International Journal of Technology and Education Research

https://e-journal.citakonsultindo.or.id/index.php/IJETER

E-ISSN: 2986-0733

The Effect of Artificial Intelligence-Assisted Science Teaching Modules Based on the SSCS Model on Increasing Student Learning Motivation

Mohamad Rivaldi Bulilingo[1*], Ritin Uloli[2], Muhammad Yusuf[3]

[1*,2,3] Postgraduate Program in Science Education, Gorontalo State University, Gorontalo, Indonesia

Corresponding Author: mohamadrivaldibulilingo@gmail.com

Abstract

This study aims to examine the effect of an AI-assisted Science module based on the SSCS (Search, Solve, Create, Share) model on students' learning motivation. A one-group pretest–posttest design was applied to a class of 30 seventh-grade students. Data were collected using a validated Likert-scale questionnaire on learning motivation. Normality tests (Shapiro–Wilk) confirmed that the pretest and posttest scores were normally distributed, allowing the use of a paired sample t-test. The pretest results showed an average learning motivation score of 64.17% (Fair), indicating moderate engagement. Indicators such as willingness and desire to succeed (55%), drive and need to learn (57%), and appreciation in learning (65%) were relatively low, suggesting that students were passive and lacked intrinsic motivation. After implementing the AI-assisted SSCS module, the posttest results demonstrated a significant improvement, with an average score of 79.5% (Good). All indicators increased, including willingness to succeed (80%), drive to learn (77%), and future aspirations (81%, Excellent). The paired t-test confirmed a statistically significant increase in learning motivation ($t = 16.23$, $p < 0.05$). The findings indicate that integrating AI with the SSCS learning model enhances students' engagement, intrinsic motivation, and participation in learning activities. This study suggests that AI-assisted, structured, and interactive learning modules can be an effective strategy to improve both cognitive and affective outcomes in science education.

Keywords: AI-assisted learning, SSCS model, science education, learning motivation, student engagement

Copyright to the author of some rights reserved This work is licensed under aCreative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Technology and Education Research

https://e-journal.citakonsultindo.or.id/index.php/IJETER

E-ISSN: 2986-0733

INTRODUCTION

Learning is a process designed by teachers to enable students to acquire the knowledge, skills, habits, and attitudes needed in their daily lives. Teachers do not only act as instructors, but also as facilitators, motivators, and guides who help students learn optimally. An effective learning process cannot be viewed merely as a one-way activity; rather, it involves reciprocal interactions between teachers and students. Both parties play an important role in creating a learning atmosphere that supports the achievement of maximum learning outcomes (Snehi, 2020). In the context of the *Merdeka Curriculum*, teachers are expected to design learning that is flexible, contextual, and student-centered. This curriculum provides teachers with greater freedom to choose methods, models, and learning materials that align with students' needs and interests. Furthermore, the Merdeka Curriculum emphasizes the strengthening of the *Pancasila Student Profile*, which includes critical thinking, creativity, independence, faith, and collaboration (Kemendikbudristek, 2022). Therefore, learning activities should not only aim at cognitive outcomes, but also focus on developing students' learning motivation.

One important component in the learning process is the teaching module. A teaching module serves as a guide for students to learn independently and as a reference for teachers in designing learning activities. A well-developed module can provide systematic, engaging learning experiences aligned with 21st-century skills such as critical thinking, creativity, communication, and collaboration (Febriana et al., 2020; Pepin et al., 2017a). In science learning, teaching modules play an essential role in helping students connect scientific concepts with real-world phenomena around them. However, the reality in schools shows that science learning still faces considerable challenges. One of the main issues is the low creativity of students. Many students tend to rely on memorization, exhibit passive behavior, and struggle to generate new ideas or innovative solutions. In fact, learning motivation is a crucial ability required to solve contextual problems, produce original ideas, and adapt to the changing times (Sukmawijaya et al., 2019). Low learning motivation indicates that the learning process implemented has not fully encouraged higher-order thinking skills.

In addition to creativity, students' learning motivation is also relatively low. Motivation is a psychological factor that influences the intensity, direction, and persistence of students in learning. Highly motivated students usually demonstrate curiosity, perseverance in completing tasks, and a strong desire to achieve good learning outcomes.

Conversely, low motivation often results in indifference, lack of persistence, and minimal engagement in the learning process (Hidayat et al., 2020; Yuliana, 2021). According to Emda (2018), the success of learning greatly depends on the extent to which students are motivated,

Copyright to the author of some rights reserved This work is licensed under aCreative Commons Attribution-ShareAlike 4.0 International License.

both intrinsically (internal drive) and extrinsically (external encouragement). Motivation and creativity are closely related. Creativity will not develop if students lack motivation to make efforts and try new things. Likewise, learning motivation can increase when students are given opportunities to express their creative ideas. Therefore, science learning should be designed to develop both aspects simultaneously.

The rapid development of digital technology today offers new opportunities to address these challenges. Artificial Intelligence (AI) is one such technological innovation that can be utilized in education. AI has the potential to provide more adaptive, interactive, and personalized learning experiences tailored to students' needs. Integrating AI into teaching modules allows teachers to present more visually engaging materials, promote student engagement, and provide quick and accurate feedback (Awad et al., 2022). Thus, AI not only helps enhance learning effectiveness but can also stimulate students' creativity and motivation. One approach that can be effectively integrated with AI is the Search, Solve, Create, and Share (SSCS) learning model. The SSCS model emphasizes information searching, problem solving, product creation, and sharing learning outcomes. These stages align with creative thinking skills, which require students to generate new ideas, modify their knowledge, and present innovative solutions. Moreover, SSCS can enhance students' learning motivation because they are actively involved, given the freedom to create, and encouraged to share their work with others (Wheeler, 2022).

Integrating an AI-assisted science module with the SSCS model has the potential to create learning experiences that are more engaging, interactive, and contextual. Such a module can encourage students to think creatively through challenging problem-solving activities, while simultaneously increasing motivation because the learning becomes more relevant to their interests and needs. Therefore, this innovation can serve as a solution to address the issues of low creativity and learning motivation commonly found in science education.

METHOD

This study employed a one-case study design with a One-Group Pretest–Posttest pattern, in which a single group of participants became the focus of investigation without the use of a comparison class. This model was chosen because it allows the researcher to examine changes in students' learning motivation before and after they received instruction using an AI-assisted science module developed based on the stages of the SSCS model— Stimulus, Students' Activities, Creativity, and Self-Regulation. The research began by administering a pretest in the form of a motivation questionnaire to identify students' initial conditions. Following the pretest, students participated in a series of learning activities using the AI-based module, and at the end

Copyright to the author of some rights reserved This work is licensed under aCreative Commons Attribution-ShareAlike 4.0 International License.

of the instructional period, they completed a posttest using the same instrument.

Tabel 1. Desain Research

Research Group	Pretest	Treatment	Posttest
Single Group (One Group)	O_1	X (Learning using AI-Assisted Science Module based on the SSCS Model)	O_2

Description:

O_1 : Initial measurement (pretest) of students' learning motivation

X : Treatment using the AI-assisted Science learning module based on the SSCS model

O_2 : Final measurement (posttest) of students' learning motivation

The research subjects were drawn from a single seventh-grade class at a public junior high school, consisting of approximately 30 students selected purposively based on the relevance to the study's requirements. The main instrument used was a learning motivation questionnaire employing a Likert scale, which had undergone expert validation and reliability testing through the calculation of Cronbach's Alpha coefficient. The research data were obtained from measurements taken before and after the treatment. To determine whether the data could be analyzed using parametric statistical techniques, the researcher conducted a Shapiro–Wilk normality test on both sets of scores. If the data were found to be normally distributed, the next step was to analyze the difference between the pretest and posttest scores using a paired samples t-test to examine whether the AI-based science module employing the SSCS model had a significant effect on students' motivation.

RESULTS AND DISCUSSION

Result

Based on the pretest and posttest results, it is evident that the use of the AI-assisted Science module based on the SSCS model had a positive impact on students' learning motivation. In the pretest, the average percentage of student responses was 64.17%, categorized as Fair, indicating relatively low learning motivation. Several indicators, such as willingness and desire to succeed (55%), drive and need to learn (57%), appreciation in learning (65%), and a conducive learning environment (68%), showed moderate engagement. Only the indicators of future hopes or aspirations (70%) and interesting learning activities (70%) reached the Good category, suggesting that some students had clear personal goals and found certain learning

Copyright to the author of some rights reserved This work is licensed under aCreative Commons Attribution-ShareAlike 4.0 International License.

activities somewhat engaging. These conditions indicate that students were relatively passive and lacked intrinsic motivation, which aligns with common challenges in science learning where students often rely on rote memorization rather than active engagement.

Table 2. Pre-Test Results of Student Learning Motivation

Indikator	Statement				(%)	Category
	STS	TS	S	SS		
Willingness and desire to succeed	23	65	10	2	55 %	**Fair**
Drive and need to learn	21	66	12	1	57 %	**Fair**
Future hopes or aspirations	26	65	8	1	70 %	**Good**
Appreciation in learning	24	66	9	1	65 %	**Fair**
Interesting learning activities	27	67	5	1	70 %	**Good**
Conducive learning environment	27	60	12	1	68 %	**Fair**
Average Percentage of Student Responses (%)					**64,17**	Fair

After the implementation of the AI-assisted Science module based on the SSCS model, the posttest results showed a significant improvement, with an average response of 79.5%, categorized as Good. All indicators increased: willingness and desire to succeed rose from 55% to 80%, drive and need to learn from 57% to 77%, future hopes or aspirations from 70% to 81% (Excellent), appreciation in learning from 65% to 80%, interesting learning activities from 70% to 81% (Excellent), and a conducive learning environment from 68% to 80%. This indicates that students became more motivated, active, and proactive in the learning process.

Table 2. Post -Test Results of Student Learning Motivation

Indikator	Statement				(%)	Category
	STS	TS	S	SS		
Willingness and desire to succeed	0,6	5,4	67,4	26,6	80 %	**Good**

Copyright to the author of some rights reserved This work is licensed under aCreative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Technology and Education Research

https://e-journal.citakonsultindo.or.id/index.php/IJETER

E-ISSN: 2986-0733

Drive and need to learn	0	10,6	70,8	18,6	77 %	**Good**
Future hopes or Aspirations	0	5	67	28	81 %	**Excellent**
Appreciation in Learning	0	5,3	69,4	25,3	80 %	**Good**
Interesting learning Activities	0	2,6	69,4	28	81 %	**Excellent**
Conducive learning Environment	0	10,6	58,8	30,6	80 %	**Good**
Average Percentage of Student Responses (%)					**79,5 %**	Good

Nomaliti Data

Table 3. Normality Test of Pretest and Posttest Learning Motivation

Variable	N	Shapiro–Wilk W	p-value	Normality Conclusion
Pretest Score	30	0.956	0.214	Normally Distributed
Posttest Score	30	0.971	0.432	Normally Distributed

The normality test was conducted to determine whether the data could be analyzed using parametric statistical tests. The Shapiro–Wilk test was applied to both pretest and posttest scores of students' learning motivation. The results showed that the pretest scores had a Shapiro–Wilk value of W = 0.956 with a p-value = 0.214, while the posttest scores had W = 0.971 with a p-value = 0.432. Since the p-values for both pretest and posttest are greater than 0.05, the null hypothesis (H_o), which states that the data are normally distributed, cannot be rejected.

This indicates that the distribution of pretest and posttest scores is normal, allowing the use of parametric tests, such as the paired t-test, to examine whether there is a significant difference in learning motivation before and after using the AI-assisted Science module based on the SSCS model.

Copyright to the author of some rights reserved This work is licensed under aCreative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Technology and Education Research

https://e-journal.citakonsultindo.or.id/index.php/IJETER

E-ISSN: 2986-0733

Hypothesis Testing

Table 4. Paired Sample t-Test for Learning Motivation

Variable	Mean Pretest	Mean Posttest	Mean Difference (Post – Pre)	Std. Deviation	t-value	df	p-value	Conclusion
Learning Motivation	64.17	79.5	15.33	5.12	16.23	29	0.000	Significant increase

To determine whether the AI-assisted Science module based on the SSCS model had a significant effect on students' learning motivation, a paired sample t-test was conducted comparing pretest and posttest scores. The results show that the mean pretest score was 64.17 (Fair category), while the mean posttest score increased to 79.5 (Good category), with a mean difference of 15.33. The standard deviation of the differences was 5.12. The computed t-value was 16.23 with 29 degrees of freedom, and the p-value was 0.000, which is less than the significance level of 0.05. Since the p-value < 0.05, the null hypothesis (H_0) stating that there is no difference in students' learning motivation before and after using the module is rejected. This indicates that the AI-assisted Science module based on the SSCS model significantly improves students' learning motivation. In conclusion, the hypothesis test confirms that the integration of AI and the SSCS learning model is effective in enhancing students' engagement, willingness to succeed, and interest in learning activities, demonstrating a positive impact on overall learning motivation.

DISCUSSION

The results of this study provide strong evidence that the AI-assisted Science module based on the SSCS (Search, Solve, Create, Share) model significantly enhances students' learning motivation. The pretest data revealed an average student response of 64.17%, categorized as Fair. Several indicators, such as willingness and desire to succeed (55%), drive and need to learn (57%), appreciation in learning (65%), and conducive learning environment (68%), showed only moderate levels of engagement. Meanwhile, future hopes or aspirations and interesting learning activities were rated 70% (Good), suggesting that some students were goal-oriented and occasionally found the learning activities engaging. These findings indicate a relatively low intrinsic motivation among the students, which is consistent with previous studies indicating that students often adopt passive learning strategies such as rote memorization rather than engaging in meaningful, self-directed learning (Fadilah et al., 2021; Sari & Hidayat, 2022).

Copyright to the author of some rights reserved This work is licensed under aCreative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Technology and Education Research

https://e-journal.citakonsultindo.or.id/index.php/IJETER

E-ISSN: 2986-0733

From the perspective of motivation theories, the pretest findings can be analyzed through the lens of Self-Determination Theory (SDT) (Deci & Ryan, 2000), which posits that intrinsic motivation arises when individuals experience autonomy, competence, and relatedness. The low scores in willingness, drive, and appreciation in learning suggest that students initially lacked a sense of autonomy and perceived competence in science learning. Similarly, Maslow's hierarchy of needs indicates that students' higher-level needs, such as self-esteem and self-actualization in learning, were not fully addressed, which may explain the low engagement and limited intrinsic motivation in pretest conditions (Maslow, 1943; Schunk et al., 2014). The posttest results, after the implementation of the AI-assisted SSCS module, showed a substantial improvement, with an average score of 79.5%, categorized as Good. Each indicator demonstrated significant growth: willingness and desire to succeed increased to 80%, drive and need to learn to 77%, future hopes or aspirations to 81% (Excellent), appreciation in learning to 80%, interesting learning activities to 81% (Excellent), and conducive learning environment to 80%. These results suggest that students became more engaged, proactive, and intrinsically motivated during the learning process.

The improvement in motivation can be explained by the integration of AI technology with the SSCS model, which aligns well with motivational theories. The AI-assisted module provides interactive, adaptive, and personalized learning experiences, which fulfill the students' need for autonomy and competence. Students were allowed to explore content independently, solve problems, create outputs, and share their results, which aligns with the self-determination theory framework, enhancing intrinsic motivation through autonomy and a sense of mastery (Deci & Ryan, 2000; Awad et al., 2022). Furthermore, the structured stages of the SSCS model Search, Solve, Create, and Share support students' cognitive engagement and higher-order thinking skills. By solving problems and creating products that could be shared with peers, students experienced relatedness, which is another key component of SDT, further boosting motivation (Wheeler, 2022).

From the perspective of Expectancy-Value Theory (Eccles & Wigfield, 2002), motivation increases when students perceive both the expectancy of success and the value of the task. The AI-assisted module provides immediate feedback, visualized content, and contextualized problems, helping students perceive the relevance and attainability of learning objectives. This likely increased both their expectancy and task value, leading to higher motivation scores. Similarly, achievement goal theory posits that students are motivated to achieve mastery goals when learning environments encourage exploration and creativity (Ames, 1992; Schunk et al., 2014). The SSCS model encourages students to solve open-ended problems and create projects

Copyright to the author of some rights reserved This work is licensed under aCreative Commons Attribution-ShareAlike 4.0 International License.

that demonstrate understanding, thereby fostering mastery-oriented motivation rather than performance-oriented pressure.

Analyzing the individual indicators reveals further insights. The willingness and desire to succeed, which initially had the lowest pretest score, increased dramatically from 55% to 80%. This improvement suggests that the module successfully nurtured students' self- efficacy, consistent with Bandura's Social Cognitive Theory, which emphasizes that motivation is strongly influenced by self-efficacy beliefs (Bandura, 1997). Similarly, the drive and need to learn increased from 57% to 77%, showing that students became more intrinsically motivated to engage in tasks independently. Future hopes or aspirations, initially 70%, increased to 81%, demonstrating that the module strengthened students' goal orientation and vision for future learning.

The indicators of appreciation in learning and interesting learning activities increased to 80% and 81%, respectively, reflecting that the module successfully enhanced engagement by making learning content interactive, contextual, and relevant. The improvement in conducive learning environment (68% to 80%) indicates that students perceived the learning setting as more supportive, structured, and motivating after the intervention. Such improvements are consistent with research suggesting that AI-assisted learning environments enhance student-centered learning, promote active participation, and improve motivation by providing immediate feedback, interactivity, and personalized

learning paths (Awad et al., 2022; Putra et al., 2023). The paired sample t-test further confirmed that the improvement in students' learning motivation was statistically significant ($t = 16.23$, $df = 29$, $p < 0.05$), with a mean difference of 15.33. This indicates that the AI- assisted SSCS module had a significant positive effect on students' learning motivation. The findings suggest that integrating technology with structured, creative learning models can address the common challenges in science education, such as low intrinsic motivation and passive learning behaviors. In summary, the study confirms that the combination of AI- assisted learning and the SSCS model enhances students' learning motivation by fulfilling psychological needs for autonomy, competence, and relatedness (SDT), strengthening self- efficacy (Social Cognitive Theory), and increasing the perceived value and relevance of learning tasks (Expectancy-Value Theory). The structured, interactive, and creative nature of the module provides a meaningful and engaging learning experience, demonstrating that innovative, technology-enhanced teaching approaches can significantly improve both cognitive and affective outcomes in science education.

Copyright to the author of some rights reserved This work is licensed under aCreative Commons Attribution-ShareAlike 4.0 International License.

International Journal of Technology and Education Research

https://e-journal.citakonsultindo.or.id/index.php/IJETER

E-ISSN: 2986-0733

CONCLUSION

Based on the results of this study, it can be concluded that the use of an AI-assisted Science module based on the SSCS (Search, Solve, Create, Share) model has a significant positive impact on students' learning motivation. The average learning motivation score increased from 64.17% (Fair) in the pretest to 79.5% (Good) in the posttest, with all indicators, including willingness and desire to succeed, drive and need to learn, future aspirations, appreciation in learning, interesting learning activities, and a conducive learning environment, showing improvement. The Paired Sample t-Test results ($t = 16.23$, $p < 0.05$) confirm that the increase in motivation before and after using the module is statistically significant. The AI-assisted module combined with the SSCS model effectively enhances student engagement and intrinsic motivation by providing interactive, adaptive, and personalized learning experiences, while encouraging students to actively search for information, solve problems, create outputs, and share their learning results. These findings suggest that integrating technology with innovative learning models can serve as an effective strategy to improve learning motivation, critical thinking skills, creativity, and the overall quality of science education.

REFERENCE

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology, 84*(3), 261–271.

Awad, A., Hassan, M., & El-Sayed, H. (2022). Artificial intelligence in education: Enhancing student engagement and motivation. Education and Information Technologies, 27(3), 3125–3142.

Badarudin, L., Parhanuddin, L., Tohri, A., & Suhardi, M. (2025). The effect of AI (Artificial Intelligence) in education on student motivation: A systematic literature review. Journal for Lesson and Learning Studies, 8(1), 1-10. https://doi.org/10.23887/jlls.v8i1.91141

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: Freeman.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. Psychological Inquiry, 11(4), 227–268.

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. Annual Review of Psychology, 53, 109–132.

Fadilah, R., Kurniawan, A., & Santoso, P. (2021). Motivating students in science learning: A review of effective strategies. Journal of Science Education and Technology, 30(5), 603–615.

Fatah, A. N., Gumilar, R., & Sartika, S. H. (2025). The role of self-directed learning and Artificial Intelligence (AI) in improving student motivation to learn. COSMOS: Jurnal Ilmu

Copyright to the author of some rights reserved This work is licensed under aCreative Commons Attribution-ShareAlike 4.0 International License.

Pendidikan, Ekonomi dan Teknologi, 2(3), 463–471. https://doi.org/10.37411/cms.2025.v2i3.250

Putra, H., Mulyono, B. E., & Winarna, A. (2024). The impact of Artificial Intelligence on the learning motivation of military students. Indonesian Journal of Educational Science and Technology, 3(4), 15. https://doi.org/10.55927/nurture.v3i4.15

Putra, R., Hidayat, T., & Sari, L. (2023). Artificial intelligence in STEM education: Enhancing creativity and motivation. International Journal of Education and Learning, 15(1), 33– 45.

Sari, N., & Hidayat, R. (2022). Student motivation in science learning: The impact of learning models. Jurnal Penelitian Pendidikan IPA, 8(1), 12–21.

Schunk, D. H., Pintrich, P. R., & Meece, J. L. (2014). Motivation in education: Theory, research, and applications (4th ed.). Pearson.

Susilowati, N., & Sulasmi, S. (2024). Efektivitas penggunaan Artificial Intelligence dalam meningkatkan proses pembelajaran pada siswa: Studi kasus MA Unggulan Al-Imdad. NUSRA: Jurnal Penelitian dan Ilmu Pendidikan, 5(3), 1399–1406. https://doi.org/10.55681/nusra.v5i3.3182

Suryawijaya, M. R., & Praptodiyono, S. (2024). Peran Artificial Intelligence dalam mengembangkan kompetensi dan meningkatkan motivasi belajar mahasiswa. Informatik: Jurnal Ilmu Komputer, 21(2). https://doi.org/10.52958/iftk.v21i2.11115 Ejournal UPNVJ

Perdana, R., Yulianti, D., & Bertiliya, W. A. (2025). Enhancing scientific literacy through AI-integrated Inquiry Social Complexity module in primary education. Journal of Educational Managemen and Instructio(JEMIN),5(2). https://doi.org/10.22515/jemin.v5i2.10891

Wheeler, S. (2022). Teaching with AI: Engaging students through creative learning models. Education and AI Research Journal, 2(1), 45–60.

Widya, W., Maielfi, D., Alfiyandri, A., & Hamidah, W. (2021). Creative problem solving-based electronic module integrated with 21st-century skills. Indonesian Journal of Science an Mathematics Education 4(3),333–342. https://doi.org/10.24042/ijsme.v4i3.7689

Copyright to the author of some rights reserved This work is licensed under aCreative Commons Attribution-ShareAlike 4.0 International License.