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Flipped Classroom Strategy in Elementary Schools: A Conceptual Review for Strengthening Character and Global Insight

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ABSTRAK

This study aims to examine the Flipped Classroom strategy in learning Natural Sciences (IPA) in elementary schools, especially in shaping the character and global insight of students. The method used is descriptive qualitative with a library research method, which analyzes various literature sources such as relevant and up-to-date scientific journals. The results show that Flipped Classroom encourages independent learning outside the classroom and collaborative activities in the classroom, which significantly improves students' conceptual understanding as well as basic scientific skills. In addition, this strategy also strengthens character traits such as independence, responsibility and tolerance, while expanding students' global horizons through access to international learning resources. The implications of this research emphasize the importance of education system support, teacher training, and the role of parents to ensure the successful implementation of this strategy in creating a learning process that is holistic, contextual, and relevant to the demands of 21st century education.

Keywords: Flipped Classroom; Natural Science Learning; Character Education; Global Insight.

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1. INTRODUCTION

The rapid transformation of education in the digital and post-pandemic era has accelerated the demand for innovative pedagogical approaches that are capable of fostering not only academic achievement but also character development, global competence, and twenty-first century skills among students. Contemporary education systems are expected to prepare learners who are adaptive, collaborative, digitally literate, and capable of responding to increasingly complex global challenges. In this context, elementary education plays a strategic role as a foundational stage for developing scientific literacy, ethical awareness, and social responsibility from an early age. Therefore, learning strategies implemented in elementary schools should move beyond conventional knowledge transmission toward more meaningful, student-centered, and transformative learning experiences [1], [2].

Natural Science learning in elementary schools holds an important position in developing students' understanding of natural phenomena, scientific inquiry skills, and critical thinking

abilities. Science education is not merely intended to help students memorize concepts, but also to encourage them to investigate, analyze, and solve problems through scientific processes [3]. In addition, science learning provides substantial opportunities to integrate character values such as responsibility, curiosity, honesty, discipline, cooperation, and environmental awareness [4]. However, despite curriculum reforms emphasizing active and inquiry-based learning, science instruction in elementary schools remains predominantly teacher-centered and content-oriented. Learning activities are frequently limited to lectures, textbook exercises, and memorization practices, resulting in passive classroom environments and limited opportunities for students to actively construct knowledge and values independently [5].

The development of digital technology and the growing emphasis on twenty-first century learning have encouraged educators to adopt innovative instructional approaches that integrate technology, collaboration, and active learning [6]. One instructional strategy that has gained considerable attention in recent years is the flipped classroom approach [7]. Unlike conventional teaching models, the flipped classroom reverses the traditional sequence of instruction by shifting content delivery outside the classroom through digital learning resources, while classroom time is devoted to collaborative discussions, inquiry activities, experimentation, and problem-solving [8]. This approach aligns closely with constructivist and social constructivist perspectives, which emphasize active participation, collaborative interaction, and reflective engagement in the learning process.

Previous studies have demonstrated that flipped classroom implementation contributes positively to students' academic achievement, learning motivation, higher-order thinking skills, and independent learning abilities. Nevertheless, existing studies have predominantly focused on cognitive and technological outcomes, particularly at secondary and higher education levels. Limited attention has been given to the conceptual potential of flipped classroom strategies in simultaneously fostering character development and global insight within elementary science learning contexts. Furthermore, discussions regarding how flipped classroom environments may support global citizenship education, intercultural awareness, and values-based learning among elementary students remain relatively underexplored.

This conceptual review seeks to address these gaps by examining the flipped classroom strategy as a transformative pedagogical approach in elementary Natural Science learning. This article positions the flipped classroom not merely as a technology-assisted instructional model, but as an educational framework capable of integrating scientific literacy, character education, collaborative learning, and global competence. Through a synthesis of contemporary literature, this study aims to explore how flipped classroom implementation can contribute to strengthening students' character formation and global insight while supporting meaningful and student-centered science learning in elementary education.

2. RESEARCH METHOD

This study employed a descriptive qualitative approach using a library research method [9]. The library research approach was utilized to explore various theories, strategies, and research findings related to Natural Science learning in elementary schools, particularly in the context of implementing the flipped classroom strategy to support the development of globally minded and character-oriented students. The data sources consisted of national and international journal articles. The selected literature fulfilled the criteria of relevance, credibility, and recency, with a minimum of ten primary references serving as the main foundation for developing the conceptual framework.

The analysis procedure in this study was conducted systematically through three main stages. The first stage involved identifying relevant literature. In the second stage, after the

selected literature had been collected, thematic analysis was conducted to identify major patterns, central concepts, and the interrelationships among ideas from various sources. In the third stage, the results of the analysis were integrated through theory synthesis by constructing a conceptual framework that combines contemporary pedagogical theories, participatory approaches, technology integration, and character values reflecting tolerance, diversity, and global responsibility.

1. RESULTS AND DISCUSSION

a. Concept and Principles of the Flipped Classroom

The flipped classroom strategy represents a transformative pedagogical approach that reverses the traditional sequence of teaching and learning activities [10]. In conventional classrooms, instructional delivery commonly occurs during face-to-face sessions, while students complete exercises independently at home. In contrast, the flipped classroom shifts the initial acquisition of knowledge outside the classroom through digital learning resources, enabling classroom interactions to focus on higher-order learning activities such as discussion, collaboration, inquiry, and problem-solving [11]. This instructional transformation reflects constructivist learning principles, where students actively construct understanding through exploration and social interaction rather than passively receiving information.

Learning materials in flipped classrooms are generally delivered through technology-based media such as instructional videos, interactive simulations, podcasts, and digital presentations that can be accessed flexibly according to students' learning pace and needs [11]. Such flexibility allows students to review concepts repeatedly, thereby supporting differentiated and self-paced learning experiences. This approach is particularly relevant in elementary education contexts, where students possess diverse learning characteristics, varying cognitive readiness, and high curiosity toward exploratory activities.

The flipped classroom also significantly changes the roles of teachers and students within the learning process. Teachers no longer function solely as the primary source of knowledge transmission; instead, they act as facilitators, mentors, and learning designers who guide students through collaborative and reflective activities [12]. Simultaneously, students are encouraged to become active participants responsible for preparing learning materials independently before classroom sessions. This pedagogical shift promotes self-regulated learning, autonomy, and active engagement, which are essential competencies in twenty-first century education.

From a theoretical perspective, the flipped classroom is strongly associated with constructivist and social constructivist learning theories. Constructivism emphasizes that knowledge is actively constructed through individual experiences, while social constructivism highlights the importance of interaction and collaboration in shaping understanding. In flipped learning environments, students engage with instructional materials independently before participating in collaborative classroom activities, allowing them to connect prior knowledge with new learning experiences. This sequence facilitates deeper conceptual understanding and encourages students to become active meaning-makers rather than passive recipients of information.

Furthermore, the flipped classroom aligns closely with self-regulated learning theory, which emphasizes learners' ability to manage, monitor, and evaluate their own learning processes. Independent engagement with digital learning resources before classroom sessions requires students to develop planning skills, self-discipline, and learning responsibility. These processes are particularly valuable in elementary education because they help cultivate independent learning habits from an early age. Through repeated exposure to self-directed learning activities, students gradually become more confident and capable of managing academic tasks autonomously.

Several studies have reported positive impacts of flipped classroom implementation on students' learning motivation, academic achievement, conceptual understanding, and collaborative skills [13], [14]. The effectiveness of this strategy can be attributed to its ability to maximize meaningful classroom interaction and provide opportunities for deeper cognitive engagement. Classroom time can be utilized for experimentation, inquiry-based learning, peer discussion, and contextual problem-solving activities that are often difficult to achieve in traditional lecture-centered environments.

Another important aspect of flipped classroom implementation is its capacity to support differentiated learning. Since students can access instructional materials repeatedly and according to their own pace, the flipped classroom accommodates differences in students' learning speed, readiness, and cognitive abilities. High-achieving students may explore additional resources independently, while students requiring more support can revisit learning materials multiple times before classroom activities begin. Consequently, flipped learning environments can reduce learning disparities and create more inclusive classroom experiences.

In elementary education contexts, the flipped classroom also contributes to increasing student engagement and learning enjoyment. Interactive videos, animations, and digital learning platforms create more visually stimulating and engaging learning experiences for young learners. Such learning environments may enhance students' curiosity and encourage active participation during classroom discussions and experiments. As engagement increases, students are more likely to develop positive attitudes toward science learning and become more motivated to participate actively in educational activities.

Nevertheless, the implementation of flipped classrooms also presents several challenges. Limited ICT infrastructure, unequal internet access, insufficient teacher digital competence, and varying levels of parental support may hinder the effectiveness of this strategy, particularly in elementary education contexts [16], [17]. Younger learners often require assistance from parents or guardians when accessing digital learning materials at home. Consequently, successful flipped classroom implementation requires systemic educational support, including teacher professional development, accessible digital infrastructure, and collaboration between schools and families.

Another challenge relates to the potential cognitive overload experienced by elementary students when instructional materials are not designed appropriately. Young learners may struggle to understand complex digital content independently without sufficient scaffolding from teachers or parents. Therefore, instructional videos and digital resources should be concise, interactive, developmentally appropriate, and visually engaging to maintain students'

attention and comprehension. Teachers must also carefully balance screen time with hands-on and social learning activities to ensure healthy and meaningful learning experiences.

Overall, the flipped classroom should not be viewed merely as a technological innovation, but rather as a pedagogical transformation that supports student-centered learning, active participation, reflective inquiry, and collaborative knowledge construction. Within elementary science education, this strategy offers strong potential to create more meaningful, engaging, and holistic learning experiences aligned with the demands of contemporary education.

b. Implementation of the Flipped Classroom in Natural Science Learning at Elementary Schools

Natural Science learning in elementary schools aims not only to develop students' understanding of scientific concepts but also to cultivate inquiry skills, critical thinking, problem-solving abilities, and environmental awareness from an early age. Elementary students naturally possess high curiosity and strong interest in exploration, making science learning highly suitable for active and experiential learning approaches. In this regard, the flipped classroom provides opportunities for students to engage with learning materials before classroom instruction, allowing face-to-face sessions to focus on collaborative investigation, experimentation, and scientific discussion.

The effectiveness of flipped classroom implementation in science learning can be explained through constructivist perspectives, which emphasize that meaningful learning occurs when students actively build understanding through experience and interaction. By studying instructional videos, animations, or interactive materials independently before class, students enter classroom activities with prior conceptual exposure, enabling deeper participation during discussions and inquiry-based tasks [20]. This learning sequence supports higher-order cognitive engagement because classroom time is no longer dominated by passive content delivery.

In elementary science learning, classroom activities within flipped environments may include simple experiments, collaborative projects, problem-solving activities, scientific observation, and group presentations. Such activities encourage students to formulate hypotheses, analyze evidence, communicate findings, and draw conclusions collaboratively. Previous studies have shown that flipped classroom implementation can improve scientific understanding, higher-order thinking skills, and learning motivation among students [20], [21]. Furthermore, collaborative learning and problem-based activities integrated into flipped classrooms

contribute positively to students' self-regulated learning and independent learning abilities [22], [23].

The flipped classroom also creates opportunities for inquiry-based learning, which is considered essential in science education. Inquiry-oriented activities encourage students to investigate phenomena, ask questions, identify problems, and construct scientific explanations based on evidence. When classroom time is allocated for exploration and experimentation rather than lectures, students become more actively involved in scientific processes. This approach supports the development of scientific literacy by helping students understand not only scientific concepts but also the nature of scientific inquiry itself.

Another significant advantage of flipped classroom implementation in science learning is the increased opportunity for collaborative learning. During classroom activities, students work together in small groups to discuss scientific phenomena, solve problems, and complete projects. Collaborative interaction enables students to exchange ideas, clarify misconceptions, and develop communication skills through peer discussion. Such social learning experiences are particularly important in elementary education because they foster teamwork, empathy, and social responsibility alongside academic development.

The use of multimedia learning resources in flipped classrooms can also improve students' conceptual understanding of abstract science concepts. Scientific phenomena that are difficult to observe directly in classroom settings can be visualized through animations, simulations, and interactive digital content. For example, topics related to the solar system, energy transformation, ecosystems, or microscopic organisms may become more understandable when presented through visual and interactive media. These digital resources help bridge the gap between abstract scientific concepts and students' concrete learning experiences.

Moreover, flipped classroom implementation supports differentiated instruction in science learning. Students who require additional support may revisit instructional materials repeatedly, while advanced learners may explore supplementary scientific resources independently. This flexibility enables teachers to accommodate diverse learning needs and provide more personalized support during classroom sessions. Consequently, students are more likely to experience meaningful and inclusive learning processes that align with their individual learning characteristics.

An important aspect of flipped classroom implementation in elementary science learning is its capacity to create student-centered and inquiry-oriented environments. Students are encouraged to become active learners who explore knowledge independently and

collaboratively rather than merely receiving information from teachers. This process supports the development of scientific literacy while simultaneously promoting communication skills, teamwork, and reflective thinking.

However, implementing flipped classrooms in elementary science education also requires careful pedagogical planning. Teachers must ensure that digital learning materials are developmentally appropriate, visually engaging, and accessible for young learners. Excessive cognitive demands or overly complex digital content may reduce students' motivation and comprehension. In addition, disparities in internet access and digital resources may create learning inequities among students from different socioeconomic backgrounds. Therefore, effective flipped classroom implementation should consider technological accessibility, students' developmental readiness, and parental involvement as integral components of the learning process.

Teachers' pedagogical competence also plays a crucial role in determining the effectiveness of flipped classroom implementation. Teachers are required not only to master digital technology but also to design meaningful inquiry activities, facilitate collaborative discussions, and provide appropriate feedback during classroom interactions. Without effective facilitation, flipped classrooms may simply shift learning responsibilities to students without generating meaningful engagement or conceptual understanding. Therefore, continuous professional development programs are essential to support teachers in implementing flipped learning effectively.

In addition, parental involvement becomes increasingly important in elementary flipped classroom settings because younger students often require guidance when accessing digital learning materials at home. Parents may assist children in managing study schedules, accessing online resources, and maintaining learning motivation. Positive collaboration between teachers and parents can strengthen students' learning experiences and create supportive home learning environments. Consequently, successful flipped classroom implementation should be viewed as a collaborative effort involving schools, teachers, families, and educational stakeholders.

c. Contribution of the Flipped Classroom to Character Building and Global Insight

Beyond improving academic achievement and conceptual understanding, the flipped classroom strategy also contributes significantly to students' character development and global awareness. Character formation within flipped classrooms does not occur incidentally; rather, it emerges through

structured opportunities for self-regulated learning, collaborative interaction, responsibility-sharing, and reflective participation. Through independent learning activities conducted outside the classroom, students gradually develop discipline, responsibility, initiative, and time-management skills as they learn to organize and monitor their own learning processes.

The independent learning structure within flipped classrooms encourages students to become more accountable for their educational progress. Students are expected to prepare learning materials before classroom sessions, complete assigned tasks responsibly, and participate actively in collaborative activities. Such experiences cultivate learning independence and strengthen students' intrinsic motivation. Over time, these habits may contribute to the formation of lifelong learning attitudes, which are increasingly important in rapidly changing global societies.

Collaborative classroom interactions further strengthen students' social and emotional competencies. Group discussions, collaborative projects, and inquiry-based activities require students to communicate effectively, respect differing opinions, listen actively, and cooperate with peers [25], [26]. Such learning experiences help students internalize important character values including empathy, tolerance, honesty, and mutual respect. In this context, the flipped classroom serves not only as an instructional strategy but also as a pedagogical environment that supports holistic student development.

The social dimension of flipped classroom learning is particularly relevant in elementary education because children at this developmental stage are still forming interpersonal and emotional competencies. Collaborative science activities encourage students to negotiate ideas, solve conflicts constructively, and appreciate diverse perspectives. Through repeated social interaction, students learn how to function effectively within group settings while simultaneously developing positive attitudes toward cooperation and inclusivity.

The flipped classroom also provides opportunities to strengthen students' global insight through exposure to diverse digital learning resources and multicultural perspectives. Access to international educational videos, global scientific issues, virtual simulations, and digital discussion platforms enables students to develop broader perspectives regarding cultural diversity, environmental sustainability, and global interconnectedness. These experiences align closely with the principles of Global Citizenship Education (GCED), which emphasizes intercultural understanding, global responsibility, and respect for diversity within contemporary education systems.

In science education contexts, global insight may also develop through discussions of worldwide environmental and scientific challenges such as climate change, biodiversity conservation, renewable energy, public health, and sustainable development. By connecting local science learning with global issues, students begin to understand that scientific problems are interconnected across societies and nations. Such awareness can strengthen students' sense of responsibility toward both local communities and the global environment.

Moreover, the flipped classroom environment promotes reflective learning practices that support ethical awareness and democratic values. During classroom discussions, students are encouraged to express opinions respectfully, evaluate evidence critically, and consider alternative viewpoints. These practices help students develop open-mindedness and reduce tendencies toward intolerance or exclusive thinking. Reflective dialogue also encourages students to become more aware of social issues, cultural diversity, and ethical responsibilities within pluralistic societies.

Another important contribution of flipped classrooms lies in their potential to support multicultural and inclusive education. Exposure to digital learning resources from various cultural backgrounds enables students to appreciate differences in language, traditions, beliefs, and ways of thinking. Such experiences can reduce prejudice and strengthen intercultural competence from an early age. In increasingly globalized societies, intercultural understanding represents a crucial competency that should be cultivated continuously through educational experiences.

Despite these advantages, several challenges remain in integrating character education and global insight within flipped classroom environments. Teachers require adequate pedagogical competence to facilitate reflective discussions and values-based learning activities effectively. Furthermore, unequal access to digital technologies may limit students' opportunities to engage with global learning resources. Therefore, schools and educational policymakers should provide continuous support through teacher training, digital infrastructure development, and curriculum policies that encourage the integration of character education and global competence into technology-enhanced learning environments.

Another challenge concerns the risk of excessive dependence on technology in learning processes. Although digital resources provide broad educational opportunities, overreliance on screen-based learning may reduce direct social interaction if not balanced appropriately. Therefore, flipped classroom implementation should maintain equilibrium between digital learning activities and face-to-face collaborative experiences to ensure balanced cognitive, social, and emotional development among elementary students.

Collectively, these findings suggest that the flipped classroom has substantial potential to function as a transformative pedagogical framework that integrates scientific literacy, character education, collaborative learning, and global competence within elementary science education. By combining technology-supported independent learning with meaningful classroom interaction, the flipped classroom can contribute to preparing future generations who are not only academically capable, but also socially responsible, culturally aware, ethically grounded, and globally minded citizens.

4. CONCLUSION

This conceptual study demonstrates that the flipped classroom strategy offers a significant transformation in Natural Science learning at the elementary school level through student-centered, independent, and collaborative learning approaches. By reversing traditional learning patterns, students not only gain stronger conceptual understanding through active and independent exploration of learning materials, but also develop twenty-first century skills such as critical thinking, communication, and collaboration. Furthermore, this strategy supports the development of positive character traits such as responsibility, discipline, and empathy, while simultaneously fostering national and global perspectives through access to multicultural learning resources and discussions that reflect inclusive values. In the context of elementary science education, the flipped classroom enables the integration of project-based learning, experimentation, and discussion activities that align with students' developmental

characteristics, thereby encouraging meaningful and engaging learning experiences. However, the successful implementation of this strategy strongly depends on infrastructure readiness, teachers' ICT competencies, parental involvement, and systemic support from educational institutions. Therefore, the flipped classroom has strong potential to become an effective pedagogical approach in shaping future generations who are not only academically competent, but also possess strong character and balanced national and global perspectives.

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