



THE INTEGRATION OF GENERATIVE ARTIFICIAL INTELLIGENCE INTO THE REACT STRATEGY TO ENHANCE SELF-REGULATED LEARNING AMONG ELEMENTARY SCHOOL TEACHER CANDIDATES

Risma Nuriyanti¹, Neni Nadiroti Muslihah², Amadhila Ellina Penehafo³ dan Abih Gumelar⁴

^{1,2}PGSD, Institut Pendidikan Indonesia, Indonesia

³ Curriculum and Materials Development, NAMCOL, Namibia

⁴ Pendidikan Umum, Pascasarjana, Universitas Pendidikan Indonesia, Indonesia

rismanuriyanti@institutpendidikan.ac.id

Received: August, 2026, Accepted: September, 2026, Published: September, 2026

ABSTRACT

The low level of self-regulated learning among university students requires serious attention. This study aimed to determine the effect of the REACT strategy integrated with generative artificial intelligence (GenAI) on the self-regulated learning of prospective elementary school teachers. An experimental method was employed, specifically a true experimental post-test-only control group design. Random sampling was used to select a total of 45 participants, divided into two groups: an experimental group of 22 students and a control group of 23 students. Data were collected using a questionnaire based on six indicators. The results of the t-test showed a significance value of 0.042 (less than 0.05), indicating a statistically significant difference between the groups; the experimental group outperformed the control group, with a mean score of 75.9 compared to 73.0 (a three-point difference) and a t-value of 2.091. Thus, it can be concluded that there is a significant difference between the experimental and control groups. However, not all indicators of self-regulated learning showed improvement; the highest score was observed in the "learning planning" indicator, while the lowest was in the "metacognitive regulation" indicator. Consequently, while the REACT strategy integrated with GenAI offers a potential solution for enhancing students' self-regulated learning, the findings suggest a need for strengthening metacognitive skills, providing balanced scaffolding, and preventing student over-reliance on AI.

Keywords: Elementary Teacher Candidates, Generative Artificial Intelligence, REACT, Self-Regulated Learning,

1. Introduction

Current educational paradigms emphasize the development of future-ready competencies, including digital literacy, critical inquiry, collaborative learning, creativity, and self-directed learning to support meaningful engagement on dynamic knowledge



Copyright:

© 2026 by the author(s).

This open access article is distributed under the terms and conditions of the Creative Commons Attribution ShareAlike (CC BY SA) license (<https://creativecommons.org/licenses/by-sa/4.0/>).

society (Franza et al., 2026). This has led to a shift in the learning paradigm from a faculty-centered approach to a student-centered one. Students are not only expected to understand concepts but must also be able to think critically, solve problems, manage information, and independently regulate their learning process (Manurung et al., 2023). These skills are becoming increasingly important in higher education because students are positioned as lifelong learners who must be able to adapt to advancements in science and technology. One skill that supports the success of independent learning is self-regulated learning—an individual's ability to plan, monitor, and evaluate their own learning process (Zimmerman, 2023)

The evolution of higher education in the digital era has positioned self-regulated learning as a key competency determining students' academic success (Inayati et al., 2026). Recent research indicates that students are no longer expected merely to master subject-specific knowledge; they must also be capable of managing their own learning processes—setting goals, devising study strategies, monitoring their understanding, and reflecting on learning outcomes (Dignath et al., 2026; Husnayain et al., 2026; Rosenthal et al., 2026). Interventions fostering self-regulated learning strengthen students' self-regulation skills, thereby boosting learning motivation and academic readiness while helping them navigate the transition to higher education (Chandy & Kumar, 2026). Consequently, self-regulated learning is no longer viewed as a supplementary skill but as a vital foundation that enables students to become independent, adaptive learners capable of meeting academic demands within an increasingly complex educational landscape.

However, in reality, students' self-regulated learning skills have not yet optimally developed; their learning autonomy remains low. This is corroborated by initial observations and a needs analysis, which reveal that many students still rely heavily on lecturer guidance. Students tend to complete assigned tasks or projects hastily, lack effective study planning, and fail to evaluate or follow up on their achieved results. These conditions indicate weaknesses in students' self-regulated learning, which plays a crucial role in the educational learning process (Bakhtiar & Hadwin, 2022; Kitsantas et al., 2025; Wigfield, 2023). Low self-regulated learning ability directly impacts students' cognitive ability to complete highly challenging tasks, one of which is academic writing based on linguistic cases.

Based on the above discussion, problem-solving approaches are needed to strengthen self-regulated learning. These problem-solving approaches require instructional designs that are contextual, active, and based on authentic experiences. One relevant strategy is REACT (Relating, Experiencing, Applying, Cooperating, Transferring). This strategy emphasizes the relevance of the material to real-world contexts, students' direct involvement in learning experiences, and the application of concepts to real-life situations that do not directly prompt students to solve problems (Clarke & Roche, 2018; Wang et al., 2017).

Meanwhile, in the Relating stage, the emphasis is on connecting new concepts with students' life experiences or existing knowledge to cultivate the ability to plan strategies for understanding cases (Farida et al., 2023). The Experiencing stage offers students opportunities for direct exploration or object manipulation to discover concepts independently, thereby enabling them to select appropriate data analysis strategies. The process of internalizing knowledge—as the practical application of the chosen strategy—proceeds to the Applying stage, where students utilize the concepts they have learned to solve practical problems. This is reinforced by the Cooperating stage, which involves learning in small groups to share ideas and solve problems collaboratively, fostering the

ability to accept feedback and disseminate chosen strategies. According to CORD (Kovačević & Barbir, 2025), social interaction during learning helps students clarify their understanding and enhances their interpersonal communication skills. Finally, the Transferring stage challenges students to apply this knowledge in new and different contexts; according to Jannah (2022), this represents the highest indicator of thorough conceptual understanding. As noted by CORD, success in this transfer stage indicates that students have achieved a level of mastery. The ability to transfer knowledge ensures that learning goes beyond short-term rote memorization, evolving instead into a competency that can be adapted to meet various future challenges.

The success of REACT learning is closely linked to students' ability to manage their own learning process. Students with high levels of self-regulation tend to be able to manage learning resources, determine problem-solving strategies, and reflect on their learning process. Conversely, students with low self-regulation tend to have difficulty controlling their learning activities independently (Zimmerman, 2002). Therefore, as information and communication technology advances—offering significant opportunities to support student-centered learning—one approach that can be integrated is the use of Generative Artificial Intelligence (GenAI), a form of technological development with the potential to support technology-based learning. Although the term “GenAI” emerged after 2015, the concept of utilizing intelligent technology in learning has been explored through approaches such as computer-supported collaborative learning, adaptive systems, and technology as a support for knowledge construction.

The use of technology in learning helps students acquire information, explore, and build understanding more independently when paired with appropriate instructional design (Mishra & Koehler, 2006). Furthermore, GenAI in education is beginning to demonstrate significant potential in supporting students' cognitive processes; GenAI can help students explore ideas and uncover relevant case studies. In the process of language analysis in elementary school, GenAI helps students explore language-related issues so they can learn independently (Kasneci et al., 2023; Rudolph et al., 2023).

The integration of the REACT strategy with GenAI in this study is based on the principle that technology should serve as a support for the learning process, rather than replacing students' thinking activities. The REACT strategy provides a pedagogical framework through contextual, collaborative, and reflective activities, while GenAI provides technological support to expand access to information and help students explore language-related issues (Hall & Hawkins, 2026). This strategy aligns with the concept of Technological Pedagogical Content Knowledge, which emphasizes that the use of technology in learning must be tailored to pedagogical strategies and the characteristics of the material being taught.

However, research on the integration of the REACT strategy with artificial intelligence-based technology in relation to self-regulated learning among elementary education students still has a wide scope for further study. Previous studies have primarily focused on the effectiveness of the REACT strategy in enhancing conceptual understanding and learning outcomes, while research examining its impact on students' self-regulation in analyzing language-related issues in elementary schools has been limited. Therefore, research is needed to examine the impact of the REACT strategy integrated with GenAI on the self-regulated learning of PGSD students as an effort to develop innovative learning approaches aligned with current educational needs.

Based on the above discussion, this study aims to examine the effect of the integrated REACT strategy using GenAI on the self-regulated learning of elementary school teacher

education students in analyzing language-related issues in elementary schools. The results of this study are expected to contribute to the development of higher education, particularly in preparing prospective elementary school teachers who possess analytical skills, independent learning abilities, and the ability to utilize technology effectively.

2. Method

This study employed a quantitative approach using a true experimental design with a posttest-only control design, which includes a control group and an experimental group (Sugiyono, 2013). The experimental group received instructional treatment using the GenAI-based REACT strategy (X), while control group use conventional learning. After instruction was completed for both groups, posttests (O1 and O2) were administered to assess the final outcomes following the intervention. Berikut Gambaran dari desain posttest-only control design

R1	X	O1
R2	-	O2

Information:

R1	: Experimental Group
X	: Treatment the integration of generative artificial intelligence to the REACT strategy
O1	: Self-Regulated Learning
R2	: Control Group
-	: Conventional Learning
O2	: Sel-Regulated Learning

The population in this study consisted of second-year PGSD students. The sampling technique used in this study was random sampling, taking into account the circumstances of the students who would receive the treatment (Sarker & AL-Muaalemi, 2022). The sample in this study consisted of 45 second-year elementary teacher education students at the Indonesian Institute of Education in Garut, divided into two groups: an experimental group of 22 students and a control group of 23 students. The sample was selected based on the characteristics of the experimental and control groups in relation to the research variables under investigation. The research instrument used in this study was a questionnaire to measure self-regulated learning based on six main indicators (Meece, 2023; Zimmerman, 2023) namely: (1) learning planning namely setting goals, creating a schedule, determining priorities, and selecting an initial strategy; (2) motivation and self-efficacy namely Believing in one's ability to complete tasks, being goal-oriented, regarding tasks as important, and persisting through difficulties; (3) cognitive strategies namely Active reading, summarizing, organizing material, connecting concepts, critical thinking; (4) metacognitive regulation namely Monitoring comprehension, checking progress, recognizing difficulties, adjusting strategies if ineffective; (5) resource management namely Managing time, selecting a study environment, managing effort, utilizing peers, teachers, lecturers, or digital resources.; and (6) self-reflection and self-evaluation namely Evaluating learning outcomes, identifying errors, making corrections, determining future strategies.

The research was conducted over five sessions, including the post-test. The learning process was carried out in stages by gradually implementing the REACT strategy integrated with GenAI. In the first session, before moving on to the REACT strategy phase, students were first instructed to form groups based on their language proficiency levels: listening, speaking, reading, and writing groups. This was intended to make it easier for students to discuss the topics to be addressed. After forming the groups, the process moved to the “relating” stage, in which students were guided to

identify types of language problems based on real-life cases presented by the instructor and encouraged to explore these issues by drawing on journal articles and field findings regarding language skills in elementary schools. This stage aimed to develop students' ability to plan strategies for understanding cases and to analyze problems based on facts and opinions. Additionally, GenAI is integrated into this stage to help students conduct a more in-depth analysis of the topics to be discussed. In the second stage—the “experiencing” stage—students are guided to analyze the cases presented and connect them to various theories and data they obtained during the “relating” stage. This stage aims to train students to select data analysis strategies and develop their argumentative skills based on the theories and data they have identified.

The second session was followed by the third stage—the “applying” stage—in which students were guided to develop a case analysis framework aimed at honing their ability to implement the strategies they had formulated. Students' self-regulated learning skills at this stage provided them with the opportunity to apply the plans they had developed in the previous stage. This was followed by the “cooperating” stage, in which students were guided to collaborate by conducting peer reviews of the problems they had identified; here, students' ability to receive feedback and evaluate the results of their studies was honed. After that, the program moved into the final stage, in which students were guided to reflect on the learning process and analyze new cases independently. In this final stage, students are trained to evaluate their learning and plan improvements based on what they have studied from the journal, with the assistance of several supported GenAI applications. During the research, students utilized several GenAI integrations in the learning process, including ChatGPT, CloudAI, Deepseek, and Gemini

The data collection and analysis procedures used in this study included a Likert scale to measure students' self-regulated learning (Robinson, 2024; South et al., 2022), descriptive statistics, and inferential analysis. The data analysis techniques to be used are descriptive analysis, specifically the normality test and the homogeneity test to determine data distribution, and the t-test to test the research hypotheses and describe the differences in students' self-regulated learning when analyzing language problems in elementary schools between the treatment group and the control group (Asyari et al., 2021).

3. Results and Discussions

3.1 Results

The research results are presented as follows:

Table 1 Normality Test

	Shapiro-Wilk		
	Statistic	df	Sig.
Experimental	.949	22	.301
control group	.961	23	.515

Based on Table 1, the Shapiro-Wilk normality test showed that the data in the control group had a significance value of 0.301, while the data in the experimental group had a significance value of 0.515. Both significance values were greater than 0.05. Thus, the

Shapiro–Wilk results indicated no statistically significant departure from normality and that the Levene’s test indicated equal variances between the groups. In addition, the data were tested for homogeneity as follows:

Table 2 Homogeneity Test

Experimental_ control group	Levene Statistic	df1	df2	Sig.
	.915	1	43	.344

Based on Table 2, the results of the homogeneity test using the Levene statistic show a p-value of 0.344. This value is greater than 0.05. Therefore, it can be concluded that the data distributions in the experimental and control groups are homogeneous. Based on the results of the prerequisite tests, the following parametric inferential analysis were conducted to test the hypotheses:

Table 3 Hypothesis Testing

Experimental_Control	F	Sig.	T	Sig. (2-tailed)
	0,915	0,344	2,091	0,042

Table 3 shows the results of the hypothesis test comparing the experimental group that received the treatment and the control group that did not receive the treatment; a significance value of 0.042 was obtained. This value is less than 0.05, which means the hypothesis is accepted. Thus, it can be concluded that there is a significant difference between the two groups tested. This means that the integrated GenAI REACT strategy has an effect on students’ self-regulated learning in analyzing language problems in elementary school.

In addition, these findings are supported by a comparison of the average levels of self-regulated learning between the control group and the experimental group, as follows:

Table 4 Comparison of Averages

Group	N	Mean
Experimental	22	75.9545
Control	23	73.0000

Based on Table 4, the mean score for the experimental group was 75.95, while that for the control group was 73.0. The difference between the experimental group and the control group is 2.94. These results indicate that the hypothesis is supported by the difference in the mean scores between the two groups, with the experimental group scoring higher.

Table 5 Percentage for Each Indicator

Indicator	Experimental group	Control group
Learning planning	84%	80%
Motivation and self-efficacy	73%	74%

Cognitive strategies	74%	73%
Metacognitive regulation	68%	69%
Resource management	77%	73%
Self-reflection and self-evaluation	70%	72%

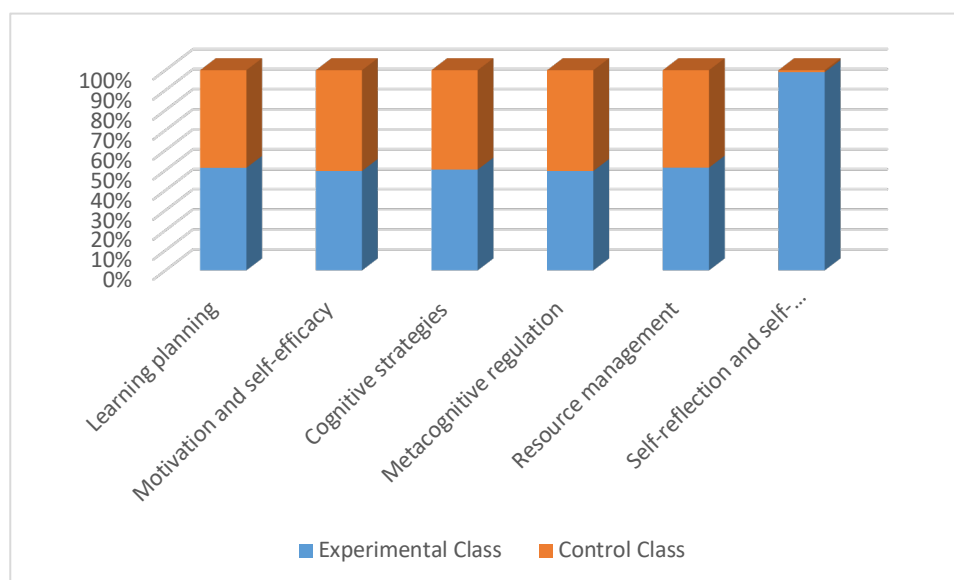


Figure 1 Percentage for Each Indicator

Table 5 and Figure 1 shows the differences in each indicator between the experimental and control groups. Based on these data, it can be concluded that self-regulated learning in both the experimental and control group showed relatively good results across all indicators. In the experimental group, the highest percentage was found in the learning planning indicator at 84%, while the lowest percentage was found in metacognitive regulation at 68%. Meanwhile, in the control group, the highest percentage was found in learning planning at 80%, while the lowest percentage was found in metacognitive regulation at 69%.

Overall, the experimental group demonstrated higher achievement on learning planning indicators, specifically in learning planning (84% versus 80%), cognitive strategies (74% versus 73%), and resource management (77% versus 73%). Meanwhile, the control group had slightly higher achievement in motivation and self-efficacy (74% versus 73%), metacognitive regulation (69% versus 68%), and self-reflection and self-evaluation (72% versus 70%). Thus, the difference in achievement between the two groups was relatively small, although the experimental group had higher scores, particularly in the aspects of learning planning and resource management.

3.2 Discussion

Based on the interpretation and analysis of the data, it appears that the integrated GenAI REACT strategy influences the self-regulated learning of elementary education students in analyzing language-related problems in elementary schools. This finding is consistent with the research by Astuti et al. (2020) which concluded that the REACT strategy is effective in enhancing students' self-regulated learning. The effectiveness of

the REACT strategy lies in its real-world experience approach, which emphasizes students' active engagement through five stages: relating concepts to real-world experiences, experiencing the learning process, applying concepts, collaborating, and transferring knowledge. (Wayan et al., 2023)

When examined through the REACT strategy framework, the formation of groups based on language proficiency specializations enables students to develop a stronger sense of self within their respective areas of expertise. This is consistent with the findings of Pratama et al. (2025) who noted that an increase in students' learning autonomy is marked by indicators such as learning initiative, the setting of learning goals, and a self-concept developed collaboratively based on objective field conditions. By focusing on a single linguistic aspect, students can explore issues in a more in-depth and structured manner, which in turn strengthens their self-regulated learning.

The integration of GenAI into the REACT strategy provides additional support that enhances the effectiveness of contextual learning. GenAI offers an instant and personalized learning environment that has the potential to improve students' SRL compared to conventional self-regulated learning interventions (Chen, jie Tian, Xionan Fu, Yu Liu, 2026). Research by Chen, jie Tian, Xionan Fu, Yu Liu, (2026) confirms that the integration of GenAI significantly improves students' motivation, self-efficacy, creativity, and higher-order thinking skills. During the relating stage, students not only identify problems but are also trained to distinguish between facts and opinions. This skill is part of the cognitive strategies involved in self-regulated learning. Thus, the collaboration between the REACT strategy and GenAI creates a synergy that strengthens students' independent learning in analyzing language problems in elementary school.

During the "experiencing" stage, students are given hands-on experience analyzing linguistic cases, which allows them to connect theoretical knowledge with real-world practice. The integration of GenAI in the "experiencing" stage enables students to verify and triangulate information. This is supported by the findings of Li et al. (2026), which revealed that students who used ChatGPT through structured prompts, revision cycles, or inquiry-based tasks demonstrated behaviors of planning, monitoring, and strategic adjustment that align with self-regulated learning.

The "applying" stage is the actual implementation of the plans developed by students. Applying the REACT principles in learning can enhance students' independent learning, as indicated by their ability to manage resources, establish learning strategies, view difficulties as challenges, and collaboratively develop their self-concept (Tarumasely, 2024). Furthermore, the cooperating stage enables students to learn together, respond to one another, share ideas, and communicate with one another. This aligns with the view of López-Pernas et al. (2025), who state that the implementation of strategies designed to stimulate self-regulated learning can encourage students to enhance their collaborative skills; their diverse perspectives enrich and foster critical thinking. The final stage of the REACT strategy is "transferring," in which students are trained to evaluate their learning process and plan for improvement. This ability is a key indicator of self-regulated learning. As noted by Xu et al., (2025), self-regulation is a

primary indicator of a student's ability to plan for improvement based on what they have studied.

In addition to being substantiated by statistical tests, the effect of the GenAI-integrated REACT strategy on students' self-regulated learning was further supported by the results of a comparison of achievement across indicators. Both the experimental and control group showed the highest percentage on the learning planning indicator. However, the experimental group outperformed the control group by a margin of 5%. Learning planning is a fundamental component of self-regulated learning that encompasses goal setting, strategy, and time management (Zilberman, 2026). Research Xu et al. (2025) found that metacognitive support in a GenAI environment significantly enhances students' self-regulated learning abilities, particularly regarding task-assignment strategies. The GenAI-integrated REACT strategy facilitates students in developing more structured learning plans through AI assistance in organizing information and establishing steps for analyzing language-related problems.

The research findings also indicate that metacognitive regulation was the lowest-scoring indicator in both groups. This confirms that metacognitive regulation is the most challenging aspect to develop in self-regulated learning. Research on GenAI in higher education reveals two distinct perspectives on GenAI. On the one hand, it can foster metacognitive development through structured support and reflective dialogue; on the other hand, it can trigger negative phenomena such as intellectual laziness and false self-efficacy (Zilberman, 2026). Therefore, GenAI itself does not carry definite risks or benefits for cognitive development; its effects are determined by the students themselves. These subtle differences in metacognitive regulation indicate that the GenAI-integrated REACT strategy is not yet optimal for fostering students' self-monitoring and self-evaluation. Without metacognitive support, students tend to use GenAI merely to complete assignments without engaging in deep reflection on their thought processes (Zhang et al., 2025).

The control group also excelled in self-reflection and self-evaluation. This may be due to the tendency of students in the control group to rely more on their internal abilities without AI assistance, thereby refining their self-evaluation process. Research on self-regulated scaffolding emphasizes the importance of scaffolding aligned with self-determination theory to optimize the benefits of GenAI (Xia et al., 2026). In other words, the presence of GenAI does not automatically improve all aspects of students' self-regulated learning; careful instructional design and support from other media are needed to enhance other indicators.

4. Conclusions

Based on the research findings and discussion, it can be concluded that the REACT strategy influences the self-regulated learning of elementary school teacher education students in analyzing language-related issues in elementary schools. This is evidenced by the results of data analysis and interpretation, specifically the t-test results, which showed a significance value of 0.042—less than 0.05—meaning the hypothesis is accepted. Furthermore, there was a difference in the mean scores between the

experimental group (which received the treatment) and the control group (which did not receive the treatment); the experimental group outperformed the control group by a margin of three points. However, not all indicators of self-regulated learning showed improvement; the highest score was obtained for the learning planning indicator, while the lowest was for the metacognitive regulation indicator. Thus, although the results suggest that the REACT strategy integrated with GenAI can be one solution to improve students' self-regulated learning, there is a need to strengthen metacognitive skills, provide balanced scaffolding, and prevent students from becoming overly dependent on AI.

5. Acknowledgements

We would like to thank the Indonesian Institute of Education for providing support and funding for this research. This support was instrumental in ensuring that the entire research process was carried out successfully. The authors also appreciate the support of the institution, which provided the opportunities and facilities necessary for this research to be completed and produce the expected results.

References

- Astuti, Y., Kania, A., & Januar, P. (2020). *A Comparative Study of Guided Discovery Learning and REACT Strategy Toward Problem-Solving Skill and Self-Regulated Learning on Fifth Grade Students*. 397(Iclique 2019), 882–890. DOI: <https://10.2991/assehr.k.200129.109>
- Asyari, L., Nuriyanti, R., Gunawan, D., & Adiredja, R. K. (2021). The Influence of Experiential Learning Model on Primary School Student's Creative Thinking Skills. *Social, Humanities, and Educational Studies (SHEs): Conference Series*, 4(1), 70–76. DOI: <https://doi.org/10.20961/shes.v4i1.48568>
- Bakhtiar, A., & Hadwin, A. F. (2022). Motivation from a self-regulated learning perspective: Application to school psychology. *Canadian Journal of School Psychology*, 37(1), 93–116. DOI <https://doi.org/10.1177/08295735211054699>
- Chandy, M., & Kumar, S. P. (2026). Mapping the Landscape of Self-regulated Learning with Interventions—A Bibliometric Guide for Academic Decision-Making. *Journal of Engineering Education Transformations*, 357–369. DOI: <https://doi.org/10.16920/jeet/2026/v39is2/26044>
- Chen, jie Tian, Xionan Fu, Yu Liu, P. (2026). *How does GenAI support self-regulated learning? Evidence from learners' questioning behavior analysis TI ES IN ES*. (November 2024). DOI: <https://doi.org/10.1057/s41599-026-08610-0>
- Dignath, C., Karlen, Y., Schuster, C., & Stebner, F. (2026). From theory to action: Supporting self-regulated learning in the classroom. *Theory Into Practice*, 1–17. DOI : <https://doi.org/10.1080/00405841.2026.2714717>
- Farida, R., Suroyo, S., & Sekarwinahyu, M. (2023). The influence of strategy relating, experiencing, applying, cooperating, transferring (react) on science learning outcomes of fifth grade elementary students viewed from critical thinking ability. *JPPIPA (Jurnal Penelitian Pendidikan IPA)*, 8(1), 1–10. DOI:

- <https://doi.org/10.26740/jppipa.v8n1.p1-10>
- Franza, G., Jackson, M., Horneck, B., Revels III, B., & Hopkins, K. (2026). THINK TANK: WE'RE PREPARING FOR A WORLD THAT DOESN'T EXIST YET: STUDENT PERSPECTIVES ON FUTURE-DRIVEN EDUCATION. *Journal for Leadership & Instruction*, 25(1), 79.
- Hall, Margeret and Hawkins, Daniel. From Tool Use to Evaluative Judgment: A Readiness Framework for Generative AI in Higher Education (April 01, 2026). Available at SSRN: <https://ssrn.com/abstract=6598018> or <http://dx.doi.org/10.2139/ssrn.6598018>
- Husnayain, M. F., Ansori, M. R., Saputra, R. S. H., & Paryadi, P. (2026). Implementation of Reflective Learning Logs in Supporting Students' Learning Development. *Journal of Education Review Provision*, 6(2), 70–82. DOI: <https://doi.org/10.55885/jerp.v6i2.1091>
- Inayati, N. L., Al Mubarak, F. U., & Rohmani, A. F. (2026). Enhancing Critical Thinking and Self Directed Learning through Integration of Digital Competence and Didactic Strategy in Higher Education. *Journal of Interdisciplinary Studies in Education*, 15(2), 85–108. DOI: <https://doi.org/10.32674/whffna77>
- Jannah, R. (2022). Implementasi Model Pembelajaran Kontekstual dalam Pembelajaran Menulis Teks Deskripsi. *Prosiding Seminar Nasional Daring: Pendidikan Bahasa Dan Sastra Indonesia*, 2(1), 770–774. DOI: <https://doi.org/10.31332/aladl.v2i1.1420>
- Kasneci, E., Seßler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günemann, S., & Hüllermeier, E. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, 103, 102274. DOI: <https://doi.org/10.1016/j.lindif.2023.102274>
- Kitsantas, A., Bembenuitty, H., Cleary, T. J., Alexander, P. A., DiBenedetto, M. K., Kaplan, A., Kolovelonis, A., Mandell, B. E., Martin, A. J., & McCrudden, M. T. (2025). Barry J. Zimmerman's Enduring Legacy: The Inspiring Fusion of Self-Regulated Learning Theory, Practice, and Mentorship. *Educational Psychology Review*, 37(3), 78. DOI: <https://doi.org/10.1007/s10648-025-10052-0>
- Kovačević, S., & Barbir, J. (2025). Frequency of Implementation of Contextual Teaching and Learning in Subject Teaching. *Croatian Journal of Education/Hrvatski Časopis Za Odgoj i Obrazovanje*, 27(2). DOI: <https://doi.org/10.15516/cje.v27i2.6343>
- Li, C., Cui, H., & Hagedorn, L. S. (2026). The cognitive impact of ChatGPT in higher education: A systematic review of critical and creative thinking outcomes. *Computers and Education: Artificial Intelligence*, 10, 100571. DOI: <https://doi.org/10.1016/j.caeai.2026.100571>
- López-Pernas, S., Misiejuk, K., Oliveira, E., & Saqr, M. (2025). The dynamics of the self-regulation process in student-AI interactions: The case of problem-solving in programming education. *Proceedings of the 25th Koli Calling International Conference on Computing Education Research*, 1–12. DOI: <https://doi.org/10.1145/3769994.3770043>

- Manurung, A. S., Fahrurrozi, E. U., & Gumelar, G. (2023). Implementasi berpikir kritis dalam upaya mengembangkan kemampuan berpikir kreatif mahasiswa. *Jurnal Papeda*, 5(2).
- Meece, J. L. (2023). The role of motivation in self-regulated learning. In *Self-regulation of learning and performance* (pp. 25–44). Routledge.
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054. DOI: <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- Pratama, R. Y., Syaifurrohman, A., & Sari, D. P. (2025). Pengembangan Model SMART dalam PjBL untuk Meningkatkan Kemandirian Belajar Mahasiswa pada Mata Kuliah Akhlakul Karimah. *Ideguru: Jurnal Karya Ilmiah Guru*, 10(3), 2589–2595. DOI: <https://doi.org/10.51169/ideguru.v10i3.2120>
- Robinson, J. (2024). Likert scale. In *Encyclopedia of quality of life and well-being research* (pp. 3917–3918). Springer. DOI: https://doi.org/10.1007/978-3-031-17299-1_1654
- Rosenthal, A., Hirt, C. N., Eberli, T. D., Jud, J., & Karlen, Y. (2026). Exploring subject-specific variations in teachers' promotion of self-regulated learning: insights from classroom observations, teachers' self-reports, and students' perceptions. *Metacognition and Learning*, 21(1), 39. DOI: <https://doi.org/10.1007/s11409-026-09488-8>
- Rudolph, J., Tan, S., & Tan, S. (2023). ChatGPT: Bullshit spewer or the end of traditional assessments in higher education? *Journal of Applied Learning & Teaching*, 6(1), 342–363. DOI: <https://search.informit.org/doi/10.3316/informit.T2025102700003092061569891>
- Sarker, M., & AL-Muaalemi, M. A. (2022). Sampling techniques for quantitative research. In *Principles of social research methodology* (pp. 221–234). Springer. DOI: https://doi.org/10.1007/978-981-19-5441-2_15
- South, L., Saffo, D., Vitek, O., Dunne, C., & Borkin, M. A. (2022). Effective use of Likert scales in visualization evaluations: A systematic review. *Computer Graphics Forum*, 41(3), 43–55. DOI: <https://doi.org/10.1111/cgf.14521>
- Sugiyono, D. (2013). *Metode penelitian pendidikan pendekatan kuantitatif, kualitatif dan R&D*.
- Tarumasely, Y. (2024). *Meningkatkan Kemampuan Belajar Mandiri (Panduan untuk Mengembangkan Self-Regulated Learning)*. Academia Publication.
- Wayan, N., Puspa, A., Made, N., & Suryanti, N. (2023). *Penerapan Strategi Pembelajaran REACT Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa dalam Pembelajaran Sosiologi Pada Siswa Kelas XI IPS 1 di SMA Negeri 1 Lingsar*. 8(September 2021), 2021–2024. DOI: 10.29303/jipp.v8i1b.1317
- Wigfield, A. (2023). The role of children's achievement values in the self-regulation of their learning outcomes. In *Self-regulation of learning and performance* (pp. 101–124). Routledge.
- Xia, Q., Yang, Y., Wang, W., & Yin, H. (2026). Promoting Interdisciplinary Learning

- With Generative AI Through Self-Regulated Scaffolding. *Journal of Computer Assisted Learning*, 42(2), e70214. DOI: <https://doi.org/10.1002/jcal.70214>
- Xu, X., Qiao, L., Cheng, N., Liu, H., & Zhao, W. (2025). Enhancing self-regulated learning and learning experience in generative AI environments: The critical role of metacognitive support. *British Journal of Educational Technology*, 56(5), 1842–1863. DOI: <https://doi.org/10.1111/bjet.13599>
- Zhang, C., Hu, X., & Wei, W. (2025). Concept Maps as Metacognitive Scaffolds: Transforming Student-GenAI Interactions in Academic Counseling. *2025 IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE)*, 1–8. DOI: <https://doi.org/10.1109/TALE66047.2025.11346728>
- Zilberman, N. N. (2026). Generative AI in Higher Education: Conditions for Supporting Students' Metacognitive Regulation. *Open Education*, 30(1), 15–22. DOI: <https://doi.org/10.21686/1818-4243-2026-1-15-22>
- Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, 41(2), 64–70. DOI: https://doi.org/10.1207/s15430421tip4102_2
- Zimmerman, B. J. (2023). Dimensions of academic self-regulation: A conceptual framework for education. In *Self-regulation of learning and performance* (pp. 3–21). Routledge.