



What motivates students to learn about ecosystems in the socio-scientific issues classroom?

Septa Adi Hendarso¹, Rina Yuliati², Anggi Tias Pratama³, Dina Maulina⁴, Poppy Rahmatika Primandiri^{1,5}, Elysabet Herawati¹, Agus Muji Santoso^{1,5*}

¹ Biology Education, Universitas Nusantara PGRI Kediri, Indonesia

² SMAN 1 Mojo, Kediri, Jawa Timur, Indonesia

³ Biology Education, Universitas Negeri Yogyakarta, Indonesia

⁴ Biology Education, Universitas Lampung, Indonesia

⁵ Pusat Unggulan Biodiversitas, Universitas Nusantara PGRI Kediri, Indonesia

*Corresponding author: agusmujisantoso@unpkediri.ac.id

ARTICLE INFO

Article history

Received: 07 December 2025

Revised: 07 January 2026

Accepted: 19 February 2026

Keywords:

Career Motivation

Creating and communicating

Grade Motivation

Interpreting

Students' self-efficacy

ABSTRACT

Research on student motivation within the Socio-Scientific Issues-based ASICC model for ecosystem topics remains limited, despite its critical role in achieving deep learning principles. This study aims to uncover students' motivation to learn biology. A standard Likert-scale-based instrument was used to measure student motivation. Data were obtained from this classroom action research based on lesson study. The average student motivation scores in each cycle were compared. Then, the student motivation data was also analyzed by comparing the dimensions of motivation according to Glynn's motivation theory. The results showed a significant and consistent increase in learning motivation from the pre-cycle to the second cycle, indicating better homogeneity of motivation. This increase was also reflected in the shift in the distribution of motivation categories, where students with high and very high motivation increased. An interesting finding from this study was that students were motivated to learn by the encouragement of grades motivation. The Socio-Scientific Issues approach to biology learning was realized by implementing ecosystem learning through the ASICC learning model. Environmental issues and cases can increase student learning motivation. However, an in-depth analysis conducted in this study revealed that students' grade motivation dimension was higher than other motivational dimensions. Presenting environmental issues or cases should be able to enhance intrinsic motivation. This finding suggests that grade motivation was the most easily stimulated dimension of motivation before developing motivation in other dimensions.

© 2026 Universitas Negeri Jakarta. This is an open-access article under the CC-BY license (<https://creativecommons.org/licenses/by/4.0>)

INTRODUCTION

Science classes, such as those in biology, are often conducted through inquiry. Students learn about ecosystems through investigations related to issues or problems in the ecosystems around them. Through investigation, students' critical and creative thinking skills can be stimulated by presenting everyday-life problems (Sudarmin et al., 2023). This type of learning is becoming a future learning trend. This is one effort to reduce environmental damage. Students learn ecological topics to improve problem-solving skills and develop a sustainable environmental awareness (Zidan et al., 2023). This learning process requires perseverance, discipline, and thoroughness. The challenge is that students must be highly motivated, possess a strong curiosity, and understand sustainable environmental management. Teachers must maintain student motivation in learning. Teachers must be attentive to help students successfully learn about ecology (Byrne et al., 2025). Because so far, obstacles to ecological learning experienced by students include a lack of interest in science and a feeling of discomfort in nature (Cooke et al., 2021; Soga et al., 2023). Observational research results revealed that student learning motivation on the topic of ecosystems in urban Kediri still needs to be improved. The initial student motivation score was still low. This was indicated by the limited number of opinions expressed during discussion sessions. Student dialogue on ecology topics was still dominated by students with high academic abilities. This means that desire and success in the learning process are influenced not only by intellectual factors but also by non-intellectual factors that are equally important in determining student learning outcomes, one of which is motivation (Suharni, 2021).

Motivation plays a crucial role in learning activities because it can drive students' enthusiasm for learning, and vice versa. Motivation not only acts as a driving force in learning activities but also determines the direction and goals of one's learning (Hamalik, 2010; Supriani et al., 2020). Students with high learning motivation will tend to be more persistent and employ better learning strategies than those with low learning motivation. The level of student learning motivation also depends heavily on several factors, such as interest, curiosity, and personal goals, as well as extrinsic factors such as parental support, the school environment, and the reward system (Suharni, 2021). The interaction between these factors can create complex motivational dynamics, which in turn influence students' overall academic success. Therefore, analyzing these factors is crucial for designing effective and adaptive learning strategies tailored to students' needs.

Such conditions require a teacher to provide various kinds of motivation to their students, so that they become active and not passive in learning. When students are passive, they will only receive information from the teacher, so they have a tendency to quickly forget what the teacher conveys (Hermawan et al., 2018). This is in line with (Emda, 2018), that learning will take place effectively if students are motivated to learn. According to Qamara (2024), for students to be encouraged to participate actively in learning, their learning motivation must be increased. The role of educators is needed in good learning management to spur student motivation in learning. One thing that educators can do is apply appropriate learning models and methods in creating an effective learning process including biology learning, because biology not only studies concrete things but also abstract ones, where this learning is not enough to be delivered in class learning only through the transfer of knowledge from teacher to student but needs to be provided with learning experiences that encourage students to think more critically.

The dimensions of student motivation can be grouped into five, namely (1) intrinsic motivation; (2) career motivation; (3) self-determination; (4) self-efficacy; and (5) grade motivation. These dimensions reflect different but complementary motivational constructs that have been widely examined in science education research (Schunk & DiBenedetto, 2020). Intrinsic motivation plays a crucial role in fostering students' persistence, discipline, and deep engagement in learning activities, particularly in conceptual science learning contexts (Lin et al., 2013; Ryan & Deci, 2020). However, intrinsic and extrinsic forms of motivation should not be viewed dichotomously; rather, they need to be orchestrated to sustain students' engagement and academic effort over time (Eccles & Wigfield, 2020; Ryan & Deci, 2020). Self-efficacy has consistently been identified as a strong predictor of students' cognitive engagement and problem-solving performance in science learning (Schunk & DiBenedetto, 2020). Likewise, career and grade motivations can function as external value drivers that reinforce students' task persistence, particularly when learning activities are cognitively demanding (Eccles & Wigfield, 2020). In ecosystem learning, the core competency requires students to generate ideas or propose solutions to ecological imbalance issues in their surrounding environment. The ability to construct such solutions is closely associated with students' motivational regulation and their

engagement in socio-scientific reasoning processes (Lin et al., 2013). Therefore, teachers need to identify which dimensions of student motivation should be strengthened during learning in order to support students in developing scientifically grounded solutions to ecosystem imbalance problems.

Observations at SMAN 1 Mojo show that students are passive in biology learning. This is evidenced by the results of a student learning motivation questionnaire, which obtained a percentage of 55.76%, which is in the low category. Furthermore, the results of the open class analysis during the learning process showed that students were less motivated to immediately complete assignments, still relying on cheat sheets from group members, and students were fixated on instant answer keys on the internet. Some students were also busy with their own activities, and some even fell asleep. This resulted in students being less responsive or lacking in student attention when the teacher explained the material in class. In the group assignment submission of 28 students, only 13 students submitted their assignments on time, 7 students took the initiative to submit them even though they were late, and the remaining 8 students did not submit their assignments at all. Low student motivation in learning biology (science) has become a common concern in many countries (Soga et al., 2023). Causes of this low motivation include: students often feel uncomfortable conducting investigations outdoors (Cooke et al., 2021), complex material (Sudiby et al., 2017), students have to carefully examine data (Setiani et al., 2024), and limited teacher learning support (Schweder & Raufelder, 2024).

One effort that can be made is to increase student learning motivation. Numerous studies have shown that the Socio-Scientific Issues (SSI) approach is effective in improving learning variables. The incorporation of SSI into pedagogical structures has been empirically demonstrated to considerably augment students' motivation for learning across a multitude of scientific domains. Empirical evidence suggests that the SSI framework promotes enhanced conceptual comprehension, critical analytical skills, and affirmative dispositions toward scientific inquiry by associating scientific principles with pertinent societal challenges, thus rendering the educational experience more pertinent and engaging (Cahyani et al., 2024; Suryani & Anggraini, 2025). For example, investigations indicate that learners who engage with SSI pedagogies exhibit enhanced capabilities in argumentation and decision-making processes, which are essential for nurturing responsible citizenship (Chowdhury et al., 2019). Moreover, the implementation of SSI within the realm of science education has been correlated with heightened scientific literacy and environmental consciousness, as students become increasingly involved with urgent global issues such as climate change (Dusturi et al., 2024a; Sanchez et al., 2024). In summary, the SSI methodology not only improves educational outcomes but also fosters a proactive and socially accountable outlook among students.

One learning model that can be used to accommodate learning with the SSI approach is the ASICC learning model. The ASICC learning model consists of the learning stages of Adapting, Searching, Interpreting, Creating, and Communicating. Implementing the ASICC learning model can facilitate students' self-reflection to achieve learning targets, gather important information, solve challenges, exchange ideas, and create a product (Santoso et al., 2021). The ASICC learning model has been shown to improve critical thinking, creative thinking, metacognition, and collaboration skills among students with different academic abilities. However, information on the dimensions of students' science learning motivation while learning about ecosystems through the ASICC learning model has not been revealed. This research will serve as a reference for teachers in schools who teach ecosystems in their classes. Science and biology teachers will understand what interventions should be provided to maintain students' motivational learning dimensions.

METHODS

Research Design

The research design used was classroom action research (CAR) based on the (Kemmis & McTaggart, 1988) model. Each cycle consisted of four stages: planning, implementation, observation, and reflection. This research was conducted over two cycles, with two meetings per cycle. The classroom action research was combined with lesson study due to the limited number of biology teachers in the school. The classroom action research was conducted as a lesson study because biology teachers in the school needed partners to share and discuss, allowing them to learn together with fellow biology teachers, as well as with the teaching and student teams. This research also played a role in enhancing collaboration between teachers and researchers for learning development, from designing learning designs, implementing learning, and conducting reflections together.

Lesson study-based classroom action research was conducted in three stages, totaling two cycles.

The first stage was planning, where the teacher and research team analyzed the characteristics and initial scores of students' learning motivation. Then, they developed learning tools in the form of teaching modules, student worksheets, learning materials, learning media, and learning evaluation questions. The second stage was implementation, where the teacher and research team conducted the learning in an open classroom. The biology teacher taught according to the lesson plan prepared in the first stage, and the research team, along with the teacher, observed the learning process. The third stage was reflection, where the teacher and research team reflected on the learning outcomes by observing photos, videos, and observation notes of student learning activities. The teacher and researchers used the reflection results to develop improvements to the teaching tools for the next meeting. This was done until two cycles were completed.

Population and Samples

The research was conducted at Public Senior High School in Kediri, one of the senior high schools in Kediri, East Java, Indonesia, as the research population. There are twenty-seven classes in the school. The class that became the subject of the research was class X-10, totaling 28 students, consisting of 11 male students and 17 female students, with a student age range of 15-16 years. Class X-10 was chosen for classroom action research because it had a low learning motivation score. The low learning motivation score was obtained from the preliminary study or pre-cycle in the introduction. The results of initial observations revealed students' lack of class participation (rarely expressing opinions, not asking questions, or the questions asked were still at a low level), not paying attention to the teacher's explanations in class, being late in submitting assignments, and incomplete assignments. These indicators were not only found during the initial observation but also during daily learning.

Instrument

There are two instruments used in this study. The first instrument is a teaching device that includes a teaching module, the ecosystem students' worksheets, learning materials, learning media, and learning evaluation questions. The material in the pre-cycle is biodiversity, the first cycle is ecosystem components and the second cycle is energy flow. The second instrument is a learning motivation questionnaire adapted from (Glynn et al., 2011). There are five indicators, namely: (1) intrinsic motivation; (2) career motivation; (3) self-determination; (4) self-efficacy; (5) grade motivation. Both instruments were compiled and developed together at the planning stage attended by a team of biology teachers, students, and lecturers. Analysis of the instrument's feasibility was carried out through *Focus Group Discussion* (FGD) with three experts in the fields of biology education, biology-ecosystems, and assessment. The results of the FGD revealed that the teaching device and motivation instrument were declared valid by the three experts with an average score 90.24.

Procedure

This research procedure was carried out over two cycles of class-level research. Each cycle was carried out in two meetings. One cycle was carried out for 6 x 45-minute face-to-face meetings. This stage includes planning (plan), where the researcher and teacher compile plans related to learning strategies, teaching methods, teaching tools such as teaching modules, student worksheets, and learning evaluation questions that will be used. Then the implementation stage (do), namely the implementation of learning activities in accordance with the previously prepared and agreed upon learning plan. Next is the reflection stage (see and reflect), namely conducting a joint reflection between the teacher and researcher to review the learning activities that have been implemented for improvement and evaluation for the implementation of the next cycle.

The SSI approach is implemented by applying the ASICC learning model. Details of the ASICC learning stages are presented in [Table 1](#). Based on [Table 1](#), student learning activities are divided into four main stages: adapting, searching, interpreting, creating, and communicating (Santoso et al., 2024). The SSI approach is carried out by presenting issues or problems containing facts and data in the form of diagrams, graphs, tables, news texts, or videos related to ecosystem material. Facts and data related to ecosystem issues/problems are presented in the adapting stage. In addition, ecosystem issues/problems are also presented in the interpreting stage.

Table 1.**Stages of Student Learning Activities in the ASICC Learning Model**

Stage	Description of Student Activities
Adapting	a. Students examine problems or cases from video that contain cases, news, or other text forms. b. Students understand the learning objectives and reflect on themselves regarding learning readiness.
Searching	a. Students from heterogeneous groups based on directions from the teacher. b. Students seek key information from various sources, including through observation in the laboratory or in the field.
Interpreting	Students analyze answer, and discuss problem based on key information obtained in groups.
Creating and communicating	Students formulate ideas, communicate these ideas, and self-reflection.

Data Analysis Techniques

The primary data in this study are student learning motivation questionnaire scores. Score data were obtained from completing the questionnaire in each cycle and analyzed descriptively. The learning motivation questionnaire was adapted from (Glynn et al., 2011) which contains 25 questions with five indicators. The five indicators are Intrinsic Motivation, Career Motivation, Self-Determination, Self-Efficacy, and Grade Motivation. This questionnaire uses a Likert scale with four answer choices consisting of "never" given a score of 0, "rarely" given a score of 1, "often" given a score of 2, and "always" given a score of 3. The data were analyzed descriptively. Each score from the 25 questions was added up and used to find the percentage of student learning motivation results which were then compared from the pre-cycle, the first cycle, and the second cycle.

RESULTS AND DISCUSSION

Based on the research conducted, it was found that the application of SSI through the ASICC learning model on the topic of ecosystems can increase student learning motivation. The results of the analysis of student learning motivation can be seen in [Table 2](#).

Table 2.**Student Learning Motivation Score on Ecosystem Topic**

	Pre-cycle	1 st Cycle	2 nd Cycle
Mean	55.76	65.62	76.81
Min.	34.67	46.67	66.67
Max.	72.00	86.67	90.67
Standard deviation	11.66	12.77	6.80

The data on student learning motivation in [Table 2](#) shows a gradual increase in average motivation from the pre-cycle phase to the second cycle. In the pre-cycle, the average motivation was 55.76. This figure then increased to 65.62 in cycle 1, and further reached 76.81 in cycle 2. This increase in average motivation indicates a positive impact of the interventions or learning strategies implemented during the research period, which contributed to an increase in students' collective learning motivation.

The increase in motivation was also reflected in the lowest and highest motivation scores achieved by students. The lowest score in the pre-cycle was 34.67, which then showed an improvement to 46.67 in cycle 1, and increased to 66.67 in cycle 2. This shift indicates that students with lower initial motivation levels experienced significant improvement. Meanwhile, the highest motivation score also showed an increase from 72.00 in the pre-cycle, to 86.67 in cycle 1, and reached 90.67 in cycle 2. This indicates that the implemented strategy was also able to encourage students who already had good motivation to reach a more optimal level.

The standard deviation analysis provides further insight into the distribution of student motivation. The standard deviation in the pre-cycle was recorded at 11.66, which increased to 12.77 in Cycle 1. However, in Cycle 2, the standard deviation showed a significant decrease to 6.8. This decrease

indicates that the variability or heterogeneity of motivation levels among students became lower. In other words, student learning motivation tended to become more homogeneous and concentrated at a higher level towards the end of the cycle. Overall, these findings provide evidence that the implemented intervention not only increased motivation levels in general but also contributed to an even distribution of motivation levels among students.

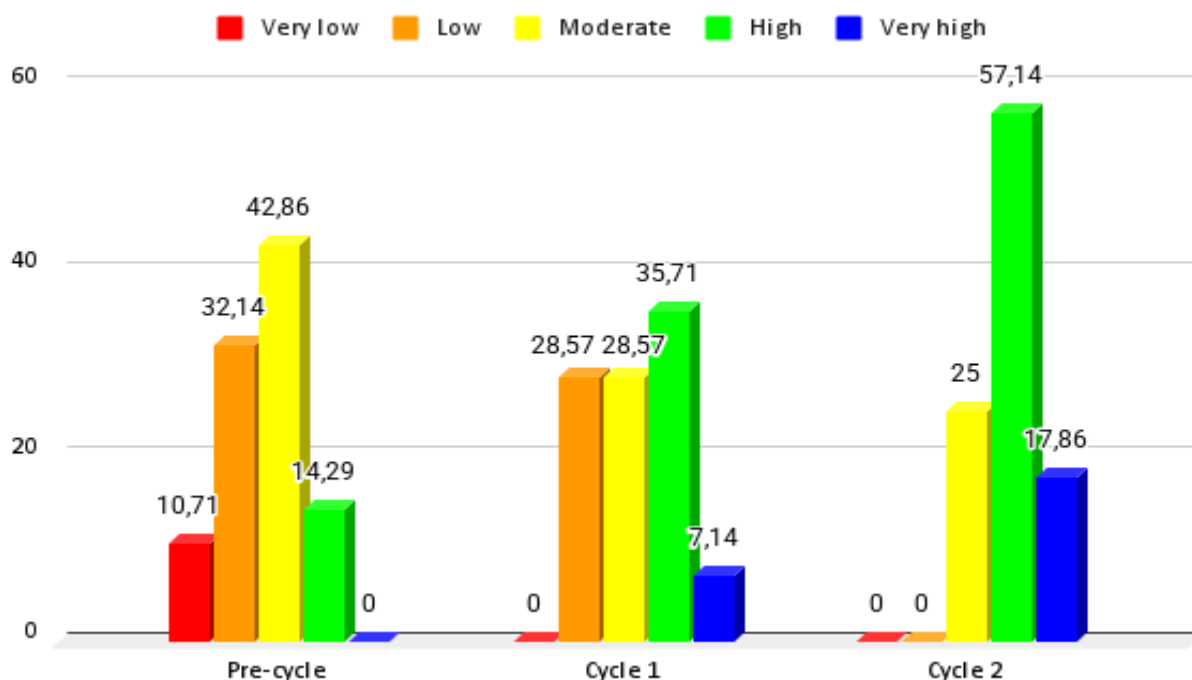


Figure 1. Categories of student learning motivation.

The research began with a preliminary study of 28 students using a learning motivation questionnaire during the pre-cycle phase. The results showed that students' learning motivation was still in a condition that needed to be improved (Figure 1). Of the total students, 3 students (10.72%) were identified as having very low learning motivation, followed by 9 students (32.14%) in the low category. The majority of students, namely 12 students (42.86%), were classified as having medium learning motivation, while only 4 students (14.29%) were identified as having high learning motivation. This pre-cycle data became the basis for researchers and teachers to design learning interventions to improve student learning motivation.

In response to the initial pre-cycle conditions, cycle 1 planning was carried out by adopting the ASICC (Adapting, Searching, Interpreting, Creating & Communicating) learning model, an innovative learning model that encourages critical thinking, collaboration, and student activeness. After implementation, cycle 1 showed a significant increase in motivation. The number of students with high motivation increased to 10 (35.71%), and 2 (7.14%) achieved the very high category. However, there were still 8 students (28.57%) in the moderate category and 8 students (28.57%) in the low category. This increase was directly demonstrated by students' activeness and curiosity during the classroom learning process.

Despite showing quite positive results, cycle 1 was not without several obstacles that caused suboptimal learning. The main problems included technical constraints such as power outages that hampered the display of learning videos during the adaptation stage, resulting in a lack of student attention. Furthermore, ineffective time management resulted in shorter learning durations, resulting in some students failing to complete assignments. Reflection results also indicated that students still needed further adaptation to the use of Student Worksheets (LKPD), given their previous experience with such media and learning models. Based on the identified problems, several emphases and improvements were planned for Cycle 2 to maximize student learning motivation and further optimize apperception at the beginning of learning through independent and group guidance through the provision of critical questions and praise.

The corrective actions taken in cycle 2 yielded very satisfactory results, marked by a significant

increase in the percentage of students' learning motivation. The number of students with high motivation reached 16 students (57.14%), followed by 7 students (25%) in the moderate category, and 5 students (17.86%) in the very high category. This shows a much better comparison when compared to the pre-cycle and cycle 1 data. This increase in motivation is also supported by the analysis of the learning motivation questionnaire results for each indicator (Figure 2).

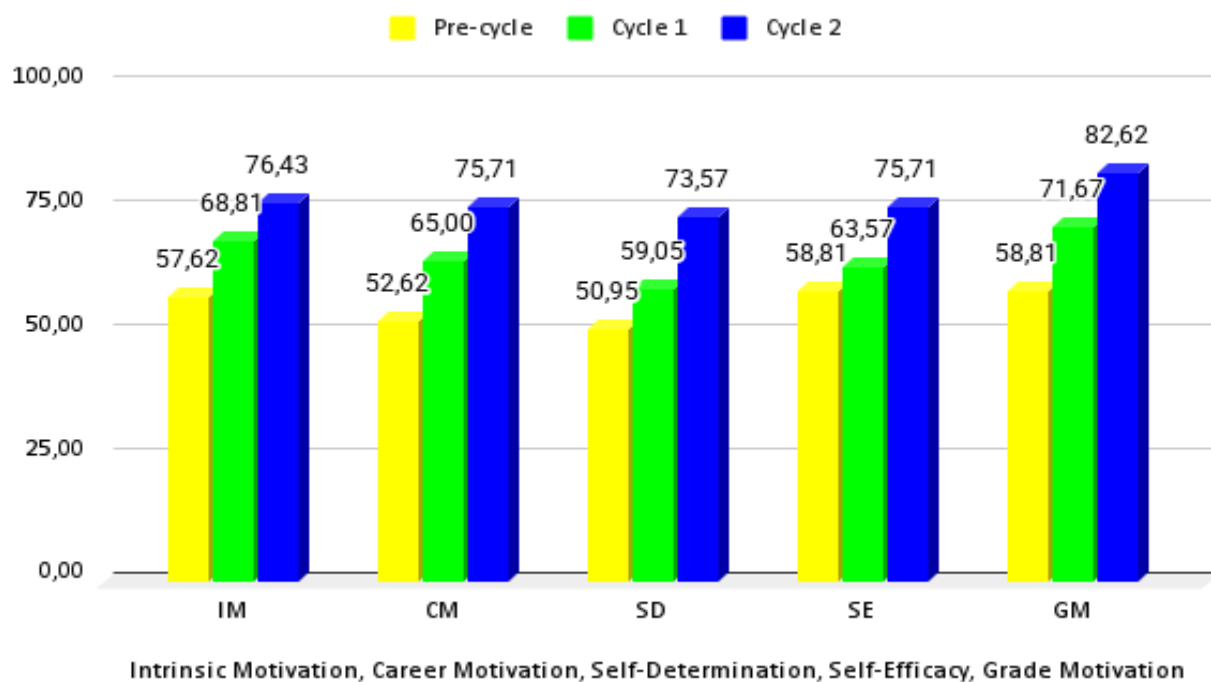


Figure 2. Learning Motivation Results for Each Indicator

Data on four motivational indicators were collected in this study: Intrinsic Motivation (IM), Career Motivation (CM), Delf-Determination (DM), Self-Efficacy (SE), and Grade Motivation (GM). Motivation increased across each indicator. The improvements in each motivational indicator reflect the overall results of the intervention. This indicates an increase in each indicator of student motivation. Therefore, this data supports the successful implementation of the ASICC learning model and its adjustments in an effort to maximize student learning motivation. Intrinsic Motivation (IM) reflects students' internal drive to actively engage during the learning process due to personal interest and satisfaction, rather than external motivation (Ryan & Deci, 2000a). The analysis results showed a consistent increase in students' intrinsic motivation, with the average IM score increasing from 58 in the pre-cycle phase to 69 in Cycle 1, and reaching a peak of 76 in Cycle 2. This increase indicates that the learning intervention successfully fostered students' curiosity and enjoyment of the material, thus making them enjoy the learning process itself more.

Career Motivation (CM), this indicator relates to students' perceptions of how education relates to their future careers, significantly influencing their motivation levels (Glynn et al., 2009). The graphical data shows that students' understanding and appreciation of the relevance of education to their career prospects has increased. CM scores rose from 53 in the pre-cycle to 65 in Cycle 1, and reached 76 in Cycle 2. This progress indicates that students are increasingly motivated because they see a direct connection between their current learning efforts and future professional aspirations.

Self-Determination (SD), this aspect refers to the motivation that originates from within the individual, where students are driven to learn because they feel they have autonomy, competence, and a sense of connectedness in the learning process (Ryan & Deci, 2000b). Analysis shows an increase in student self-determination. SD scores increased from 51 in the pre-cycle to 59 in Cycle 1, and reached 74 in Cycle 2. This increase indicates that students feel more in control of their learning, have more confidence in their abilities, and feel an integral part of the learning environment, which is important for active participation and initiative.

Self-Efficacy (SE) measures a student's belief in their ability to perform the necessary actions to achieve desired outcomes. Students with high self-efficacy tend to believe in their ability to succeed in

learning, thus having stronger learning motivation. Conversely, low self-efficacy can hinder and hinder students' motivation in achieving learning goals (Monika & Adman, 2017). The results of the study showed a clear improvement in students' self-efficacy. SE scores rose from 59 in the pre-cycle to 64 in Cycle 1, and reached 76 in Cycle 2. This improvement reflects students' growing confidence in facing learning challenges, making them more persistent, resilient, and optimistic about their academic achievements.

Grade Motivation (GM) refers to the extent to which students are motivated to achieve good academic grades (Pintrich & Schunk, 2002). Grades can be an extrinsic motivator, driving students to study for good grades, but they can also be intrinsic if students understand the importance of learning and relate it to personal values. The data show that grade motivation experienced the most significant increase among all indicators. GM scores jumped from 59 in the pre-cycle to 72 in Cycle 1, and reached 83 in Cycle 2. This significant increase indicates that students have a very strong drive to achieve and achieve satisfactory academic results, possibly as a positive response to the applied learning methodology.

This research revealed an interesting finding. Grade motivation (GM) scores from the beginning of the pre-cycle, the first cycle, and the second cycle were higher than the scores for other indicators. This indicates that students' motivation to learn ecosystems is driven by the desire to achieve better grades. This motivation falls under the extrinsic category. Students will gain confidence if their completed assignments are appreciated. For example, if students receive a good grade on an assignment, they will be motivated to repeat the same task. During the reflection session, the team of teachers, lecturers, and students understood this phenomenon.

This can be explained as follows. Students' focus on grades is a rational response to an education system that emphasizes quantitative metrics and often neglects deeper learning. Deci et al. (2001) reported that grading that emphasizes quantitative aspects will weaken students' intrinsic motivation for the assigned tasks. Another study by Ryan & Weinstein (2009) found that assessments that focus too much on grades will cause students to strive to achieve target grades, thus de-emphasizing the essence of learning, which emphasizes the process. Kohn (2011) also reported in his research that an education system that relies more on quantitative grades will cause students to actively learn only to achieve what will be measured.

However, this is not entirely true. In this study, the ecosystem learning design was developed with the SSI approach through the application of the ASICC model. In the initial stage (adapting stage), students have been exposed to ecosystem issues/problems that must be analyzed. Students analyze the facts and data provided. Students seek key information from various sources to understand the facts and data (searching stage). This stage requires thoroughness and critical thinking to sort information sources and determine the key information needed. The next stage (interpreting stage), students are also required to think at a higher level to be able to interpret problems using the key information obtained. And the final stage (creating & communicating) where students are required to be able to think creatively and argumentatively. This process requires repeated habituation. (Mubeen & Reid, 2014) revealed that for some students grade is not important. This applies if students are accustomed to carrying out tasks in depth. Therefore, it is understandable that at this stage of empowering student motivation, students still have a focus on grade orientation.

Despite these findings, the implementation of the SSI approach through the application of the ASICC learning model on the topic of ecosystems is considered capable of increasing student learning activity in the classroom, with teaching materials in the form of learning videos presented in it, instructions for carrying out critical thinking activities and communicating them by providing praise, real reflections or values. This is in line with (Smith, 2010) research which states that a contextual approach can increase learning motivation, because it allows students to apply concepts to different situations related to real-life problems and allows students to understand the concept more deeply. Interesting learning activities must be created by a teacher through various means, one of which is with learning methods that students like, and the teacher's approach in learning and giving rewards to students (Huda, 2017). Motivation will grow when students feel appreciated. In learning, praise can be used as a motivational tool to create a sense of satisfaction and pleasure (Sanjaya, 2006).

In addition, teacher innovation and creativity in the learning process are also important in increasing student learning motivation to be more enthusiastic and reduce boredom so that students are motivated and feel happy with the teacher (Oktiani, 2017). In cycle 2, students were more active in working on assignments given in groups. This agrees with (Sudibyo et al., 2017), students are said to be

interested in learning if they can complete the assignments presented well. According to Jayadiningrat & Ati (2018), when solving a problem, students will apply previously acquired knowledge or try to acquire new knowledge so that the learning carried out can be more meaningful, which ultimately students try to actively think to find answers. Thus, the analysis results for each indicator strongly confirm the effectiveness of the implemented intervention. The increase in student learning motivation was proven not only to occur generally but also to be evenly distributed across fundamental aspects, both intrinsic and extrinsic. This indicates that student learning motivation was successfully enhanced across various categories, as reflected in all measured motivational aspects.

Previous studies have shown that intrinsic motivation plays a significant role in student learning development. Students with strong intrinsic and extrinsic motivation that is well internalized have a positive influence in supporting students' psychological needs to be more autonomous and competent (Teng, 2025). Students with strong intrinsic motivation to learn tend to have less dependence on peer tutors. Such students are able to enjoy the independent learning process, especially module-based (Schweder & Raufelder, 2024). Other studies have shown that intrinsic motivation plays a stronger role in encouraging students to be more actively involved in the inquiry process and be more diligent in the learning process. This causes intrinsic motivation to have a long-term influence on student learning development. Meanwhile, students who have stronger extrinsic motivation than intrinsic motivation only aim to obtain rewards or avoid negative things. This shows that extrinsic motivation has a shorter-term influence (Teng, 2025).

Students will be motivated if they are involved in activities and interact directly. Previous studies have shown that students who are motivated to work on homework believe that the assignments are beneficial to their academic development at school (Rodríguez et al., 2020) and enjoy collaborative learning with hands-on practice (Bailey et al., 2021). Furthermore, motivation can be enhanced by providing interactive media (Ningsih et al., 2019). In environmental learning, the presence of digital media is still necessary, including the use of social platforms, which are more promising in supporting adaptive learning designs (Husamah et al., 2025).

Ecosystem learning conducted using the SSI approach through the application of the ASICC learning model may not have a direct impact on increasing students' intrinsic motivation. Although ecosystem material has a broad context, it makes it easier for educators to connect concepts and theories with environmental conditions around students (Podungge et al., 2022). However, this finding can be explained by its alignment with the behavior change model theory of Prochaska & Velicer (1997). This theory states that when someone is about to make a behavioral change, there are crucial stages they must go through. One of these is the contemplation stage. At this stage, someone will consider alternatives, and this stage takes time (Stupnisky & Salahuddin, 2025). This explains why students' intrinsic motivation grades when learning about SSI-based ecosystems through the ASICC learning model are lower. This is consistent with the analysis of the characteristics of the students in the study. Students are not accustomed to intrinsic motivation for learning, including in biology. Teachers rarely intervene in student motivation through the presentation of case studies, problems, or environmental issues in Kediri. This study revealed that grade motivation was the first dimension of student motivation successfully activated in students who were not accustomed to learning motivation through the ASICC learning model with the SSI approach.

CONCLUSION

Grade motivation is a type of student motivation in learning ecosystem topics in biology subjects which is implemented using the ASICC learning model. However, the application of SSI through the ASICC learning model is still recommended as a strategy to improve students' motivation to learn biology.

ACKNOWLEDGMENT

This research topic is one of the collaborative research umbrellas between lecturers and students. Therefore, the author would like to thank the Directorate of Research, Technology, and Community Service, Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia for funding this research through the Applied Research Grant scheme with Contract Number 109/E5/PG.02.00.PL/2024 to the corresponding author.

REFERENCES

- Bailey, D., Almusharraf, N., & Hatcher, R. (2021). Finding satisfaction: intrinsic motivation for synchronous and asynchronous communication in the online language learning context. *Education and Information Technologies*, 26(3), 2563–2583. <https://doi.org/10.1007/s10639-020-10369-z>
- Byrne, L. B., Rauschert, E. S. J., Rodgers, V. L., Bowser, G., Casper, A., Dewsbury, B., Morales, N., Vance-Chalcraft, H. D., & Weber, L. (2025). Diversifying Ecology Education for Everyone Through More Inclusive, Interdisciplinary, and Accessible Teaching. *The Bulletin of the Ecological Society of America*, 106(2). <https://doi.org/10.1002/bes2.2233>
- Cahyani, V. P., Fadly, D., Islawati, I., & Ahmad, F. (2024). The Attitude of Chemistry Education Students to Socio-Scientific Issues (SSI) in Chemistry Learning. *INSECTA: Integrative Science Education and Teaching Activity Journal*, 5(2), 212–223. <https://doi.org/10.21154/insecta.v5i2.9812>
- Chowdhury, T. B. M., Holbrook, J., & Rannikmäe, M. (2019). *Teachers' Ownership Towards Using Socio-Scientific Issues for an Active Informed Citizenry*. 3834–3840. <https://doi.org/10.21125/edulearn.2019.0989>
- Cooke, J., Araya, Y., Bacon, K. L., Bagniewska, J. M., Batty, L. C., Bishop, T. R., Burns, M., Charalambous, M., Daversa, D. R., Dougherty, L. R., Dyson, M., Fisher, A. M., Forman, D., Garcia, C., Harney, E., Hesselberg, T., John, E. A., Knell, R. J., Maseyk, K., ... Lewis, Z. (2021). Teaching and learning in ecology: a horizon scan of emerging challenges and solutions. *Oikos*, 130(1), 15–28. <https://doi.org/10.1111/oik.07847>
- Deci, E. L., Koestner, R., & Ryan, R. M. (2001). Extrinsic rewards and intrinsic motivation in education: Reconsidered once again. *Review of Educational Research*, 71(1), 1–27. <https://doi.org/10.3102/00346543071001001>
- Dusturi, N., Nurohman, S., & Wilujeng, I. (2024). Socio-Scientific Issues (SSI) Approach Implementation in Science Learning to Improve Students' Critical Thinking Skills: Systematic Literature Review. *Jurnal Penelitian Pendidikan IPA*, 10(3), 149–157. <https://doi.org/10.29303/jppipa.v10i3.6012>
- Eccles, J. S., & Wigfield, A. (2020). From Expectancy-value Theory to Situated Expectancy-value Theory: A Developmental, Social Cognitive, and Sociocultural Perspective on Motivation. *Contemporary Educational Psychology*, 61, 101859. <https://doi.org/10.1016/j.cedpsych.2020.101859>
- Emda, A. (2018). Kedudukan Motivasi Belajar Siswa dalam Pembelajaran. *Lantanida Journal*, 5(2), 172. <https://doi.org/10.22373/lj.v5i2.2838>
- Glynn, S. M., Brickman, P., Armstrong, N., & Taasoobshirazi, G. (2011). Science Motivation Questionnaire II: Validation with Science Majors and Nonscience Majors. *Journal of Research in Science Teaching*, 48(10), 1159–1176. <https://doi.org/10.1002/tea.20442>
- Glynn, S. M., Taasoobshirazi, G., & Brickman, P. (2009). Science Motivation Questionnaire: Construct Validation with Nonscience Majors. *Journal of Research in Science Teaching*, 46(2), 127–146. <https://doi.org/10.1002/tea.20267>
- Hamalik, O. (2010). *Proses Belajar Mengajar*. PT Remaja Rosdakarya.
- Hermawan, H., Syarbini, A., & Asmawati, L. (2018). Penerapan Model Pembelajaran Student Teams Achievement Division (STAD) Dalam Pembelajaran IPA Untuk Meningkatkan Minat dan Hasil Belajar Siswa SD. *JTPPM (Jurnal Teknologi Pendidikan Dan Pembelajaran): Edutech and Instructional Research Journal*, 5(1), 14–26. <https://dx.doi.org/10.62870/jtppm.v5i1.7469>
- Huda, M. (2017). Kompetensi Kepribadian Guru Dan Motivasi Belajar Siswa (Studi Korelasi Pada Mata Pelajaran Pai). *Jurnal Penelitian*, 11(2), 237–266. <https://doi.org/10.21043/jupe.v11i2.3170>
- Husamah, H., Rahardjanto, A., Permana, T. I., & Lestari, N. (2025). Learning Media for Environmental Education, What Can the Scopus Database Tell Us? A Review. *Al Jahiz: Journal of Biology Education Research*, 6(1), 93–114. <https://doi.org/10.32332/al-jahiz.v6i1.10401>
- Jayadiningrat, M. G., & Ati, E. K. (2018). Peningkatan Keterampilan Memecahkan Masalah Melalui Model Pembelajaran Problem Based Learning (Pbl) Pada Mata Pelajaran Kimia. *Jurnal Pendidikan Kimia Indonesia*, 2(1), 1–10. <https://doi.org/10.23887/jpk.v2i1.14133>
- Kemmis, S., & McTaggart, R. (1988). *The Action Research Planner (3rd Edition)*. Deakin University Press.
- Kohn, A. (2011). The case against grades: When schools cling to letter and number ratings, students get stuck in a system that undermines learning. *Educational Leadership*, 69(3), 28–33. <https://www.ascd.org/el/articles/the-case-against-grades>
- Lin, T.-J., Deng, F., Chai, C. S., & Tsai, C.-C. (2013). High School Students' Scientific Epistemological Beliefs, Motivation in Learning Science, and Their Relationships: A Comparative Study within The Chinese Culture. *International Journal of Educational Development*, 33(1), 37–47.

<https://doi.org/10.1016/j.jjedudev.2012.01.007>

- Monika, M., & Adman, A. (2017). Peran efikasi diri dan motivasi belajar dalam meningkatkan hasil belajar siswa sekolah menengah kejuruan. *Jurnal Pendidikan Manajemen Perkantoran*, 2(2), 109–117. <https://doi.org/10.17509/jpm.v2i2.8111>
- Mubeen, S., & Reid, N. (2014). The Measurement of Motivation with Science Student. *European Journal of Educational Research*, 3(3), 129–144. <https://doi.org/10.12973/eu-jer.3.3.129>
- Ningsih, L. R., Rusdi, R., & Miarsyah, M. (2019). Exploring respiratory system to improve biological learning motivation: resysmart media application. *Biosfer*, 12(2), 211–222. <https://doi.org/10.21009/biosferjpb.v12n2.211-222>
- Oktiani, I. (2017). Kreativitas Guru dalam Meningkatkan Motivasi Belajar Peserta Didik. *Jurnal Kependidikan*, 5(2), 216–232. <https://doi.org/10.24090/jk.v5i2.1939>
- Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in Education: Theory, Research, and Applications* (2nd Edition, Ed.). Merrill.
- Podungge, R., Nusantari, E., Katili, A. S., Dama, L., Baderan, D. K., & Mamu, H. D. (2022). Analysis of Students Scientific Literacy Skills on Ecosystem Materials at Boalemo District Junior High School. *Nukleus: Jurnal Pembelajaran Dan Biologi*, 8(3), 694–702. <https://doi.org/10.36987/jpbn.v8i3.3231>
- Prochaska, J. O., & Velicer, W. F. (1997). The Transtheoretical Model of Health Behavior Change. *American Journal of Health Promotion*, 12(1), 38–48. <https://doi.org/10.4278/0890-1171-12.1.38>
- Qamara, N. D. (2024). *Implementasi Model Pembelajaran PjBL Dengan Metode Berdiferensiasi Produk Untuk Meningkatkan Motivasi Dan Hasil Belajar Biologi Kelas X SMAN 4 Madiun*. Universitas PGRI Madiun.
- Rodríguez, S., Piñeiro, I., Regueiro, B., & Estévez, I. (2020). Motivación intrínseca y utilidad percibida como predictores del compromiso del estudiante con los deberes escolares. *Revista de Psicodidáctica*, 25(2), 93–99. <https://doi.org/10.1016/j.psicod.2019.11.001>
- Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, 25(1), 54–67. <https://doi.org/10.1006/ceps.1999.1020>
- Ryan, R. M., & Deci, E. L. (2000b). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68–78. <https://doi.org/10.1037/0003-066X.55.1.68>
- Ryan, R. M., & Deci, E. L. (2020). Intrinsic and Extrinsic Motivation from A Self-determination Theory Perspective: Definitions, Theory, Practices, and Future Directions. *Contemporary Educational Psychology*, 61, 101860. <https://doi.org/10.1016/j.cedpsych.2020.101860>
- Ryan, R. M., & Weinstein, N. (2009). Undermining quality teaching and learning: A self-determination theory perspective on high-stakes testing. *Theory and Research in Education*, 7(2), 224–233. <https://doi.org/10.1177/1477878509104327>
- Sanchez, J. M. P., Picardal, M. T., Fernandez, S. R., & Caturza, R. R. A. (2024). Socio-Scientific Issues in Focus: A Meta-analytical Review of Strategies and Outcomes in Climate Change Science Education. *Science Education International*, 35(2), 119–132. <https://doi.org/10.33828/sei.v35.i2.6>
- Sanjaya, W. (2006). *Strategi pembelajaran berorientasi standar proses pendidikan*. Kencana Prenada Media Group.
- Santoso, A. M., Primandiri, P. R., & Zubaidah, S. (2024). Development of Student Worksheets Containing Green/Blue Economy for Prospective Teacher Students. In *9th Mathematics, Science, and Computer Science Education International Seminar, MSCEIS*((pp. 371-383)), 400–407. https://doi.org/10.2991/978-2-38476-283-5_37
- Santoso, A. M., Primandiri, P. R., Zubaidah, S., & Amin, M. (2021). Improving student collaboration and critical thinking skills through ASICC model learning. *Journal of Physics: Conference Series*, 1806(1). <https://doi.org/10.1088/1742-6596/1806/1/012174>
- Schunk, D. H., & DiBenedetto, M. K. (2020). Motivation and Social Cognitive Theory. *Contemporary Educational Psychology*, 60, 101832. <https://doi.org/10.1016/j.cedpsych.2019.101832>
- Schweder, S., & Raufelder, D. (2024). Why Does a Self-learning Environment Matter? Motivational Support of Teachers and Peers, Enjoyment and Learning Strategies. *Learning and Motivation*, 88, 102067. <https://doi.org/10.1016/j.lmot.2024.102067>
- Setiani, D. E., Purwoko, B., Sulistiyowati, T. I., Primandiri, P. R., & Santoso, A. M. (2024). Application of the ASICC Learning Model in Human Physiological System to Improve Students' Critical Thinking

- and Creative Thinking Skills. *Biosfer*, 17(2), 485–492. <https://doi.org/10.21009/biosferjpb.44325>
- Smith, B. P. (2010). Instructional Strategies in Family and Consumer Sciences: Implementing the Contextual Teaching and Learning Pedagogical Model. *Journal of Family & Consumer Sciences Education*, 28(1), 23–38.
- Soga, M., Gaston, K. J., Fukano, Y., & Evans, M. J. (2023). The Vicious Cycle of Biophobia. *Trends in Ecology & Evolution*, 38(6), 512–520. <https://doi.org/10.1016/j.tree.2022.12.012>
- Stupnisky, R. H., & Salahuddin, M. (2025). Motivation is Important, But Can It Be Improved? Examining Faculty Perceptions of Research Motivation and Productivity Interventions. *Higher Education*. <https://doi.org/10.1007/s10734-025-01546-5>
- Sudarmin, S., Pujiastuti, Rr. S. E., Asyhar, R., Tri Prasetya, A., Diliarosta, S., & Ariyatun, A. (2023). Chemistry Project-based Learning for Secondary Metabolite Course with Ethno-STEM Approach to Improve Students' Conservation and Entrepreneurial Character in The 21st Century. *Journal of Technology and Science Education*, 13(1), 393. <https://doi.org/10.3926/jotse.1792>
- Sudibyo, E., Jatmiko, B., & Widodo, W. (2017). Pengembangan Instrumen Motivasi Belajar Fisika: Angket. *Jurnal Penelitian Pendidikan IPA*, 1(1), 13. <https://doi.org/10.26740/jppipa.v1n1.p13-21>
- Suharni, S. (2021). Upaya Guru dalam Meningkatkan Motivasi Belajar Siswa. *G-Couns: Jurnal Bimbingan Dan Konseling*, 6(1), 172–184. <https://doi.org/10.31316/g.couns.v6i1.2198>
- Supriani, Y., Arifudin, O., & Kartika, I. (2020). Upaya Meningkatkan Motivasi Peserta Didik dalam Pembelajaran. In *Jurnal Al-Amar (JAA)* (Vol. 1, Number 1).
- Suryani, Y., & Anggraini, W. (2025). The Effect of Socio-Scientific Issues Approach on Student Learning Outcomes in Physics Learning: A Review. *Jurnal Pijar Mipa*, 20(3), 509–514. <https://doi.org/10.29303/jpm.v20i3.8861>
- Teng, M. F. (2025). Examining longitudinal development of writing motivation in the GenAI context: A self-determination theory perspective. *Learning and Motivation*, 91, 102157. <https://doi.org/10.1016/j.lmot.2025.102157>
- Zidan, Z., Maftuhah Maftuhah, Diana Yusti, Adi Rahmat, Riandi Riandi, & Kusnadi Kusnadi. (2023). Learning Strategies on Ecosystem Concepts and Environmental Change: A pedagogical Study Analysis. *Assimilation: Indonesian Journal of Biology Education*, 6(2), 141–152. <https://doi.org/10.17509/aijbe.v6i2.59777>