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Implementing Character Education in Biology Learning to Foster Environmental Awareness Among High School Students of SMA Negeri 20 Medan

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Abstract

Background: *Character education is essential to achieving the Sustainable Development Goals (SDGs), particularly in shaping a principled and environmentally conscious generation. This study aims to describe the implementation of character education in biology lessons at SMA Negeri 20 Medan.* **Methodology:** *The method used is qualitative with a case study, involving biology teachers and 10th-grade students selected purposively. Data was collected through participant observation, semi-structured interviews, and documentation, then validated through triangulation of sources and methods.* **Findings:** *The results of the study indicate that character education is integrated through intraschool activities such as group prayers, laboratory experiments, discussions, and classroom cleanliness, and reinforced through extracurricular activities like Rohis. Teachers applied varied strategies, particularly Contextual Teaching and Learning (CTL), effectively fostering students' environmental awareness. The impact of implementation was evident in changes in students' attitudes, such as becoming more disciplined, responsible, and environmentally conscious.* **Contribution:** *These findings align with previous research on the effectiveness of contextual learning but contribute new insights by emphasizing the integration of intraschool and extracurricular activities as a simultaneous model for character education.*

Keywords: *Character Education; Biology Learning; Contextual Teaching and Learning; Environmental Awareness; Case Studies*

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INTRODUCTION

Education plays a strategic role in shaping an intelligent generation that has good character, and is competitive amid the dynamics of the 21st century. The advancement

of technology and globalization demands that students not only excel in cognitive aspects but also possess moral sensitivity and social responsibility. This aligns with the national education objectives outlined in Law Number 20 of 2003, which aims to cultivate individuals who are faithful, pious, of noble character, healthy, intelligent, independent, and responsible individuals. Therefore, integrating character education into learning is essential to prepare a generation that is academically excellent and morally upright (Ifrianti & Ningrum, 2020).

Theoretically, character education is understood as a guidance process to help students develop holistically, encompassing aspects of the heart, mind, body, and behavior (Samani & Hariyanto, 2013). Salahudin & Alkrienciehie (2013) define it as an effort to instill morals and good character to shape good behavior in daily life. Zubaedi (2012) emphasizes that character education is a systematic plan by teachers to instill ethical values comprehensively, while Azzet (2014) views it as a system for instilling positive values to align knowledge, attitudes, and actions. Thus, character education is not merely about discipline and morality but also about consistent personality development in real actions. Based on these perspectives, it is evident that character education serves by Lidi et al., (2022) as a cornerstone for the Indonesian nation in addressing the challenges of the digital age, where various groups can easily access information that is open, free, and unrestricted.

From an Islamic perspective, the importance of character education is also emphasized in the interpretation of Surah Luqman verses 13–14. The interpretation by Ministry of Religious Affairs Indonesia Republic (2019) states that these verses convey two main messages: the prohibition of associating partners with Allah, which reinforces the religious aspect, and the command to honor one's parents, which reflects responsibility and discipline. These moral values are highly relevant in fostering religious attitudes, responsibility, and concern for the environment in the context of contemporary education.

However, character building requires serious attention from various parties, ranging from the government, society, families, and schools, because schools are strategic institutions for instilling character values in students. Through character education, students are expected to be able to independently utilize their knowledge, analyze, and internalize moral values and noble ethics so that they can be manifested in real behavior in daily life within society (Sari, 2017). In the context of biology education, character education has strong relevance because biology material is closely related to life and the environment. Biology teaches scientific concepts and fosters scientific attitudes such as honesty, discipline, responsibility, and concern for nature. Students can understand the connection between theory and real-life situations through contextual learning, allowing character values to develop naturally. Thus, Biology serves a dual purpose: equipping students with scientific knowledge while instilling character values. Biology teaches scientific concepts and cultivates scientific attitudes such as honesty, discipline, responsibility, and concern for nature. The subject of Biology is a systematic collection of theories, with applications generally limited to natural phenomena, and it has emerged and developed through scientific methods such as observation and experimentation. Biology education also requires scientific attitudes, including curiosity, openness, honesty, and other positive attitudes. Based on this, it can be understood that biology learning not only focuses on knowledge

aspects but also plays an important role in instilling character education values that every student needs after going through the learning process (Maisyaroh & Miterianifa, 2023). Students can understand the connection between theory and everyday life through contextual learning, allowing character values to develop naturally. Thus, Biology serves a dual purpose: equipping students with scientific knowledge while instilling character values. However, the main challenge in implementing character education in biology learning lies in the ability of teachers to balance cognitive development with character building in students. This difficulty arises due to the complexity of biology material and the demand to integrate character values into it (Sari & Rivan, 2024).

SMA Negeri 20 Medan faces challenges in integrating character education, particularly concerning environmental awareness. According to Ministry of National Education and Culture (2010), environmental awareness is an attitude and action that continually strives to prevent damage to the natural environment around us and to develop efforts to repair damage that has already occurred. However, initial observations indicate that despite regular activities such as classroom cleanliness and tree planting, some students remain inconsistent in maintaining the environment, for example, littering or being less active in greening programs. These challenges are exacerbated by limited facilities and family support, resulting in the implementation of character values not being fully realized. This situation underscores the need for more systematic and innovative learning strategies. Character education plays a crucial role in shaping a generation with positive personalities. The process of instilling these noble values requires active involvement from educators, as the role of teachers cannot be replaced by technology. This is because teachers serve as role models who instill moral values, tolerance, and goodness in students (Rusmalinda, 2025). Previous studies have shown the success of character education in biology education. Hendriani et al., (2025) found that environmental awareness at SMAN 7 Mataram positively impacted learning outcomes. Zami (2024) emphasized the importance of habit formation through routine activities and environmental projects at MAN 1 Probolinggo, while Siregar & Ulfa (2022) highlighted the role of teachers as role models in instilling values of tolerance and health awareness at an integrated Islamic school. However, most of these studies still focus on one or two dominant values, not on the simultaneous application of multiple character values.

The novelty of this study lies in integrating five key character values—religious, honest, disciplined, responsible, and environmentally conscious—which are simultaneously applied in biology lessons at SMA Negeri 20 Medan. This approach emphasizes cognitive aspects and aims to foster environmental awareness through teacher modeling, contextual learning strategies, including Contextual Teaching and Learning (CTL), and student involvement in real-world activities. Based on this, the study aims to describe the implementation of character education, identify the strategies used, and analyze their impact on students' environmental awareness at SMA Negeri 20 Medan.

METHOD

Type of Research

This research uses a qualitative approach with a single case study design. This design was chosen because it is able to explore phenomena in depth in a real context. According to Nasution (2023) this design by paying attention to the dynamics of participants and the environment.

Research Location and Subjects

The research was conducted at SMA Negeri 20 Medan with the observation subjects being one first grade (10th- class) consisting of 30 students. The observation was carried out to record the dynamics of biology learning and student behavior related to character education. From that class, 10 students were selected for interviews using purposive sampling, considering the representativeness of participation levels and variations in attitudes toward environmental activities. The number of 10 students was deemed sufficient to obtain in-depth data in accordance with qualitative research principles. Additionally, the interview subjects included 1 Biology teacher acting as the learning facilitator and 1 school principal providing perspectives on policy and the implementation of character education at the institutional level (Sugiyono, 2017).

Research Instruments

The main instrument is the researcher himself, assisted by observation guidelines, interview guidelines, and supporting documents. Observations were conducted participatively on all tenth-grade students to record the implementation of character values in biology learning and school activities (Aswidar & Saragih, 2022). Semi-structured interviews were conducted with the principal, Biology teachers, and 10 selected students to obtain in-depth and flexible data. Documentation in the form of lesson plans, school activity records, and student reflections was used to reinforce the findings.

Data Analysis Techniques

Data analysis uses Miles and Huberman's interactive model, which includes data reduction, data presentation, and conclusion drawing. The analysis process is cyclical until consistent themes are obtained (Wibowo & Muhamad, 2024).

Data Validity Testing

Data validity is strengthened through source triangulation (teachers, students, school principals), method triangulation (observation, interviews, documentation), and member checking to confirm the researcher's interpretation to the participants (Sugiyono, 2017).

RESULT AND DISCUSSION

Implementation of Character Education in Biology Learning

The implementation of character education in biology learning at SMA Negeri 20 Medan covers five main values: religious, honest, disciplined, responsible, and environmentally conscious. Religious values are instilled through the habit of praying before and after lessons, as well as linking biology material with gratitude for God's creation. The value of honesty is demonstrated in laboratory activities, where students are required to record observation results accurately without manipulating data. The value of discipline is cultivated through the habit of submitting assignments on time and maintaining classroom order during the learning process. The value of responsibility is evident when students are assigned group tasks and must complete their work according to their respective roles. Meanwhile, environmental awareness is realized through activities such as maintaining classroom cleanliness, waste management, and student involvement in school greening projects.

This finding aligns with Zubaedi (2012) that character education is a process of internalizing moral values in real learning activities. This means that character building in biology learning does not stop at the cognitive realm but is integrated into students' daily attitudes and behaviors. This is reinforced by Maya et al., (2017), who demonstrated that the implementation of character education values in Biology learning at the senior high school level can be carried out through the integration of moral values and environmental awareness into the subject matter, thereby enabling students not only to comprehend the concepts but also to actualize these values in real-life actions consistently.

Table 1. Thematic Matrix 1: Implementation of Character Education in Biology Learning

No	Character Values	Data Source	Data Quote	Interpretation
1	Religious	Biology Teacher	"At the beginning of each lesson, we pray, and I remind students to be grateful for God's creation."	Biology education is linked to religious values.
2	Honest	Student	"During the practicum, we were asked to write according to our observations. We were not allowed to fabricate data."	Honesty is cultivated through practical activities.
3	Discipline	Observation	Students submit assignments on schedule and maintain classroom order.	Teachers instill discipline in accordance with classroom rules.

No	Character Values	Data Source	Data Quote	Interpretation
4	Responsibility	Biology Teacher	"In group assignments, I assign each student a role so that they learn to be responsible".	Students are trained to complete tasks according to their respective responsibilities.
5	Caring for the environment	Observation	Students clean the classroom and participate in greening activities.	Learning encourages concern for the school environment

The matrix above shows that various practical activities integrate religious values, honesty, discipline, responsibility, and environmental awareness into biology learning. Teachers serve as role models by encouraging prayer and linking biology material to gratitude, thereby helping students internalize religious values. Practical activities encourage honesty in data recording, while assignment collection rules reinforce discipline. Assigning roles in group work builds individual responsibility, and routine cleaning and greening activities foster environmental awareness. These findings confirm that character education in Biology learning is not merely a transfer of values but a process of habit formation through contextual activities. This aligns with Samani & Hariyanto (2013) theory that effective character development occurs when consistently trained through activities relevant to students' lives.

Of the five character values, several activities most effectively bring about real change in students. First, praying together before and after class has been proven to establish a religious routine that strengthens the spiritual atmosphere in the classroom, allowing students to be calmer and more focused on their studies. Second, biology practicals are the most effective medium for instilling the value of honesty, as students are confronted with empirical data that cannot be manipulated. Third, regular classroom cleaning activities foster environmental awareness, as students see the direct impact of maintaining or neglecting the cleanliness of their learning space. These three activities demonstrate that character is more easily instilled when linked to routine and contextual activities that involve direct experience.

Biology Learning Strategies to Foster Environmental Awareness

Teachers play a crucial role in fostering environmental awareness through science education, as they can guide students to understand and internalize values of care for nature (Hasibuan & Sapri, 2023). In line with this, the learning strategies used by biology teachers at SMA Negeri 20 Medan are varied, including interactive lectures, group discussions, project-based learning, teacher role modeling, and a contextual approach (Contextual Teaching and Learning (CTL). These strategies not only serve to convey biology material but also act as a means of internalizing character values in students.

In interactive lectures, teachers emphasize the values of discipline and responsibility when delivering material, for example, by reminding students of the

importance of consistency in maintaining the environment. This aligns with the opinion (Nadia et al., 2025) that character education can be achieved by cultivating attitudes such as instilling discipline to create a conducive atmosphere. With such habits being cultivated and applied in daily life, students' thinking patterns will be shaped, thereby fostering students with a tolerant character and preventing intolerant attitudes.

Furthermore, group discussions are used to instill the values of cooperation, respect for others' opinions, and train members' responsibility in completing tasks. Project-based learning is done through creative assignments, such as making energy-saving posters, which train creativity while increasing students' awareness of environmental issues. In addition, teacher modeling proved to be an effective strategy; teachers consistently maintained classroom cleanliness and used polite language, which students indirectly emulated.

Contextual teaching and learning (CTL) was the most prominent method because it encouraged students to relate biology concepts to their daily experiences. For example, the teacher took 30 tenth-grade students outside to observe the school's environmental conditions. Twenty-five students actively took notes on findings related to yard cleanliness, plant types, and waste conditions. In comparison, five students were initially passive but eventually became involved after being guided by their groupmates. Interactions occurred naturally; students discussed, pointed out specific areas, and even compared observation results between groups. After the activity, students reflected that they had become more aware of the importance of maintaining school cleanliness. This activity demonstrates that CTL strengthens understanding of ecosystem concepts and fosters environmental awareness through concrete experiences.

Group discussions also revealed the social dynamics among students. They were divided into five groups of six members each. During discussions on solutions for school waste management, some students dominated the conversation, while others remained quiet. The teacher intervened by allowing all members to express their opinions. Eventually, students who were usually passive began to voice their ideas. The discussion results were presented alternately, and this interaction fostered self-confidence and responsibility within the group. This aligns with research conducted by Muharna et al., (2023) to support character education in science learning at SMPN 1 Parepare, where teachers developed co-curricular activities in science learning by assigning tasks such as interviews and observations to be completed in groups. The results were reported in written form and presented in class, which helped instill the character of cooperation among peers. Kusuma (2025) also noted that group discussion methods are considered effective in instilling values of collaboration, responsibility, and integrity. Biology teachers at School emphasized that group discussion-based learning enhances student participation while training them to take responsibility for assigned tasks. These findings align with recent research stating that collaboration in the learning process helps students recognize the importance of individual roles and contributions in achieving common goals.

In the project strategy, students were asked to create posters encouraging environmental protection. Eighteen students demonstrated high creativity by adding images, colors, and catchy slogans, while others opted for a more straightforward

approach. All posters were successfully collected on time and displayed in the classroom. Student response was positive; some even shared their work on social media. This demonstrates that project-based learning enhances environmental awareness and motivates students to spread positive messages to a broader community.

Table 2. Thematic Matrix 2. Teacher Learning Strategies in Character Education

No	Strategy	Data Source	Data Quote	Interpretation
1	Interactive Lecture	Biology Teacher	"I explain the concept while reminding students of the importance of discipline and responsibility".	Lectures are used to link biology material with character values.
2	Group Discussion	Student	"When discussing, we must work together so that the results are good and everyone plays a role".	Discussions foster cooperation, tolerance, and responsibility.
3	Project-based learning	Observation	Students create posters about protecting the environment	A project that develops creativity and environmental awareness.
4	Teacher Role Models	Headmaster	"Teachers set an example by helping to keep the classroom clean".	Teachers serve as role models for real-life behavior.
5	CTL	Biology Teacher	"I asked them to observe the school environment's condition and then to find simple solutions".	CTL helps students connect biology concepts to everyday experiences and fosters environmental awareness.

Table 2 shows that the teachers' learning strategies are integrative and contextual. Interactive lectures provide a conceptual foundation accompanied by moral values, group discussions foster social skills, projects strengthen creativity and awareness, while the teachers' exemplary behavior serves as a source of inspiration for student behavior. The most significant aspect is the implementation of CTL, which has proven effective because students receive information and directly experience environmental issues in their surroundings. Through these experiences, students more easily internalize character values, particularly environmental concern. This reinforces Johnson (2014) that contextual learning can foster a deeper meaning of learning, as students build understanding through interaction with the realities of their lives.

Husaini (2019) also revealed that the direct involvement of students in environmental projects can effectively instill values of responsibility and social awareness.

Impact of Implementation on Students' Environmental Awareness

The study results show a change in student behavior after participating in biology lessons integrated with character education. Before the intervention, some students tended to be passive toward environmental issues; they were less concerned about classroom cleanliness, disposed of trash carelessly, and only a few actively participated in school-based environmental activities. After implementing the learning strategy, particularly through CTL, there was a shift in attitude: students became more disciplined in maintaining cleanliness, actively participated in discussions about environmental solutions, and enthusiastically worked on projects such as creating energy-saving posters. This change demonstrates that contextual learning can foster environmental awareness by connecting biological concepts to real-world experiences. Zami (2024) also stated that learning through CTL has a positive impact because learning is not always limited to classroom activities involving only listening to explanations, but also needs to be conducted outside the classroom so that students can understand the actual conditions. For example, environmental damage caused by littering in rivers may only be known through pictures in class, but by going directly to the field, students can see the impact in real life. Therefore, theoretical learning and concrete experiences need to be introduced in a balanced manner so that the knowledge gained is more meaningful.

Table 3. Thematic Matrix 3: Impact of Character Education Implementation on Students' Environmental Awareness

No	Impact	Data Source	Data Quote	Interpretation
1	Change of attitude	Student	"I used to litter a lot, but now I remember to throw my trash in the right place".	There has been a shift in attitude towards caring for the environment.
2	Increased participation	Biology Teacher	"After the CTL activity, more students got involved in keeping the classroom clean".	CTL increases student engagement in real-world action
3	Collective concern	Observation	Most students are actively involved in environmental poster projects.	Environmental awareness develops into collective action

The matrix above shows that the implementation of character education positively impacts changes in student attitudes. Environmental awareness values are beginning to appear in daily behavior, participation is increasing, and collective awareness is beginning to form through joint activities. These changes confirm the effectiveness of contextual strategies in fostering environmental awareness.

Table 4 shows the shift in student behavior after implementing character-based learning strategies, particularly through CTL. The most significant changes were seen in increased participation and environmental awareness.

Table 4. Dynamics of Changes in Student Behavior Before and After Intervention

No	Aspect	Before Intervention	After Intervention
1	Attitude	Not caring about cleanliness, still often littering	Be more disciplined in maintaining cleanliness and disposing of trash in its proper place.
2	Participation	Only a small percentage of students are active in environmental activities.	Most students actively participated in discussions, observations, and poster projects on environmental conservation.
3	Responsibility	Group assignments are often done only by certain students.	All members of the group are involved according to their respective roles.

Obstacles and Supporting Factors in The Implementation of Character Education

Implementing character education through biology lessons at SMA Negeri 20 Medan is not without obstacles and supporting factors. The main obstacle faced by teachers is limited learning time. This condition prevents the internalization of character values, especially in the affective and psychomotor domains, from being carried out in depth. Additionally, some students exhibit passive tendencies at the initial stages of activities, necessitating teachers to provide repeated guidance to ensure all students actively participate. Another challenge stems from the family environment, as not all parents consistently support environmentally conscious habits, resulting in practices instilled at school often not continuing at home.

Meanwhile, the implementation of character education also receives support from various factors that strengthen its effectiveness. Rohis extracurricular activities are essential for fostering religious values and responsibility through the habit of worship and social activities. The role of the student council (OSIS) and school security officers also contributes to maintaining order and instilling discipline in the school environment. Additionally, the availability of CCTV surveillance helps monitor student behavior more comprehensively. These factors collectively strengthen the character-building process, so that despite the challenges, the implementation of character education can still proceed effectively and consistently.

CONCLUSION

This study shows that the implementation of character education in biology lessons at SMA Negeri 20 Medan successfully instilled religious values, honesty, discipline, responsibility, and environmental awareness through various strategies, particularly

the Contextual Teaching and Learning (CTL) approach, which proved effective in fostering students' environmental awareness. These findings align with previous relevant research confirming the effectiveness of contextual learning, but differ in that they highlight the integration of both intraschool activities (laboratories, discussions, and classroom cleanliness) and extracurricular activities (Rohis) in supporting character development. These findings contribute significantly theoretically by reinforcing the concept of contextual character education, practically by guiding teachers in designing meaningful learning experiences while instilling character values, and policy-wise by encouraging schools to develop more integrated and sustainable character education programs. Thus, this study affirms that character education can be successful when implemented simultaneously through real learning experiences and school environment support. The implications of this research are the need for teachers to consistently apply contextual learning in instilling character values and school support in providing programs and supporting facilities to ensure the sustainability of character development.

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