



Applying the STEAM Approach in IPAS Learning to Instill Discipline Character in Islamic Elementary School

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Abstract

This research aims to describe the implementation of the STEAM approach in Natural and Social Sciences (IPAS) learning and analyze the instilling of discipline character in 4th-grade students at SD Islami Qur'ani, East Lampung. The study employed a qualitative approach with a case study design involving 12 students and one classroom teacher as research subjects. Data were collected through participant observation across six sessions, in-depth interviews, and documentation, focusing on a simple water filter project themed around the water cycle. The findings indicate that the STEAM approach effectively instills three forms of discipline character simultaneously: procedural discipline, reflected in adherence to scientific step sequences; time discipline, through the timely completion of tasks aided by timers and learning contracts; and responsibility discipline, which arises from the awareness of fulfilling roles following technical failures within the group. The internalisation of these characters was supported by the teacher's role as a facilitator, the accessibility of low-cost practical materials, and the reinforcement of Islamic values regarding amanah (trustworthiness), while inhibiting factors included variations in students' learning paces and limited meeting time. This study concludes that the natural consequences mechanism within STEAM is capable of intrinsically re-engineering student discipline through direct experience. As a recommendation, future researchers are expected to conduct longitudinal studies to test the stability and resilience of students' discipline character over a longer period and across different subject contexts.

INTRODUCTION

Character education has become one of the main agendas in Indonesia's national education system, especially since the enactment of the Independent Curriculum which emphasizes the establishment of the Pancasila Student Profile as the main axis of educational transformation (Zainuddin et al., 2025). In this grand vision, character is not only seen as additional material, but as the main substance whose position is equivalent to the mastery of students' cognitive competencies (Ratnawati

et al., 2024; Nur Hidayat & Qodat, 2026). Among the various character elements that want to be instilled, discipline occupies a very fundamental position because its function is as a foundation for the development of self-quality, discipline is not simply interpreted as obedience to school rules outwardly, but as a person's ability to manage himself, respect time, and be responsible for tasks and commitments carried out consciously (Aryani & Yuliarti, 2023). Without discipline, other characteristics such as responsibility, hard work, independence, and integrity will be difficult to develop optimally, because discipline is the driving force for consistency of behavior in achieving academic and social goals (Yulia et al., 2025; Lumadi, 2025; Yuliana et al., 2025).

At the elementary school level, especially in grade 4, children are in an important transition period between the stage of concrete operational thinking to the stage of abstract thinking, based on the perspective of the development of cognitive psychology, students in the age range of 9 to 10 years begin to be able to understand more systematic cause-and-effect relationships, but they still need real hands-on experience so that abstract values such as discipline can be deeply embedded (Siregar et al., 2025; Susanto & Wulandari, 2024). The value of discipline will not be effective if it is only memorized through text or imposed from the outside through adult authority without any understanding of meaning (Shiddiq et al., 2024; Jayanti et al., 2025;). This concrete operational period requires an empirical learning stimulus (direct experience), where children can see and practice directly the values being taught through relevant scientific activities (Abdullah et al., 2022; Saracho, 2023). If discipline education is only provided through one-way indoctrination, students tend to view it as an external pressure to be avoided in the absence of supervision, rather than as a functional necessity for the success of their activities (Herrán-Gascón & Rodríguez-Herrero, 2024; Firayani, 2026).

Facts in the field show that the cultivation of discipline character in many elementary schools still faces various systemic problems, even though discipline character tends to be very important to be instilled from an early age as a provision in socializing in every student. As various studies show that there are still many students who show less disciplined behavior, among others, it can be seen from delays in collecting assignments, non-compliance with the practicum procedures that have been set, and inequality of responsibility in group work situations (Addelia Agustin & Munisah, 2025; Arodani et al., 2025; Damayanti et al., 2025). This phenomenon of indiscipline is a real challenge, including Islamic-based Private Elementary Schools (SDS) under the auspices of Islamic education foundations. As an educational institution that prioritizes the integration of religious values, SDS Islam has a moral burden to produce a generation that has noble manners. From an Islamic perspective, discipline is closely related to the values of the Islamic world. *Trust* (responsibility for duties) and *Itqan* (accuracy and professionalism in work) (Hayati & Zahroh, 2025; Hidayat & Thoha, 2026). However, there is often a disconnect where the value of religion stops at the theoretical level in religious studies, but has not been practically integrated in the academic activities of science in the classroom (Rosyada et al., 2024; Mirza, 2024).

The emergence of undisciplined behavior is caused by various things, ranging from learning methods that do not actively involve students to the absence of consequences or strict sanctions, either naturally or through disciplinary actions from educators that are educational (Muslihin & Sariati, 2025). Learning that has been carried out by several teachers, such as lecture methods and assignments from one-way textbooks, makes students passive and does not feel the direct impact of instilling indiscipline in the classroom (Utami & Harmanto, 2022). In this rigid learning pattern, students lose intrinsic motivation because the learning process is felt to be irrelevant to their daily needs. According to the theory of self-determination

(*Self-Determination Theory*), external reprimands or punishments are often ineffective in the long run because students do not develop an awareness within themselves of the reasons behind a rule (Frank & Kohn, 2023; Ryan & Deci, 2023). As a result, discipline that is practiced outside the classroom such as during ceremonies or other formal activities is not naturally connected to the academic learning experience in the classroom, in the end teachers often experience difficulties in instilling discipline because of the absence of a sanction mechanism or direct action that students feel when students are not disciplined in the learning process (Apriyanti et al., 2024; Nwaokugha & Nworgu, 2026).

The disconnect between the rules and the real impact in the previous Natural and Social Sciences (IPAS) learning often leads students to think that neglecting practicum procedures is not a big risk for the individual himself. In conventional methods, students' mistakes in following the experimental procedure usually only lead to a reduction in assessment points that are abstract on paper, without any direct technical responsibility burden being felt (Rinto Alexandro et al., 2021). Therefore, an innovative pedagogical approach is needed that is able to synergize mastery of science concepts with character training that has real consequences for success in instilling character in students. One of the approaches that is currently being developed to address these challenges is the STEAM approach (*Science, Technology, Engineering, Arts, and Mathematics*). STEAM emphasizes real problem-solving through a systematic, collaborative, and creative process, where each stage has procedures that must be followed sequentially and measurably (Segarra-Morales & Juca-Aulestia, 2024; Yakman & Lee, 2012).

The uniqueness of the STEAM approach in the character education dimension lies in the mechanism of "natural consequences" (*Natural Consequences*), in the STEAM framework, students are positioned as designers or engineers who must solve technical problems, if a student does not follow engineering procedures (*Engineering*) correctly, not being careful in measuring, or ignoring the sequence of steps, then the project he is working on will fail to function technically (Segarra-Morales & Juca-Aulestia, 2024; Siregar et al., 2023). This creates a situation where discipline grows from within the student as a logical necessity, where if the student wants the project to succeed and the water to be clear (in the context of a water filter), then they are obliged to follow the instructions and time management that has been set. Discipline is no longer seen as a forced rule, but rather as a technical prerequisite for achieving the goals of the student's work, in addition, the integration of elements *Arts* (art) gives space of ownership (*sense of ownership*) for students to their work, which is expected to foster the discipline of responsibility to maintain tools and complete tasks as well as possible (Roshayanti et al., 2022; Siregar et al., 2023).

Although the STEAM approach has the potential to improve conceptual understanding, creativity, and high-level thinking skills has been widely documented in various national and global literatures, research focuses that specifically associate STEAM with the simultaneous cultivation of disciplinary character are still very rare. Most STEAM research in Indonesia tends to focus on cognitive learning outcomes or science literacy skills in public elementary schools as research from (Fadhilah et al., 2024; Muntamah et al., 2023; Muntazah et al., 2025; Riyanto & Kawuryan, 2025; Zubaidah, 2019). There is still a lack of literature that describes in depth how the process of internalizing discipline through the STEAM stages takes place in a real classroom setting, especially in Islamic elementary schools that have strong religious values about order and consistency. Without an understanding of the process, teachers tend to apply STEAM only for purely academic purposes, while the optimization of its potential in character education, especially the character of the discipline, is not applied deeply to students.

This literary void is a strong foundation for the urgency of conducting research at SD Islami Qur'ani East Lampung, as a private school that has a strong religious foundation but still follows the national curriculum, SD Islami Qur'ani faces representative challenges on how to manage student discipline in the context of active IPAS learning. Through the selection of the "Simple Water Filter" project, this study seeks to dissect how this approach trains the accuracy of steps (procedural discipline), the accuracy of task completion (time discipline), and individual accountability in the group (responsibility discipline). The integration of Islamic values such as *amanah* and *mu'awanah* (cooperation) is an integral part of the design of this research, where individual discipline is positioned as the key to collective success.

The novelty of this research lies in the effort to present a contextual picture in which the STEAM approach is integrated into the learning of IPAS not only to master the concept of the water cycle in the subject matter, but also to be able to naturally cultivate the character of discipline through procedural discipline, time discipline, and responsibility discipline. Based on this, the purpose of this study is to describe the application of the STEAM approach in social studies learning and analyze how the cultivation of discipline character occurs through this approach in grade 4 elementary school students. Through this exploration, it is hoped that an effective learning pattern can be formulated in building student discipline through meaningful direct experience, so that discipline is no longer seen as a shackling rule, but as the main key to the success and usefulness of the work.

METHODS

Research Design

This study employed a qualitative research approach using a case study design to explore in depth how the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach in IPAS (Natural and Social Sciences) learning contributes to the cultivation of discipline character among elementary school students. A qualitative case study was considered appropriate because it allows researchers to investigate a bounded educational phenomenon within its real-life context and capture participants' experiences, interactions, and behavioral changes comprehensively (Armenta & Dominguez, 2024). The study focused on understanding not only the implementation of STEAM-based learning but also the process through which discipline values were internalized during classroom activities.

Research Setting and Participants

The research was conducted at SD Islami Qur'ani, East Lampung, Indonesia, during the even semester of the 2025/2026 academic year over a period of three weeks. This school was selected purposively because it integrates Islamic values into daily learning practices while implementing the Independent Curriculum, making it relevant for investigating character education.

Participants consisted of 12 fourth-grade students (aged 9–10 years) and one homeroom teacher directly involved in the IPAS learning process. The student participants were selected because Grade 4 students are at the transitional stage from concrete operational to early abstract thinking, where experiential learning significantly influences character formation (Saracho, 2023). Additionally, four students were purposively selected for in-depth interviews, representing low, moderate, and high initial discipline levels based on teacher assessment and preliminary observations. This purposive sampling strategy enabled the study to capture diverse disciplinary behaviors and responses.

Data Collection Techniques

Data were collected using three complementary techniques to ensure data richness and triangulation.

First, participant observation was conducted across six learning sessions (2 × 35 minutes each). The researcher observed student behaviors during the STEAM-based project, focusing on indicators of discipline character, including procedural discipline, time discipline, and responsibility discipline. Observation notes documented interactions, compliance with procedures, task completion, and group dynamics.

Second, semi-structured interviews were conducted with the classroom teacher and selected students. The interview protocol explored participants' perceptions regarding the STEAM learning process, disciplinary challenges, and behavioral changes during project implementation. Semi-structured interviews allowed flexibility while maintaining alignment with research objectives.

Third, documentation was used to support primary data, including classroom photographs, student worksheets, project outputs, and learning contracts. These documents served as supplementary evidence for validating observational and interview findings. The STEAM project involved constructing a simple water filter using recycled materials such as plastic bottles, gravel, sand, charcoal, cotton, and cloth. This project was selected due to its alignment with the IPAS topic on the water cycle and environmental sustainability.

Data Analysis

Data were analyzed using the interactive model of Miles, Huberman, and Saldaña (2014), consisting of three stages: data condensation, data display, and conclusion drawing/verification. During data condensation, raw field notes, interview transcripts, and documentation were coded and categorized according to the three discipline dimensions. The data were then organized into thematic matrices to identify patterns and relationships among observed behaviors. Finally, conclusions were drawn iteratively by comparing findings across multiple data sources to ensure analytical consistency.

Trustworthiness

To ensure research rigor, the study applied trustworthiness criteria. Credibility was established through source and method triangulation, combining observation, interviews, and documentation. Member checking was conducted with the classroom teacher to confirm interpretative accuracy. Dependability was strengthened by maintaining detailed field notes and an audit trail of analytical decisions. Confirmability was ensured by minimizing researcher bias through reflective memos throughout the research process.

RESULTS AND DISCUSSION

This section presents the empirical findings concerning the implementation of the STEAM approach in IPAS learning and its role in cultivating discipline character among fourth-grade students at SD Islami Qur'ani, East Lampung. The findings were derived from participant observation across six meetings, semi-structured interviews with one classroom teacher and four selected students, and supporting documentation such as student worksheets, project outputs, and field notes. The results are organized into three major themes. First, the study explains the implementation process of the STEAM approach during classroom instruction. Second, it presents the forms of discipline character developed during project-based learning. Third, it identifies supporting and inhibiting factors influencing the internalization of discipline values.

The data indicate that the STEAM approach contributed significantly to the development of student discipline through experiential learning. Three dimensions of discipline consistently emerged: procedural discipline, time discipline, and responsibility discipline. Improvement was observed progressively from Meeting 1 to Meeting 6, indicating that repeated engagement with the STEAM project strengthened students' behavioral regulation.

Table 1. Summary of Research Findings

Aspects	Findings
STEAM Implementation	Implemented sequentially through Science, Technology, Engineering, Arts, and Mathematics stages using a water filter project
Discipline Character Formation	Three dimensions emerged: procedural discipline, time discipline, and responsibility discipline
Supporting Factors	Teacher facilitation, learning contracts, timers, Islamic values, low-cost materials
Inhibiting Factors	Limited instructional time, differences in learning pace, narrow classroom space

Source: Observation sheets, interview transcripts, and researcher documentation, 2026

Implementation of the STEAM Approach in IPAS Learning

The STEAM approach was implemented through a simple water filtration project using recycled materials, including plastic bottles, gravel, sand, charcoal, cotton, and cloth. The project was designed to support the IPAS topic on the water cycle while encouraging students to solve real-world environmental problems related to water cleanliness.

The intervention took place over three weeks with six meetings, each lasting 2 × 35 minutes. During the implementation, students worked in groups of three to four members. Each group completed STEAM activities sequentially. In the Science stage, students observed demonstrations of evaporation, condensation, and precipitation using simple equipment. Observation notes showed that 11 out of 12 students (91.7%) actively participated by asking questions or responding to teacher prompts. Students demonstrated high curiosity, especially when observing visible changes in water states.

During the Technology and Engineering stages, students designed and assembled water filters. These stages produced the most critical behavioral observations because students were required to follow procedural instructions precisely. Observation data from Meeting 1 showed that 8 out of 12 students (66.7%) made procedural errors, primarily by arranging filter layers incorrectly. Common mistakes included placing sand at the bottom layer and pouring water before completing the structure. These errors resulted in cloudy filtration output. A critical classroom moment occurred when the teacher intentionally allowed students to experience the consequences of procedural mistakes instead of correcting them immediately.

The teacher explained:

“Previously, I often became frustrated because students ignored practicum procedures. In this project, I deliberately did not immediately correct them when they made mistakes. I allowed them to continue and observe the result. When the water came out cloudy, they became confused and began checking every layer themselves. After that, they became much more careful.”

This statement indicates the teacher's deliberate use of natural consequences as a pedagogical strategy.

The observation findings support this explanation. After experiencing failure, students became more attentive to instructions. By Meeting 4, procedural errors decreased to 4 students (33.3%), and by Meeting 6, only 2 students (16.7%) still required teacher correction.

One student described this learning process:

“At first, I thought we could directly pour water and get results quickly. But our filter failed because we arranged the layers wrongly. We had to dismantle everything and rebuild it. After that, I always checked every step carefully.”

This quote demonstrates that technical failure became a mechanism for self-correction.

Another student stated:

“When our group failed, everyone felt disappointed because we wanted to present good results. That made us read the instructions together before continuing.”

These findings indicate that the STEAM process shifted learning from teacher-centered instruction toward collaborative inquiry, where failure served as meaningful feedback.

Forms of Discipline Character Cultivated Through STEAM

Analysis revealed three major forms of discipline character cultivated through the STEAM approach.

Procedural Discipline

Procedural discipline refers to students' adherence to scientific procedures and sequential instructions during project completion. At the beginning of the intervention, procedural discipline was relatively low. Observation during Meetings 1–2 showed that approximately 70% of students attempted to skip instructions or rushed through steps to obtain immediate results.

A recurring behavior involved students ignoring worksheet instructions and relying solely on intuition.

The teacher described this change:

“Students who were previously the least disciplined during practical activities became the most careful after experiencing failure. They did not want their filter to fail again, especially during presentations in front of classmates.”

This indicates behavioral transformation triggered by direct experience.

The observation data showed progressive improvement:

Meeting 1: 8 students made procedural errors

Meeting 3: 5 students made procedural errors

Meeting 6: 2 students made procedural errors

This trend suggests strong improvement in procedural discipline.

A student reflected:

“I used to think instructions were not important. But after failing twice, I realized skipping steps only creates problems.”

This statement indicates cognitive restructuring.

Another student added:

“Now I remind my friends too. If someone wants to skip steps, I stop them.”

This suggests procedural discipline evolved into peer monitoring.

Thus, procedural discipline developed not through punishment but through experiential awareness.

Time Discipline

Time discipline refers to students’ ability to manage task duration and complete activities within allocated time.

During Meetings 1 and 2, time management was a major challenge. Observation data showed that 3 of 4 groups exceeded allocated work time by 10–15 minutes. Students spent excessive time discussing design ideas or decorating prototypes.

To address this issue, the teacher introduced timers and learning contracts.

The teacher explained:

“After introducing timers and clear task division, students became much more aware of time. They no longer played around because they knew each stage had a deadline.”

The use of timers created visible behavioral changes.

Observation showed:

Meetings 1–2: 3 groups exceeded time limit

Meetings 3–4: 2 groups exceeded time limit

Meetings 5–6: only 1 group exceeded time limit

Off-task behavior also decreased substantially.

A student stated:

“Before the timer, I felt there was always plenty of time. But our group almost missed the presentation because we worked too slowly.”

This reflects increased awareness of time constraints.

Another student said:

“When the timer sounds, everyone becomes serious because we know the next stage must start.”

This indicates that external scaffolding successfully fostered internal time regulation.

By the final meetings, students demonstrated improved pacing and task prioritization.

Responsibility Discipline

Responsibility discipline refers to students’ commitment to fulfilling assigned roles within group work. Each student received a specific role, including material collector, assembler, recorder, measurer, and presenter. This role division created interdependence among group members. A critical incident occurred during Meeting 2 when several students forgot to bring assigned materials. Observation data showed that 4 students (33.3%) failed to bring required materials, causing delays in two groups.

The teacher explained:

“There were students who forgot to bring charcoal and cotton, causing their group to stop working. They had to apologize to their teammates. That social pressure was more effective than my anger.”

This suggests that peer accountability played an important role in character formation.

After this incident, responsibility improved significantly:

Meeting 2: 4 students forgot materials

Meeting 4: 1 student forgot materials

Meetings 5–6: 0 students forgot materials

One student reflected:

“When I forgot to bring cotton, my group could not continue. I felt guilty because everyone depended on me.”

This indicates the emergence of emotional accountability.

Another student stated:

“Now we remind each other before class so no one forgets.”

This shows responsibility discipline extended beyond classroom activities into peer communication. The data suggest that collaborative dependency strengthened responsibility awareness.

Supporting and Inhibiting Factors

Several supporting and inhibiting factors influenced discipline cultivation. The strongest supporting factor was the teacher’s facilitative role. Instead of giving immediate solutions, the teacher encouraged reflection and allowed students to experience consequences. Observation showed this approach increased self-correction and independence.

The second supporting factor was the use of accessible materials. Because materials were inexpensive and easy to obtain, all 12 students participated fully without economic barriers. The third supporting factor involved Islamic values embedded in school culture, especially *amanah* (trustworthiness) and respect for time.

The teacher explained:

“Our school integrates Islamic values in daily activities. Students already understand amanah, so when discipline is linked to responsibility before God and classmates, they understand faster.”

This indicates religious values reinforced discipline internalization.

However, the study also identified several obstacles. The main inhibiting factor was variation in learning speed. Observation showed that 3 high-performing students frequently dominated decision-making, while slower learners became passive.

One student expressed:

“Sometimes the fast students want to do everything themselves because they think it is quicker.”

This reduced balanced participation.

Another obstacle was limited instructional time. Each meeting lasted only 70 minutes, which was sometimes insufficient for discussion, revision, and presentation.

The teacher noted:

“Time limitation is our biggest challenge. Sometimes students need more time to revise their designs.”

Additionally, the narrow classroom space restricted movement during group activities.

Despite these limitations, the data indicate that supporting factors were more dominant than inhibiting factors. Overall, the STEAM approach successfully created a learning ecosystem that encouraged procedural discipline, time management, and responsibility through meaningful direct experience.

STEAM as an Experiential Mechanism for Internalizing Discipline Character

This study demonstrates that the STEAM approach in IPAS learning functions not merely as an instructional framework for improving scientific understanding, but as an experiential mechanism for cultivating discipline character among elementary students. The most significant finding is that discipline emerged through direct engagement with task consequences rather than through external enforcement. This finding aligns with recent international studies suggesting that STEAM-based learning promotes self-regulation, problem-solving, and behavioral engagement because students interact with authentic tasks requiring procedural accuracy and collaboration (Segarra-Morales & Juca-Aulestia, 2024; Sánchez Milara & Orduña, 2024).

The first major finding regarding procedural discipline indicates that students became more careful in following instructions after experiencing technical failure in the water filtration project. This supports studies showing that inquiry-driven STEAM environments enhance metacognitive awareness because students learn through iterative trial and error rather than passive instruction (Perignat & Katz-Buonincontro, 2022; Conradt & Bogner, 2023). Unlike conventional classroom settings where discipline is often maintained through teacher authority, the present study reveals that procedural discipline developed through what may be called natural consequence-based learning. This differs from many previous STEAM studies in Indonesia, which largely emphasize science literacy or academic achievement rather than character formation. Therefore, the novelty of this study lies in showing that procedural compliance can become internally motivated when errors directly affect project outcomes.

The second finding highlights the emergence of time discipline through the use of timers and structured learning contracts. This result is consistent with recent research indicating that project-based STEAM activities improve executive functioning and time management by creating deadline-oriented collaborative tasks (Kim & Choi, 2022; Henriksen et al., 2023). However, this study extends prior findings by demonstrating that time regulation becomes stronger when external scaffolding gradually transforms into internal self-regulation. In this sense, the findings resonate with self-determination theory, which argues that sustainable discipline emerges when learners understand the functional value of rules rather than merely complying with imposed authority (Ryan & Deci, 2023). Instead of viewing time constraints as pressure alone, students began to perceive time as a strategic resource necessary for successful task completion.

The third finding concerning responsibility discipline reveals the importance of collaborative interdependence. Students became more accountable when they realized that individual negligence negatively affected group performance. This finding supports international evidence that collaborative STEAM learning strengthens social responsibility, peer regulation, and collective accountability (Herro et al., 2022; Quigley & Herro, 2023). However, the present study contributes a unique contextual dimension by integrating Islamic values such as *amanah* (trustworthiness), which reinforced students' moral understanding of responsibility. This integration represents an important theoretical contribution because it suggests that STEAM effectiveness may be amplified when interdisciplinary learning is

connected to local cultural and spiritual values rather than implemented as a purely technical pedagogical model.

Practically, this study suggests that teachers should design STEAM activities that intentionally allow productive failure, collaborative role distribution, and structured reflection. Such strategies can transform discipline from externally imposed obedience into internally regulated behavior. The study also implies that character education may be more effective when embedded within authentic academic tasks rather than taught as separate moral instruction.

Despite these contributions, this study has limitations. The research involved only one Islamic elementary school, a small sample, and a short intervention period of three weeks. Consequently, the long-term stability of discipline character remains unclear. Future studies should employ longitudinal or mixed-method designs across diverse sociocultural contexts to examine whether discipline cultivated through STEAM persists over time and transfers to other academic subjects. Further comparative studies between Islamic and non-religious school settings would also enrich understanding of cultural influences on character internalization.

CONCLUSION

This study concludes that the application of the STEAM approach in social studies learning has proven to be effective as an instrument for instilling discipline character in 4th grade students of Qur'ani Islamic Elementary School. The process of internalizing this character takes place systematically through the stages of project design ranging from *Science, Technology, Engineering, Arts, to Mathematics*, where teachers play the role of facilitators who prioritize natural consequences. The three manifestations of discipline that are successfully instilled simultaneously and naturally include: (1) procedural discipline, which is characterized by the student's adherence to the sequence of scientific steps; (2) time discipline, which is the accuracy of completing tasks through *timer support*; and (3) responsibility discipline, which is reflected in the accuracy of individuals in group roles after experiencing technical failures. This success is driven by supporting factors in the form of adaptive teacher roles and Islamic values such as *trust*, although there are still technical obstacles such as limited time and classrooms.

Based on these findings, it is recommended for teachers to integrate the STEAM approach routinely in IPAS learning as an authentic character education strategy. Schools are expected to support this initiative by providing training for educators and providing flexibility in the allocation of learning time, the next researcher is recommended to conduct longitudinal research to test the resilience of the discipline's character in the long term, as well as conduct comparative research on schools with different sociocultural backgrounds, this study recognizes the limitations of short duration and focuses on one project type, so that exploration of other variations of STEAM projects is indispensable to enrich the literature on character education in elementary schools.

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