A Review of Research on Self-regulated Learning Interventions for Different Types of Students

Dajia Chen

1. Hanshan Normal University, Chaozhou, Guangdong 521000

2. Sultan Idris Education University, Tanjung Malim, Perak Darul Ridzuan 35900

Abstract: This review examines self-regulated learning (SRL) interventions across education levels, highlighting four key approaches: ALAD, "N=me, " extended training, and classroom scenarios. It reveals tech tools' impact in higher education and teaching-based interventions in earlier stages. The article calls for future research on adaptability, technology, cross-cultural studies, teacher training, and policy integration in SRL.

Keywords: Self-regulated learning (SRL); Adaptive learning analysis dashboard (ALAD); "N=me" learning analysis; Educational intervention

1. Introduction

The modern world necessitates proactive learning and lifelong education, with societal value chains significantly altered by global demographic shifts, technological advancements, and capital flows since the 21st century. The educational sector has been transformed by the internet and field innovations, offering opportunities and challenges. Global entities have developed 21st-century competency frameworks to meet these demands.

Initiatives like the U.S.'s P21 and OECD's DeSeCo framework, along with the EU's "Key Competences for Lifelong Learning" and China's "Core Competencies for Chinese Students' Development, " emphasize learning to learn as a core competency, highlighting the need for students to develop self-awareness, learning method selection, and learning process assessment.

Despite recognizing self-regulated learning's importance, research on intervention effectiveness across student groups is limited. This review seeks to address this by analyzing literature on self-regulated learning interventions and their impact on student outcomes in diverse educational settings.

2. Interventions in Self-Regulated Learning

This section reviews various Self-Regulated Learning (SRL) interventions in education, including Adaptive Learning Analytics Dashboards (ALAD), N=me research, Extended SRL training programs, and classroom situation setting. It analyzes these interventions' methods and scenarios to enhance student autonomy and academic performance. The review compares their effectiveness across educational contexts and discusses limitations, offering insights for educators on optimizing interventions to fit student needs.

2.1 The Adaptive Learning Analytics Dashboard (ALAD)

The rise of online education and internet big data has led to the development of the Adaptive Learning Analytics Dashboard (ALAD), designed to offer personalized learning based on learner behavior and performance. Rooted in Winne and Hadwin's SRL model(Winne & Hadwin, 1998), ALAD facilitates goal setting and strategy regulation through analytics, supporting the development of SRL skills with real-time feedback.

Initially, ALAD collected basic data to predict outcomes but lacked personalization. Advances in adaptive learning technologies later allowed for machine learning to customize learning paths, enhancing self-paced learning and self-regulation skills. Further development provided detailed feedback and analytics, helping learners adjust strategies and improve understanding of their learning process.(Gašević et al., 2015)

ALAD offers benefits such as personalized feedback and increased motivation, but also presents challenges like technological dependency and privacy concerns. Implementing ALAD requires balancing these to support self-regulated learning effectively. Its evolution reflects a move towards systems that emphasize personalization and self-regulation, with future potential in active engagement and AI-enhanced learning outcomes.(Park, 2022)

2.2 The "N=me" Learning Analytics Research Intervention

The "N=me" learning analytics research intervention, introduced by Winne (2022), is a personalized approach where learners are both the subjects and analysts of their own learning process. Rooted in Winne's SRL theory and leveraging online data collection, "N=me" differs from traditional research by focusing on individual learning strategies rather than general patterns.

Winne proposed frameworks like SMART, COPES, and AEIOU to guide learners in understanding their cognitive operations, learning tasks, and metacognitive skills(Winne, 2017). The nStudy software system aids in collecting learning data, enabling learners to analyze their strategies and processes like scientists, identifying effective methods through experimentation(Winne et al., 2019a).

This approach supports the development of self-regulated learning abilities, allowing learners to independently manage and optimize their learning. Winne (2019) suggests that with learning analytics tools like nStudy, learners can track behaviors and outcomes, gaining insights to design personalized experiments and improve learning efficacy.

However, "N=me" faces challenges, including technological dependency, privacy concerns, the need for learner training in data analysis, and the potential for overwhelming complexity. It also risks over-surveillance and learner stress, requiring a balance between personalization and standardized education. The evolving role of educators necessitates professional development to effectively support "N=me" research.

For "N=me" to be effective, continuous improvement of learning analytics tools and training in data analysis is crucial, ensuring privacy and personalized learning are upheld. This method positions learners at the forefront of their educational journey, empowered to explore and enhance their learning through self-regulated strategies.

2.3 Extended Self-Regulated Learning (SRL) Training Programs (Explicit Strategy Instruction)

Extended Self-Regulated Learning (SRL) training programs are systematic, real-world classroom interventions designed to enhance students' self-regulation skills over an extended period. These programs are explicit strategy instructions, teaching students various cognitive, metacognitive, and resource management strategies, in contrast to implicit strategy instruction that integrates strategy use into daily activities.

SRL modules can be integrated with specific subjects or taught as standalone skills. Integration with target courses, such as Management Information Systems or industrial design, allows for direct application of SRL strategies within the subject context, improving practicality and performance. For instance, a meta-analysis by Sohayla A. Elhusseini et al. (2022) showed that self-regulation strategies positively impact academic outcomes in mathematics, reading, and writing for younger students.

In 2024, Jayme Del Mario and Hong Tran(Del Mario & Tran, 2024) identified obstacles in implementing SRL in science education, such as time constraints and lack of training, and proposed solutions like integrating SRL into curricula and enhancing teacher professional development.

Characteristics of effective SRL programs include multiple training stages, direct strategy instruction, a variety of strategies, theoretical grounding, practical application, and effectiveness evaluation through tests and follow-ups. These programs aim to help students set goals, monitor progress, reflect on outcomes, and adjust strategies for improved learning.

Explicit strategy instruction ensures that all students understand and master the necessary skills, quickly recognizing the importance and application of strategies, thus improving efficiency. It also allows teachers to assess and track strategy use, ensuring learning objectives are met and adjusting teaching methods as needed.

However, explicit instruction can increase the learning burden by requiring students to learn additional strategies alongside content. Overemphasis on explicit strategies might disconnect teaching from practical use, hindering flexible application in real communication. Teachers must ensure strategy teaching is universally applicable and adaptable, considering individual differences and learning backgrounds.

2.4 Classroom Situation Setting Interventions (Implicit Strategy Instruction)

Implicit strategy instruction integrates SRL into teaching naturally, promoting mastery without overt instruction, unlike explicit training that focuses on direct strategy teaching. Haelermans (2022) study divided middle school students into groups with different learning strategies and applied various teaching methods. The instruction-independent group excelled in self-organization, while the dependent group received more teacher guidance. A balanced approach in the average group improved performance and motivation. Admiraal (2024) research showed that supporting student autonomy in learning significantly enhanced SRL strategies. Zhang Lina's 2019 study found that autonomous cooperative inquiry teaching improved the learning environment and cognitive strategies in high school. These studies indicate that environments that support student control and cooperative learning are effective for SRL. Educators should tailor classroom control based on students' SRL strategies to improve performance, balancing autonomy and guidance for optimal SRL development.

3. Application of Self-Regulated Learning Strategy Interventions in Different Educational Stages

In education, self-regulated learning interventions must be customized to students' developmental levels and contexts. Tools like ALAD and "N=me" are tech-based, while Extended SRL Training and Classroom Situation Setting are teaching practice strategies.

3.1 Adaptability of Technology-Based Learning Analytics Tools in Different Educational Stages

Adaptive Learning Analytics Dashboards (ALAD) and N=me interventions use technology and data to enhance personalized learning and self-regulated learning (SRL). High school and higher education students, with their developed autonomous learning and self-monitoring skills, can effectively use these tools for personalized feedback and goal tracking. In higher education, where learning tasks are complex and self-direction is key, ALAD and N=me are especially beneficial, helping students adapt to academic challenges. While secondary students might lack some proficiency, these tools can still support SRL in tech-integrated, inquiry-based learning environments.

3.2 Adaptability of Teaching Practice-Based Intervention Strategies in Different Educational Stages

Extended Self-Regulated Learning (SRL) training and classroom interventions are vital for nurturing students' self-regulation skills. In basic education, they help young learners form effective learning habits and strategies, fostering self-awareness and control. As students progress to secondary and higher education, these interventions continue to support the development of sophisticated SRL skills, crucial for academic success and lifelong learning. Diverse teaching and interactive tasks in secondary education further refine these skills. College students, preparing for career or further studies, benefit from practice-based interventions that enhance research and problem-solving abilities, essential for career readiness and advanced learning tasks.

4. Prospects and Recommendations

Future SRL research should integrate technology, focusing on tools like ALAD and "N=me" for personalized learning. It must adapt to learners' needs and stages, embrace cross-cultural studies, and emphasize teacher training. Evaluating long-term impacts and strategy adaptability is key, alongside integrating SRL into policy and practice. An interdisciplinary approach will deepen SRL comprehension, supporting 21st-century skills development.

References

[1]   Del Mario, J., & Tran, H. (2024). A literature review: analyzing barriers hindering the implementation of self-regulated learning in science classrooms. *Frontiers in Education*, *9*. https://doi.org/10.3389/feduc.2024.1330449

[2]   Elhusseini, S. A., Tischner, C. M., Aspiranti, K. B., & Fedewa, A. L. (2022). A quantitative review of the effects of self-regulation interventions on primary and secondary student academic achievement. *Metacognition and Learning*, *17*(3), 1117–1139. https://doi.org/10.1007/s11409-022-09311-0

[3]   Gašević, D., Adesope, O., Joksimović, S., & Kovanović, V. (2015). Externally-facilitated regulation scaffolding and role assignment to develop cognitive presence in asynchronous online discussions. *Internet and Higher Education*, *24*. https://doi.org/10.1016/j.iheduc.2014.09.006

[4]   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

[5]   Park, E. (2022). *Understanding How Students Control Their Learning in Adaptive Learning Environments*. https://doi.org/10.3102/1687712

[6]   Winne, P. H., & Hadwin, A. F. (1998). Studying as self-regulated engagement in learning. In *Metacognition in Educational Theory and Practice*.

[7]   Winne, P. H., Teng, K., Chang, D., Lin, M. P. C., Marzouk, Z., Nesbit, J. C., Patzak, A., Rakovic, M., Samadi, D., & Vytasek, J. (2019a). NStudy: Software for learning analytics about learning processes and self-regulated learning. *Journal of Learning Analytics*, *6*(2). https://doi.org/10.18608/jla.2019.62.7