senior secondary students, were chosen significantly for this study.

2.3.2 Exclusion criteria

Studies were excluded, however, if their participants were primary school children, university students, adult learners, workplace learning or clinical contexts as they are educationally and developmentally different from senior secondary students. Editorials, dissertations, conference abstracts, opinion papers and non-peer-reviewed works are not included to ensure methodological rigor and scholarly quality. Articles not written in English, are not sufficiently methodologically detailed, or lack reports dealing with the SRL related constructs, were also excluded from consideration. Following duplicate removal, title and abstract screening and full-text evaluation, a final literature matrix and synthetic analysis included 40 studies that were most highly conceptualized, outlined methodologically and supported the research's objectives.

2.4. Summary of Study Selection

Search strategies and selection criteria were developed to guarantee that the review would stay focused on self-regulated learning in senior secondary educational settings. Database searches were conducted in Scopus, ERIC, Web of Science, and Google Scholar from January to February 2026. The initial literature searches resulted in 579 entries altogether. After eliminating duplicate articles and performing the title and abstract screening, 196 papers were eligible for further full-text evaluation.

Screening included predetermined criteria for inclusion and exclusion. Articles were selected based on self-regulated learning, metacognition, motivation, learning engagement, technology-supported learning, or contextual factors associated with adolescence or secondary school learners. Research focusing solely on university students, adult learners, work-based learning, or clinical settings was excluded from the final review. In appropriate cases, a small number of studies conducted within a higher education context were also reviewed for comparative purposes without influencing findings concerning senior secondary learners. Editorials, conference abstracts without complete datasets, and research papers with inadequate descriptions of methodologies were also excluded.

Based on the full-text assessment, 94 studies proved to be relevant to the wider review domain. Nevertheless, only 40 studies that showed the strongest alignment with senior secondary schooling, research method, and theory were chosen for further analysis and included in the final literature matrix. Consistency checks



were conducted to verify that all the articles contained within the literature matrix are the same as those that met the PRISMA selection criteria.

2.5. Appraisal of the Quality

This review follows a narrative approach, but the studies included in this review were evaluated with regard to conceptual relevance, clarity of method, contextual appropriateness, and theoretical and practical contribution to SRL theory. Greater emphasis was placed on studies that clearly had a solid theoretical basis, a well-defined methodology and relevance to the learning context of adolescents and/or senior secondary students. The selected studies were analyzed using the following themes: the selected studies: The major SRL theoretical models Motivation and Metacognition Factors. The ability to consider context and technological factors. Considering context and technological factors. The methodological changes and developments in SRL research. The educational and policy implications of these findings are discussed. The development in analytical interpretation is informally supported by the frameworks of Zimmerman, Winne and Hadwin to secure a coherent developmental and theoretical structure throughout the review.

2.6. Summary

This literature on methodology shows that SRL cannot be assessed using one methodology alone. SRL in adolescents is multidimensional, situation-specific, and developmental, which means that methodologies must be used to capture the cognitive, motivational, emotional, and behavioral aspects of SRL within different contexts and periods. These methodological advances provide a strong foundation for future research.

3. Theoretical Foundations of Self-Regulated Learning

The principal components and relationships within self-regulated learning are illustrated in Figure 2.

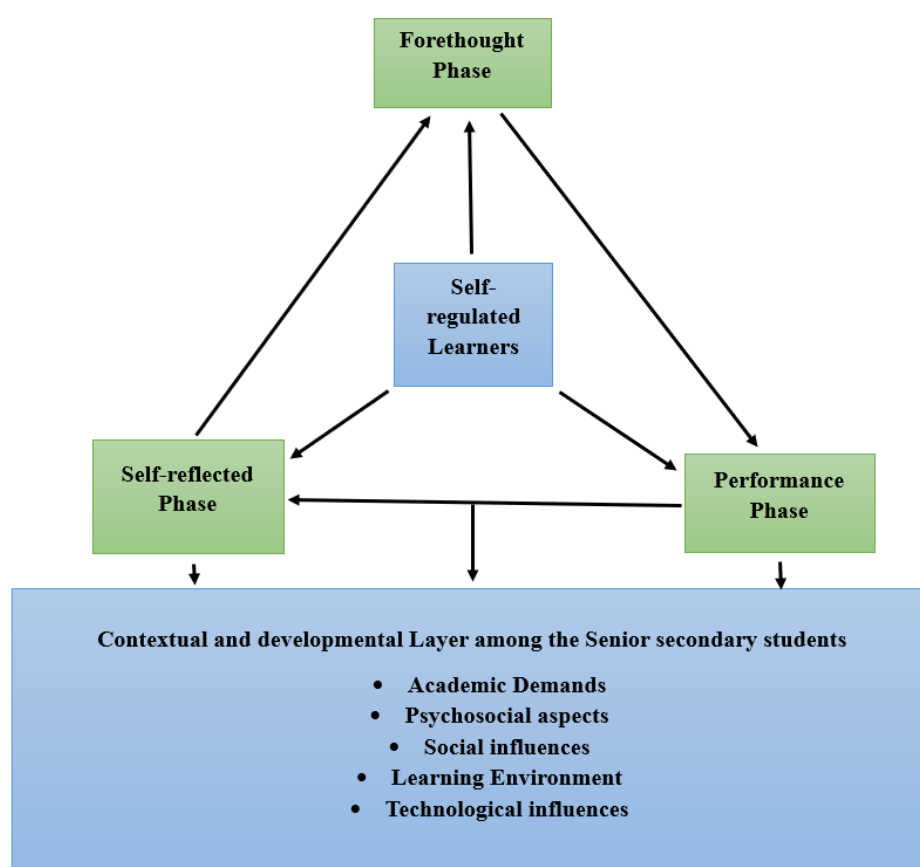


Figure 2. Self-Regulated Learning Model.

3.1 Overview of SRL Theories

The Self-Regulated Learning theory is one of the most influential theoretical frameworks within the field of educational psychology. It explains how learners regulate their learning process cognitively, emotionally, motivationally, and behaviorally during their learning activities. This theory is particularly relevant to senior secondary education because of students' developmental changes during late adolescence, examination-oriented learning environments, and learners' increasing responsibility for independent learning in senior secondary education. SRL theory focuses on the capacity of students to establish goals, monitor understanding, regulate learning strategies, control emotions, and reflect on outcomes. Such processes are especially important in senior secondary education where learners need to think independently and demonstrate persistence in their learning process.

Several researchers have established the relationship between SRL and the metacognitive, motivational, self-efficacy levels, and classroom environment of adolescent learners. These studies indicate that context and gender are the major variables that affect SRL. Similarly, Kesuma *et al.* (2021) discovered that there are differences in SRL skills among the high school SLLU students. This suggests that the skills required for SRL are not uniformly developed during adolescence.

Moreover, other SRL theories have been able to recognize the significance of agency in learning processes. There is a positive correlation between students' usage of goal behaviour and their interests in Biology classes, which can serve as an illustration of the role played by the process of motivation regulation in helping students persist in learning biology and maintaining their interest in it. The connection between SRL and higher-level cognition is reflected in the findings by Ghimby (2023), in which there is a positive association between SRL and critical thinking and learning outcomes. These studies prove the practicality of SRL theories since they link psychological processes with learning.

More recently, there have been some elements of technology and context in the theories regarding SRL. According to Abraham *et al.* (2023), Google Classroom improved the process of teaching and learning Chemistry in a senior secondary classroom since it increased interaction and organization among the students. In addition to this, according to Akinoso (2023), incorporating ICT into Math education had a positive influence on the motivation and involvement of learners in math education. In view of these results, it can be said that a digital context should be considered important when discussing SRL theories in the present-day scenario, considering that adolescents of this generation are regulating their own learning through the internet and other related technologies.

Moreover, within SRL theory, learning regulation depends on the social interactions and evaluations that occur in the process of learning. Assessment and peer review tasks improved the self-regulation skills of students, increasing the level of reflection and responsibility, according to Orluwene and Ekim (2020). Another important point raised by Arnold (2022) relates to the link between assessment and student involvement, thereby engaging learners in participation in classroom learning activities. It turned out that SRL is socially mediated and supported with the help of pedagogical practices that included elements of reflection, feedback, and learner autonomy.

3.2 Foundation of Self-Regulated Learning Models.

Conceptual models of SRL provide a systematic understanding of how students regulate their academic actions during the process of learning. These models are particularly useful for examining adolescent SRL, especially their regulation of thoughts, emotions and motivation in relation to examinations. In the area of secondary education, the typical models utilized are usually the cyclical models, the metacognitive models, and the motivational models, which help explain differences between learners.

One approach focuses on the circular regulation process, such as planning, monitoring, performance control and reflection. Kesuma *et al.* (2021) conducted a study showing that the processes of behavior monitoring and reflecting were difficult for senior high school students to conduct during the learning process. The finding implies that although teenagers may know the significance of regulation approaches, they are not able to apply them systematically in the academic process. In a similar way, Ambaryani and Putranta (2022) revealed outstanding effects of SRL problem solving on students' metacognition skills.



Table 2. Comparative Overview of Major Self-Regulated Learning Models and Their Relevance for Senior Secondary Students

Dimension	Zimmerman's Cyclical Phases Model	Winne & Hadwin's COPES Model	Efklides' MASRL Model
Theoretical foundation	Social Cognitive Theory; learning as a cyclical, goal-driven process	Information-processing and metacognitive theory; learning as recursive task interaction	Metacognitive and affective regulation theory; learning as cognition–emotion interaction
Core structure	Three recursive phases: Forethought, Performance, Self-reflection	Four phases with a structure provided by COPES architecture (Conditions, Operations, Products, Evaluations, Standards)	Two-level structure: Person level (traits) - Task x Person level (situational experiences)
Primary focus	Set goal, strategic plan, self-monitor, self-evaluate	Task interpretation, strategy selection, internal feedback loops, monitor accuracy	Cognitive, motivational, and affective integration in regulation
Treatment of motivation and affect	Primary consideration of motivation is self-efficacy and outcome expectations	Primary consideration of motivation is implicit, secondary to cognitive monitoring and task definition	Motivation is central, and emotions have a modulating, energizing influence on regulation
Strengths for senior secondary learners	Clear structure of instructions, strong empirical support with adolescents, easily scaffoldable with teachers	Fine-grained explanations of task engagement behavior, explain strategy adaptation for complex and digital tasks	Developmentally sensitive, explains disruptions of emotions, efforts, and persistence during adolescence
Empirical support (secondary level)	Strong support for high school studies (e.g., goal orientation, modeling, planning, self-evaluation)	Aligned with support for trace data and computer-based learning (e.g., nStudy, gStudy)	Linking to research on affective experiences, persistence, seeking help, and strategies
Key limitations	Limited attention to emotional regulation and social/task complexity	High because of cognitive and theoretical complexity; limited pedagogical accessibility	High because of cognitive and theoretical complexity; limited pedagogical accessibility
Pedagogical applicability	High – well-suited for classroom instruction and teacher-directed SRL interventions	High – well-suited for classroom instruction and teacher-directed SRL interventions	Moderate – requires teacher expertise to address affective regulation explicitly
Relevance for senior secondary education	Most effective for teaching SRL skills explicitly and supporting academic autonomy	Best for understanding how adolescents regulate learning during complex tasks	Most suitable for explaining the role of affect in the variability of SRL performance in adolescents

Another important dimension of the conceptual models of SRL is motivational regulation. [Zhang *et al.* \(2023\)](#) explored the association between intrinsic and extrinsic motivation among senior high school students in China and found that there are reciprocal relationships between motivation and cognition over the course of the study. This research proved that the process of motivation and behavior determination is a dynamic one rather than two different processes. In line with this idea, applied the goal-setting strategy to improve academic interest in biology.

Technology-mediated conceptualizations of SRL have recently become increasingly relevant to senior secondary education. In the online education environment, for example, [Nieva and Prudente \(2022\)](#) found that online SRL was a strong predictor of students' academic achievement and well-being during senior high school education. Furthermore, [Ni and Cheung \(2023\)](#) revealed that secondary students are motivated to learn English using intelligent tutoring systems due to such qualities as autonomy, feedback, and adaptation. The findings of the research



demonstrate that digital technologies are now important means of regulating SRL in addition to the development of modern SRL theories. The teachers' self-regulation has a positive effect on the SRL of their students, which clarifies the essential role of teachers in the context of the SRL behaviours in a secondary classroom (Sáez-Delgado *et al.*, 2022).

Contextual and classroom-level factors also influence conceptualizations of SRL. As pointed out by Anyichie *et al.* (2023), culturally responsive pedagogy helped improve engagement by fostering the development of learners' identities, involvement in the learning process, and increasing self-confidence. Oladejo *et al.* (2022) revealed that application of the culturo-techno-contextual approach in which technology is used alongside cultural factors promoted deep learning of chemistry in African students. Therefore, it can be concluded that SRL theories prove to be highly effective when accounting for cultural responsiveness.

Assessment-oriented conceptualizations also emphasize feedback and collaborative learning. According to the results by Orluwene and Ekim (2020), the use of peer and self-assessment helped develop learners' reflection and sense of responsibility. Furthermore, the study conducted by Haelermans (2022) revealed that grouping according to learning strategies can facilitate better academic outcomes and engagement. All these empirical studies indicate that collaborative learning regulation, peer interaction, and classroom scaffolding become more intertwined in the framework of the SRL model employed in secondary education.

3.2.1 Zimmerman's Cyclical Phases Model

Zimmerman's model conceptualizes SRL that can be associated with the phases of the L2 writing process which are cyclical in nature. The model presents SRL as a continuous cycle (forethought, performance, self-reflection). The forethought stage includes the development of motivational beliefs, goal setting, and strategy formulation. The performance phase includes strategy implementation, focus maintenance and self-monitoring, and self-reflection whereas self-reflection consists of self-evaluation and response adjustments according to outcomes.

The cyclic perspective is particularly relevant for senior secondary school students who operate in environments in which they must organize their learning plans and prepare for exams with limited supervision. Evidence indicates that the "forethought" phase of academic involvement is seen as being significant in academic involvement, evidenced by the findings when they found out that the strategy of goal setting positively affected students' interest in biology. Moreover, Zhang *et al.* (2023) found a synergistic relation between motivation and cognitive engagement. In this regard, Zhang *et al.* (2023) provided evidence of lopsided interaction between motivation and cognitive engagement and further stated that the interaction is mutually reinforcing in nature and takes place over time, hence signifying cyclicity in the SRL process.

The cultural context is another strong predictor of performance during the phase. According to Nieva and Prudente (2022), academic performance and well-being of senior high school students are significant predictors of online SRL. This outcome shows that the individuals who have control over the skill set of attention monitoring, digital distraction management, and motivation performed significantly well in the online setting. Additionally, Abraham *et al.* (2023) reported that Google Classroom supported chemistry teaching and learning by improving learner interaction and organization.

3.2.2. Winne and Hadwin's Four-Phase COPES Model

According to the Winne and Hadwin COPES model, SRL refers to a recursive process that involves conditions, operations, products, evaluations, and standards. In this COPES model, the activities in learning are focused on cognitive monitoring and the flow of information within learning activities. The COPES model is especially useful in senior secondary as the learners will encounter complex learning activities at the cognitive level and need to be engaged in strategic regulation of learning activities.

The key aspect in the COPES model is metacognitive awareness. Further studies showed that students demonstrate stronger metacognitive performance who reflect and monitor their learning processes actively. These results are supported by the findings of Kesuma *et al.* (2021) who observed variations among adolescent learners regarding planning and self-monitoring activities in SRL.



The COPES model could also be adopted for use in digital learning and collaborative learning settings. According to [Haelermans \(2022\)](#), [Haelermans \(2022\)](#) concluded that adaptation conditions to learning positively influence the learning process non-cognitively, in that regard results showed better learning strategies among participants of the target group. [Egara and Mosimege \(2024\)](#) confirmed that there is an increase in the level of achievement of mathematics and the level of interest in learning among learners of the research in relation to flipped classroom learning, which suggests that the learning process involves continuous active monitoring and participation in learning activities.

Technology-mediated instruction is also compatible with the COPES model because both emphasize the continuous feedback and reflection processing of students' performance. [Ni and Cheung \(2023\)](#) argued that secondary students had a positive attitude to the use of intelligent tutoring systems to assist in cognitive regulation, indicating increased use of technologies for cognitive regulation. Thus, the use of the COPES model will help evaluate how students process information and improve students' performance and learning strategies.

3.2.3. Efklides' Metacognitive and Affective Model (MASRL)

In the Metacognitive and Affective Model of Self-Regulated Learning (MASRL), Efklides concentrated on the association between different components of SRL such as metacognitive, affective, cognitive, and motivational components. The main idea behind the MASL is the shift from the cognitive approach to learning regulation and the increased emphasis on the role of emotions and motivation. It is quite relevant about senior secondary education because, in this case, the adolescents go through different stressors associated with their transitions, peer comparison, emotional expiry, and many more.

As reported by [Dewaele and Li \(2022\)](#), the higher levels of language enjoyment are positively associated on academic achievement whereas the increased levels of language anxiety are negatively associated. This finding supports the findings of the MASRL perspective according to which the individuals' emotional experiences plays a great role in the regulation of learning process.

In addition to self-regulated learning behaviors, motivational experiences also are also highly significant within the MASRL approach. According to previous research, intrinsic motivation has been shown to be beneficial for math success ([Abah et al., 2022](#)), while motivation and engagement relationships are pointed out by [Zhang et al. \(2023\)](#). From these conclusions, emotional and motivational elements can be regarded as important for effective SRL processes during the teenage years.

One of the major advantages of using the MASRL approach includes gaining information about social and contextual influences on learning activities. According to the findings presented by [Anyichie et al. \(2023\)](#), creating a psychologically safe classroom climate with a culturally responsive pedagogy promotes engagement in all learners trying to manage and regulate their emotions. Therefore, using the MASRL approach helps to observe how cognition, emotions, motivational beliefs and contextual experiences influence SRL behaviors in adolescents from a developmental perspective.

3.3 Integration of Theories in Adolescent Learning Contexts

Because no single SRL model fully captures the characteristics of developing adolescents, theoretical integration is necessary. It should be acknowledged that, in relation to senior secondary students, the control processes related to cognition, motivation, and emotion are developed; social regulations, especially digital, should also be considered. Hence, many recent studies exploring SRL in modern students are grounded on an integration of cognitive, motivational, affective and contextual perspectives on explaining learner behavior.

The need for theoretical synthesis is especially apparent in technology-rich learning environments. As shown by [Akinoso \(2023\)](#), the impact of ICT on motivation and engagement in math learning is generally positive. [Tashtoush et al. \(2023\)](#) reported that ICT-based education stimulated higher academic enthusiasm among math learners. Furthermore, [Banda and Nzabahimana \(2023\)](#) found that simulation learning is one of the methods of increasing motivation and achievement in physics learning. Based on the above-mentioned findings, it becomes clear that SRL models should not only consider technology but motivation as well.



Socio-contextual factors must also be considered. As [Wey-Amaewhule](#) and [Dike \(2023\)](#) established in their study, the management styles employed by institutions are instrumental in affecting the quality of instruction provided. [Bada et al. \(2024\)](#) pointed out the importance of instructional leadership in secondary institutions. This means that there is an institution-level context, within which classrooms are created to facilitate or inhibit SRL processes.

3.4 Towards a Developmentally Sensitivity Model of SRL for Late Adolescents

Developmentally appropriate SRL models for senior secondary education should take into consideration the psychological, emotional, and academic growth that occur during the later stages of adolescence. Factors such as examination stress, increased independence, identity development, peer influence, and career/university decisions occur for adolescents at this stage. It is evident that developmental factors significantly affect the ability to learn the control of cognitive, motivational, and emotional aspects.

Regarding high school students' SRL, [Andrianie et al. \(2025\)](#), high school students exhibited different profiles of SRL competencies showing that regulation skills continue to develop during adolescence. According to [Onukwuli et al. \(2023\)](#), also found that internet addiction adversely affects the health of children and adolescents showing that more emphasis should be placed on self-regulation for digital learning within the modern education system. Similarly, [Asanga et al. \(2023\)](#) found out that excessive use of social media negatively impacts the academic performance of Senior secondary school students.

Emotional resilience, digital regulation, motivational perseverance, and contextual support, as such, must also be incorporated into these SRL models that are sensitive to emotional development. The use of artificial intelligence (AI) technologies is affecting the learning experiences of adolescents in ways that must be or must have been accounted for by these frameworks. According to [Gouseti et al. \(2025\)](#), there is a requirement for educational regulation due to the ethical issues related to using AI to teach K-12 learners.

3.5. Summary

SRL theoretical approaches indicate that learning regulation is a multifaceted and developmental process involving such dimensions as cognitive, motivational, emotional, behavioral, and interactive aspects of the context. Modeling approaches presented by ZIMMERMAN, WINNE & HADWIN and EFKLIDES provide various aspects of knowledge about the regulation of learning by adolescents. In summary, the reviewed articles indicate that metacognitive knowledge, emotional resilience, motivation, digital engagement, social support at class and contextual aspects at institutions are strongly correlated with SRL.

Moreover, the literature also indicates that higher autonomy, self-regulation, emotional self-control, and adaptation in learning are features of the senior secondary school level of development. With increased technological usage and implementation of learning technologies with the help of artificial intelligence, collaborative learning classrooms have become more common among adolescents. From an idealistic point of view, any theory about SRL should not remain focused on understanding only the SRL cognitions but extend beyond considering the whole learner (including his or her characteristics, technological settings, emotions, and education).

4. Empirical Evidence of SRL at the Senior Secondary Level

4.1 Factors Influencing SRL

Motivation is a learned variable that is known to be a significant predictor of SRL. Reciprocal associations are established in the case of Secondary mathematics learners who showed signs of being motivated and cognitively engaged by [Zhang et al. \(2023\)](#).

Self-efficacy plays a critical role too. As indicated by [Wu et al. \(2023\)](#), there are significant associations concerning self-regulatory confidence and the performance of the learners in Chemistry. In addition, [Ambaryani](#) and [Putranta \(2022\)](#) indicated the positive influence of problem-solving activities and SRL on the development of metacognition skills.



Goal orientation can also lead to effective regulation behavior. It is reported that goal-setting strategies are found to be positively related to interest in Biology for Senior Secondary learners.

Finally, adolescent emotion regulation must be considered. Dewaele and Li (2022) reported that foreign-language enjoyment was positively associated with achievement, whereas anxiety showed a negative association. Self-feedback processes during learning are linked to SFL skills, and that structured SSO programmes affect students' self-feedback practices, which in turn affects their reflective engagement in learning (Torres *et al.*, 2024).

4.2 Classroom Level Factors

Teacher scaffolding has a substantial impact on SRL development. According to Anyichie *et al.* (2023), culturally responsive teaching is associated with cultural engagement and improved self-regulation.

Furthermore, assessment is another factor influencing SRL. Language and reflective learning are encouraged by assessment for learning in accordance with Arnold (2022).

Learning-related communication can be strengthened in a peer-assisted learning environment. In such cases, motivation and peer-assisted learning helped improve student interest, thus leading to improved mathematics learning, as found out by Arthur *et al.* (2022).

Besides, school leadership and positive school climate affect opportunities to regulate. Instructional leadership can also contribute substantially to increased teaching efficacy in secondary schools, as argued by Bada *et al.* (2024).

4.3. Technology-Mediated Factors

Technology has a substantial influence on adolescents' SRL experiences. According to Ni and Cheung (2023), AI Tutoring Systems Facilitating Language Learning Regulation with Adaptive Feedback helps language learners regulate their learning process while receiving language inputs. According to Abraham *et al.* (2023) the application of "Google Classroom" helped increase the engagement of chemistry learning for Nigerian senior secondary school students. According to Egara and Mosimege (2024), the application of flipped classrooms has been found to increase the math scores of students and their engagement towards studying through enhancing their involvement in self-directed learning. According to Banda and Nzabahimana (2023), interactive PhET simulations had an extremely positive effect on the achievement of physics students. It is not without risks, however, that technology poses. The addiction of adolescents towards the internet has increased since the onset of the COVID-19 pandemic according to the principles stated by Onukwuli *et al.* (2023). There are also some mixed impacts from social media. According to Asanga *et al.* (2023), evidence is mixed regarding the significant relationship between the usage of social media and the performance of senior secondary school students.

4.3. Summary

From empirical literature, it can be established that SRL in senior secondary school learners is achieved through an interaction between various factors, including the characteristics of the learner, classroom interventions, and technology-enabled contexts. Such factors as motivation, self-efficacy, emotional control, teacher scaffolding, and online learning systems affect learning regulation.

5. Methodological Trends in SRL Research

Research on SRL has utilized a wide range of qualitative, quantitative, and mixed-method designs, representing the complexity and multidimensionality of SRL processes. The use of computer simulation to develop concepts, motivate, and foster SRL among students is explained by AlArabi *et al.* (2022), where computer simulation is used in science education to create an interactive environment for inquiry-based learning. Quantitative methods are dominant in the field and allow for standardized measurement of SRL components, such as motivation, metacognition, strategy use, and goal orientation. One of the most used tools is the Motivated Strategies for Learning Questionnaire. In a multilingual environment, the link between the two in terms of motivational-metacognitive processes in SRL between language and self is highlighted. The MSLQ consists of 15 scales, six assessing motivation and nine assessing learning strategies, for a total of 81 items. Each item is articulated as a statement delineating a



self-regulatory behavior within an academic context and is rated on a seven-point scale ranging from behaviors that are “not representative” to “very representative” of the respondent’s activities. According to Angwaomadoko (2023), it can be argued that the indirect support for SRL provided by good leadership styles includes higher teacher motivation, teacher effectiveness during instruction, and improved classroom learning environment in secondary schools. To adapt this measure to other languages and educational settings, some have changed the MSLQ to increase its cultural validity and comparability across settings.

As stated by Rahman *et al.* (2024), the project-based learning approach is an important pedagogical strategy for developing a collaborative, self-directed, reflective, and problem-solving model of SRL. The methodology used in SRL research involving adolescents is highly varied because of the multi-faceted nature of SRL processes. Quantitative methods continue to be the most common, especially the use of standardized questionnaires such as the MSLQ. As explained by Apeadido and Amedeker (2023), the application of advanced organizers during cooperative learning classrooms positively influences students' academic achievements through stimulating strategic thinking, encouraging students' involvement, and facilitating self-regulation. However, an increasing trend has been noted in which researchers apply qualitative and mixed methods to address some aspects that can only be captured using these methods. For example, think aloud procedures, semi-structured interviews, learning diaries, classroom observations, and computer trace analysis are becoming common in investigating how learners regulate their cognitive, motivational, and behavioral processes, particularly in technology-enhanced environments. According to Olasunkanmi (2024), the teachers consider social media as a helpful tool for communicating in classrooms and motivating their students to become self-directed learners. The trend does not reflect a shift from one methodology to another but a movement towards process-focused and multi-method SRL investigations. The principal variable categories, measurement approaches, and commonly used instruments are summarized in Table 3.

Table 3. Variables Chart: Methodological Trends in SRL Research

Variable Category	Specific Variables	Measurement Approach	Common Instruments / Methods
Motivational Variables	Motivation, Self-efficacy, Task value, Intrinsic/extrinsic goal orientation	Quantitative self-report scales	MSLQ Motivation Scales (e.g., self-efficacy, task value), adapted MSLQ versions
Cognitive Variables	Cognitive strategy use, Rehearsal, Elaboration, Organization	Surveys, think-aloud, learning diaries	MSLQ cognitive strategy scales; think-aloud protocols
Metacognitive Variables	Metacognitive awareness, Monitoring, Self-evaluation, Planning	Mixed: surveys + qualitative tracing	MSLQ metacognitive regulation scales; interviews; think-aloud studies
Behavioral Variables	Time management, Effort regulation, Help-seeking	Surveys, observations	MSLQ behavioral regulation items; classroom observations
Affective Variables	Emotional regulation, Academic emotions	Interviews, diaries, some survey items	Semi-structured interviews; reflective journals
Contextual Variables	Learning environment, Teacher support, Peer influence	Qualitative or mixed methods	Classroom observations; teacher/student interviews
Process-level SRL Variables	Strategy sequencing, Real-time regulation, Decision-making	Process tracing, think-aloud, logs	Think-aloud protocols; log data; diary method
Outcome Variables	Academic performance, SRL proficiency	Mixed: exams, SRL scale scores	Achievement data; SRL scale scores; task performance records

6. Synthesis and Educational Implications

6.1 Summary of Major Findings

The reviewed literature indicates that SRL among secondary school learners in secondary education cannot be understood solely in cognitive terms. SRL appears to be a dynamic process that evolves through interactions



among such as motivation, emotions, metacognition, context support, and digital interaction. In the context of science in school, using the multimodal literacy method, students will be able to read, evaluate and then integrate two or more modes of scientific representations to learn on their own, and this can help in developing self-regulated learning skills (SRL) (Unsworth *et al.*, 2022). The 'Zimmerman Model' remains highly relevant in relation to instruction design since it provides a step-by-step process of development. The 'Winne & Hadwin Model' is an especially valuable explanation of digital task engagement and process monitoring while Efklides' theory brings important knowledge about emotional control in adolescence. Moreover, there is also evidence that late adolescence is a time that requires special educational support.

6.2 Implications for Teaching and Curriculum Design

Explicit teaching of SRL should be embedded in senior secondary education curricula. It is recommended that in regular classes, teachers apply goal setting, self-monitoring, metacognitive discussions and reflective journaling. Some scholars have been investigating the issue of whether a personalized learning approach, which focuses on adapting the speed and manner of instruction to meet the needs of an individual learner (van Alten *et al.*, 2021). As far as the assessment is concerned, there must be some shift from test-centeredness towards reflective, peer and self-assessment. The processes of assessment as learning are helpful for agency and reflection according to Arnold (2022). Scaffolding for the teachers remains quite important. Anyichie *et al.* (2023) pointed out the importance of culturally responsive pedagogy that will lead learners to regulated learning. Support for learners in computer-mediated contexts requires scaffolding that is adaptive and reflective. As shown by Ni and Cheung (2023), application of tutoring systems based on AI-supported learning is helpful in improving regulation skills where feedback is clear and encouraging.

6.3 Policy and Practice Recommendations

Educational stakeholders should recognize self-regulated learning as a key educational competency and include it in the senior secondary curriculum and assessment policies. Teacher education and professional development programmers should train teachers to promote metacognitive skills, motivation, and self-regulated learning among students. Schools should create learner-centered environments that encourage students to become independent learners while supporting their emotional well-being and culturally responsive learning. In addition, schools should emphasize the appropriate use of technology and artificial intelligence to enhance self-regulated learning and provide effective teacher guidance. These policy changes can help students develop lifelong learning skills and improve their overall learning outcomes.

6.4. Limitations of the Review

There are several limitations that need to be addressed. Firstly, while the inclusion criteria are stringent, some studies from higher education settings were included to allow methodology and context comparisons. Secondly, the current study is limited to research papers in English in the four databases considered. Lastly, since this is a narrative review, qualitative analysis of the data is given preference to quantitative synthesis.

7. Future Directions for Research

The future directions of studies on SRL will be defined by developmental concerns specific to senior secondary education. Firstly, there is a clear demand for longitudinal studies aimed at tracking the dynamics of SRL development across late adolescence, especially at the transition stages from senior secondary to higher education and further vocational training.

Another direction that needs to be addressed is related to developing new assessment methods of SRL that could be applied in a classroom setting and provide insight into SRL processes as they unfold in an authentic school environment. It is important that the existing body of research focuses mainly on measuring SRL with generalized questionnaires, and there are very few studies devoted to SRL strategies used by learners during classroom activities, tests, collaboration, or computer-assisted instruction.



Finally, future researchers will have to explore comparative dimensions of SRL across cultural contexts, curriculum organization, examination regimes, or digital platforms in senior secondary schooling. In terms of methodology, future research should continue to include process-based methodologies like think-alouds, learning journals, observations, and digital trace analysis. This mixed methodological approach is particularly useful as it enables researchers to explore the interaction among motivational beliefs, emotions, context, and regulation. Lastly, future research should give more consideration to emotional regulation, academic pressure, identity development, and social comparisons in their adolescent phases.

8. Conclusion

Self-regulated learning (SRL) is a multidimensional construct that involves the regulation of cognitive, motivational, affective and behavioural processes during learning. Self-regulated learning is particularly relevant for senior secondary school students because of increased academic responsibility, examination pressure, emotional instability, social comparisons, and other uncertainties accompanying late adolescence. In this review, scholarly literature on the topic of self-regulated learning published in the last ten years is analyzed focusing on the issue of senior secondary education. It has been found that each of the models mentioned, namely, the Cyclical Phases Model by Zimmerman, the COPES model by Winne & Hadwin, and the MASRL model by Efklides, describes unique aspects of adolescent self-regulation. The review has also pointed out some key factors related to the learner characteristics, classroom environment, and technology-mediated learning context for SRL growth. Motivation, self-efficacy, metacognition, teacher scaffolding, feedback mechanisms, and digital learning settings are found to exert considerable impact on students' regulation behaviors. Methodologically, the existing literature clearly shows more attention paid to a process-focused and mixed methods framework suitable for exploring SRL in its dynamic and context-bound nature. An important contribution of the current review is the development-focused approach in examining the issues associated with SRL among older students. Considering the specificities of self-regulation in the context of adolescent development, this review offers an overview of SRL that can be used as a basis for further research, curriculum development, assessment, teacher training, and technology-based learning environments.

References

- Abah, J.A., Ogugua, K.K., Okoh, V.L. (2022). Impact of Intrinsic Motivation on Junior Secondary School Students' Academic Performance in Mathematics despite Family Background in Ohimini Local Government Area of Benue State, Nigeria. *VillageMath Educational Review (VER)*, 3(1), 72–96. <https://dx.doi.org/10.2139/ssrn.4061815>
- Abraham, A.I., Victor, O.O., Endurance, I. (2023). The Effect of Google Classroom as a Tool in Chemistry Teaching and Learning in Senior Secondary Schools in Ankpa LGA, Kogi State, Nigeria. *International Journal of Research in Education and Sustainable Development*, 3(3), 8–14.
- Ahmed, E.A., Karim, M.R., Banerjee, M., Sen, S. (2022). Comparison of Scholastic Attainment in English and Math amongst Other Studies at the Higher Secondary Level: A Study Using Mahalanobis Distance. *Educational Administration: Theory and Practice*, 28(4), 1–13.
- Akinoso, S.O. (2023). Motivation and ICT in Secondary School Mathematics Using Unified Theory of Acceptance and Use of Technology Model. *Indonesian Journal of Educational Research and Technology*, 3(1), 79–90. <https://doi.org/10.17509/ijert.v3i1.47183>
- AlArabi, K., Tairab, H., Wardat, Y., Belbase, S., Alabidi, S. (2022). Enhancing the Learning of Newton's Second Law of Motion Using Computer Simulations. *Journal of Baltic Science Education*, 21(6), 946–966. <https://doi.org/10.33225/jbse/22.21.946>
- Ambaryani, S.E., Putranta, H. (2022). Improving Learners' Metacognitive Skills with Self-Regulated Learning Based Problem-Solving. *International Journal of Instruction*, 15(2), 139–154. <https://doi.org/10.29333/iji.2022.1528a>
- Andrianie, S., Wulandari, A., Krismona, E.B., Putri, D.R., Aren, M. (2025). An Analysis of Self-Regulated Learning among High School Students. *Jurnal Bikotetik (Bimbingan dan Konseling: Teori dan Praktik)*, 9(2), 231–241.
- Angwaomaodoko, E.A. (2023). The Effect of Leadership Styles on Teacher Job Satisfaction in Nigerian Secondary Schools. *International Research in Education*, 11(2), 15–28. <https://doi.org/10.5296/ire.v11i2.21012>



- Anyichie, A.C., Butler, D.L., Perry, N.E., Nashon, S.M. (2023). Examining Classroom Contexts in Support of Culturally Diverse Learners' Engagement: An Integration of Self-Regulated Learning and Culturally Responsive Pedagogical Practices. *Frontline Learning Research*, 11(1), 1–39. <https://doi.org/10.14786/flr.v11i1.1115>
- Apeadido, S., Amedeker, M.K. (2023). Enhancing Students' Academic Performance through Advance Organizers in a Cooperative Learning Classroom at a Senior High School in the Ashanti Region, Ghana. *East African Journal of Education and Social Sciences*, 4(6), 48–57. <https://doi.org/10.46606/eajess2023v04i06.0333>
- Arnold, J. (2022). Prioritising Students in Assessment for Learning: A Scoping Review of Research on Students' Classroom Experience. *Review of Education*, 10(3), e3366. <https://doi.org/10.1002/rev3.3366>
- Arthur, Y.D., Dogbe, C.S.K., Asiedu-Addo, S.K. (2022). Enhancing Performance in Mathematics Through Motivation, Peer Assisted Learning, and Teaching Quality: The Mediating Role of Student Interest. *Eurasia Journal of Mathematics, Science and Technology Education*, 18(2), e2072. <https://doi.org/10.29333/ejmste/11509>
- Asanga, M.P., Essiet, U.U., Ukhurebor, K.E., Afolorunso, A., Hussaini, P. (2023). Social Media and Academic Performance: A Survey Research of Senior Secondary School Students in Uyo, Nigeria. *International Journal of Learning, Teaching and Educational Research*, 22(2), 323–337. <https://doi.org/10.26803/ijlter.22.2.18>
- Ayilimba, A., Tindan, T.N., Dorsah, P. (2024). The Myth of Theory and the Theory-Laden Nature of Scientific Knowledge: Views of Senior High School Students. *European Journal of Contemporary Education and E-Learning*, 2(3), 117–130. [https://doi.org/10.59324/ejceel.2024.2\(3\).10](https://doi.org/10.59324/ejceel.2024.2(3).10)
- Bada, H.A., Tengku Ariffin, T.F., Nordin, H.B. (2024). The Effectiveness of Teachers in Nigerian Secondary Schools: The Role of Instructional Leadership of Principals. *International Journal of Leadership in Education*, 27(1), 44–71. <https://doi.org/10.1080/13603124.2020.1811899>
- Banda, H.J., Nzabahimana, J. (2023). The Impact of Physics Education Technology (PhET) Interactive Simulation-Based Learning on Motivation and Academic Achievement among Malawian Physics Students. *Journal of Science Education and Technology*, 32(1), 127–141. <https://doi.org/10.1007/s10956-022-10010-3>
- Dewaele, J.M., Li, C. (2022). Foreign Language Enjoyment and Anxiety: Associations with General and Domain-Specific English Achievement. *Chinese Journal of Applied Linguistics*, 45(1), 32–48. <https://doi.org/10.1515/CJAL-2022-0104>
- Dignath, C., Veenman, M.V. (2021). The Role of Direct Strategy Instruction and Indirect Activation of Self-Regulated Learning—Evidence from Classroom Observation Studies. *Educational Psychology Review*, 33(2), 489–533. <https://doi.org/10.1007/s10648-020-09534-0>
- Egara, F.O., Mosimege, M. (2024). Effect of Flipped Classroom Learning Approach on Mathematics Achievement and Interest Among Secondary School Students. *Education and Information Technologies*, 29(7), 8131–8150. <https://doi.org/10.1007/s10639-023-12145-1>
- Ghimby, A.D. (2023). The Effect of Self-Regulated Learning on Critical Thinking Skills and Learning Outcomes. *SOLIDARITY Journal of Social Studies*, 3(1), 18–32. <https://doi.org/10.35719/solidarity.v3i1.82>
- Gouseti, A., James, F., Fallin, L., Burden, K. (2025). The Ethics of Using AI in K–12 Education: A Systematic Literature Review. *Technology, Pedagogy and Education*, 34(2), 161–182. <https://doi.org/10.1080/1475939X.2024.2428601>
- Haelermans, C. (2022). The Effects of Group Differentiation by Students' Learning Strategies. *Instructional Science*, 50(2), 223–250. <https://doi.org/10.1007/s11251-021-09575-0>
- Hertel, S., Karlen, Y. (2021). Implicit Theories of Self-Regulated Learning: Interplay with Students' Achievement Goals, Learning Strategies, and Metacognition. *British Journal of Educational Psychology*, 91(3), 972–996. <https://doi.org/10.1111/bjep.12402>
- Kesuma, A.T., Retnawati, H., Putranta, H. (2021). Analysis of Self-Regulated Learning Skills in Senior High School students: A phenomenological study. *TEM Journal*, 10(3). <https://doi.org/10.18421/TEM103-35>
- Ng, D.T.K., Wu, W., Leung, J.K.L., Chu, S.K.W. (2023). Artificial intelligence (AI) Literacy Questionnaire with Confirmatory Factor Analysis. In *Proceedings of the 2023 IEEE International Conference on Advanced Learning Technologies (ICALT)*, IEEE, Orem, UT, USA, 233–235. <https://doi.org/10.1109/ICALT58122.2023.00074>



- Ni, A., Cheung, A. (2023). Understanding Secondary Students' Continuance Intention to adopt AI-powered Intelligent Tutoring System for English Learning. *Education and Information Technologies*, 28(3), 3191–3216. <https://doi.org/10.1007/s10639-022-11305-z>
- Nieva, A., Prudente, J. (2022). Online Self-Regulated Learning, Academic Performance, and Well-Being of Senior High School Students in the NCR: A mediation analysis. *Bedan Research Journal*, 7(1), 48–62.
- Oladejo, A.I., Okebukola, P.A., Olateju, T.T., Akinola, V.O., Ebisin, A., Dansu, T.V. (2022). In search of Culturally Responsive Tools for Meaningful Learning of chemistry in Africa: We stumbled on the culturo-techno-contextual approach. *Journal of Chemical Education*, 99(8), 2919–2931. <https://doi.org/10.1021/acs.jchemed.2c00126>
- Olasunkanmi, O.A.O.O.A. (2024). Science teachers' perception of the use of Social Media in Teaching and Learning in Senior Secondary Schools in Osun State, Nigeria. *Nigerian Online Journal of Educational Sciences and Technology*, 6(1), 380–395. <https://nojest.unilag.edu.ng/article/view/2140>
- Onukwuli, V.O., Onyinye, E.N., Udigwe, I.B., Umeh, U.M., Enebe, J.T., Umerah, A.T. (2023). Internet addiction during the COVID-19 Pandemic among Adolescents in Southeast Nigeria and Implications for Adolescent Care in the Post-Pandemic Era: A cross-sectional study. *SAGE Open Medicine*, 11, 20503121231152763. <https://doi.org/10.1177/20503121231152763>
- Orluwene, G.W., Ekim, D.K. (2020). Promoting self-regulated learning through self-and Peer-Assessment Techniques among Secondary School Students. *International Journal of Arts and Commerce*, 9(4), 1–16.
- Rahman, I., Kaema, M.T., Nurhapipah, N., Nelwati, S., Sabri, A., Rahmanda, R. (2024). Systematic Literature Review: Analysis of Project-based Learning Models from Elementary to High School. *Al-Ashri: Ilmu-Ilmu Keislaman*, 9(2), 53–66. <https://ojs.stai-bls.ac.id/index.php/Al-Ashri/article/view/119>
- Sáez-Delgado, F., López-Angulo, Y., Mella-Norambuena, J., Baeza-Sepúlveda, C., Contreras-Saavedra, C., Lozano-Peña, G. (2022). Teacher Self-Regulation and its Relationship with Student Self-Regulation in Secondary Education. *Sustainability*, 14(24), 16863. <https://doi.org/10.3390/su142416863>
- Tashtoush, M.A., AlAli, R., Wardat, Y., Alshraifin, N., Toubat, H. (2023). The Impact of Information and Communication Technologies (ICT)-based Education on the Mathematics Academic Enthusiasm. *Journal of Educational and Social Research*, 13(3), 284–293. <https://doi.org/10.36941/jesr-2023-0077>
- Torres, A.C., Duarte, M., Pinto, D., Mouraz, A. (2024). Self-Regulated Learning in Secondary School: Students' Self-Feedback in a Peer Observation Programme. *Studies in Educational Evaluation*, 83, 101407. <https://doi.org/10.1016/j.stueduc.2024.101407>
- Unsworth, L., Tytler, R., Fenwick, L., Humphrey, S., Chandler, P., Herrington, M., Pham, L. (2022). Multimodal Literacy in School Science: Transdisciplinary Perspectives on Theory, Research and Pedagogy (1st ed.). Routledge. <https://doi.org/10.4324/9781003150718>
- Van Alten, D.C., Phielix, C., Janssen, J., Kester, L. (2021). Secondary Students' Online Self-Regulated Learning during Flipped Learning: A latent profile analysis. *Computers in human Behavior*, 118, 106676. <https://doi.org/10.1016/j.chb.2020.106676>
- Wey-Amaewhule, B., Dike, C. (2023). Principals' School Management Strategies for Effective Teachers' Instructional Delivery in Public Senior Secondary Schools in Rivers State. *Journal of Education in Developing Areas*, 31(2), 333–342. <https://journals.journalsplace.org/index.php/JEDA/article/view/357>
- Wu, M., Sun, D., Yang, Y., Li, M., Sun, J. (2023). Investigating Students' Performance at Self-Regulated Learning and its Effects on Learning Outcomes in Chemistry Class at the Senior Secondary School. *International Journal of Science Education*, 45(16), 1395–1418. <https://doi.org/10.1080/09500693.2023.2209693>
- Zhang, Y., Yang, X., Sun, X., Kaiser, G. (2023). The Reciprocal Relationship among Chinese Senior Secondary Students' Intrinsic and Extrinsic Motivation and Cognitive Engagement in Learning Mathematics: A three-wave longitudinal study. *ZDM–Mathematics Education*, 55(2), 399–412. <https://doi.org/10.1007/s11858-022-01465-0>

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Yes



Conflict of Interest

The authors have no conflicts of interest to declare. There is also no financial interest to report. The author certifies that the submission is original work and is not under review at any other publication.

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