

Boarding Education Through The LSTEAM Learning Model: A Strategic Response to The Demands of 21st Century Education

Mahdi Sudrajat

Indraprasta PGRI University Jakarta, Indonesia



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ABSTRACT

Objective: This conceptual article aims to explore how boarding schools can integrate the LSTEAM (Law, Science, Technology, Engineering, Art, and Mathematics) model to develop globally competent students who are ethically grounded and culturally rooted. **Method:** Through a literature review and contextual analysis, the study investigates the potential for applying the LSTEAM approach within the unique ecosystem of boarding school education. **Results:** The findings suggest that LSTEAM provides a transformative framework that aligns ethical reasoning, scientific exploration, technological literacy, and creative expression. The study highlights the importance of project-based learning, cultural relevance, and collaborative pedagogy in implementing LSTEAM effectively in a boarding school setting. **Novelty:** This article contributes to the growing body of knowledge by proposing a holistic educational model for boarding schools, emphasizing the integration of LSTEAM to produce students capable of navigating global challenges while staying connected to their cultural roots. The model promotes a balance between global competence and local cultural awareness, offering new insights into 21st-century education.

INTRODUCTION

The demands of 21st-century work require workers to possess a variety of related skills, such as creative thinking, problem-solving, and communication. This is as stated by the National Education Association 2012, which states that if students want to compete in the global era, they must possess the skills of communication, collaboration, critical thinking, and creativity, known as the 4Cs [1].

According to Bybee, if students only learn to memorize and recite knowledge and practice specific skills (traditional learning, chalk and talk teaching), it is feared they will only be prepared for a single type of job, a skill that is increasingly becoming less marketable in today's workforce. In reality, the learning process implemented by teachers in Indonesia has not yet directed students to develop higher-order thinking skills, a requirement for 21st-century work, as reflected in the 2015 PISA results, which ranked Indonesia 63rd out of 72 countries surveyed. This is certainly a challenge for all educators to implement learning and educational processes that stimulate students to develop their abilities in science and mathematics [2].

The problem students face in school is connecting one subject to another, and even more challenging is connecting between subject areas. To address this issue, it is necessary to find an approach that can integrate these subject areas in a concrete way,

allowing students to experience the connections and benefits of contextual learning [3], [4].

21st-Century Learning is learning that prepares the 21st-century generation. There are three main subjects in 21st-century learning:

1. Learning and innovation skills, which encompass ways of thinking and working.
2. Information, media, and technology, which encompass the tools used in work.
3. Life and career skills, which encompass skills for living in the real world.

Thinking skills are the thinking skills that students must master to face the 21st century. These thinking skills include creative thinking, critical thinking, problem-solving, and decision-making. Meanwhile, the way of working refers to the ability to work in a global and digital world. Students must be able to communicate, cooperate, and collaborate both individually and within communities and networks. Students must also be able to master the tools needed to work. 21st-century learning should be relevant to the challenges and demands of real life, including fostering the ability to work collaboratively, problem-solving skills, self-control, critical thinking, mastery of technology, and the ability to process information and communicate effectively [5].

This aligns with Law No. 20 of 2003 concerning the objectives of national education, which is to develop skills and shape the character and civilization of a dignified nation in order to educate the nation. The learning process should foster students as individuals and citizens who are faithful, productive, creative, and innovative, and able to contribute to the life of society, the nation, the state, and global civilization [6].

According to Zubaidah, STEAM (Science, Technology, Engineering, Art, and Mathematics) empowers teachers for project-based learning involving five disciplines (science, technology, engineering, art, and mathematics) and fosters an inclusive learning environment where all students contribute. Unlike traditional learning models, educators who use the STEAM framework integrate disciplines, enhancing the dynamic synergy between processes through a holistic approach. Even for students who do not pursue careers in either STEM or STEAM fields, the skills gained from STEAM learning can be transferred into almost any future career [7], [8], [9].

In this literature review, the author will attempt to explain the implementation of LSTEAM (Law, Science, Technology, Engineering, Art, and Mathematics) in 21st-Century Learning. The LSTEAM (Law, Science, Technology, Engineering, Art, and Mathematics) learning model is a learning approach that provides students with opportunities to expand their knowledge of the sciences and humanities while simultaneously developing skills for 21st-century growth, such as communication skills, critical thinking, leadership, teamwork, creativity, resilience, and other skills. It also adds a legal dimension as a foundation for ethics and social norms. This integration enables students to understand the world holistically—from scientific aspects to human values and their potential implementation in a boarding environment.

RESEARCH METHOD

The method used in this research is a literature review. A literature review is a critical examination of a topic already discussed by researchers or scientists in various sources. Information sources can include books, journals, e-books, or other scientific articles, as well as the practice of boarding school education in Indonesia. The analysis was conducted by identifying the relevance of LSTEAM to 21st-century educational needs and its potential implementation in a boarding school environment.

The writing steps are:

1. Collecting data on LSTEAM (Law, Science, Technology, Engineering, Art, and Mathematics) and its implementation in 21st-century learning in a boarding school environment.
2. Analyzing the data obtained based on the author's thoughts; and
3. Summarizing the results of the literature review.

RESULT AND DISCUSSION

1. Change from STEM to STEAM

One area that has received attention in the current global education debate is the shift from STEM to STEAM, a push that incorporates arts (STEM) = (STEAM) into the learning of science, technology, engineering and mathematics. The emergence of the STEM movement towards STEAM was based on an effort to involve the arts in STEM as an equally important aspect and not just an additional subject. STEAM education is based on the premise that STEM and the arts function more effectively when combined together than when used alone. STEAM is a new theme, but collaboration between art and STEM is not a new idea. Eisner and Powell also outlined the view that art and science exist in different worlds, and emphasized the similarities that can be seen across various disciplines. The STEM to STEAM movement provides a new language to shape cross-disciplinary thinking [10], [11].

2. What is STEAM?

STEAM (Science, Technology, Engineering, Art, and Mathematics) is an extension of STEM education by incorporating elements of art into its learning activities.

STEAM stimulates students' curiosity and motivation in higher-order thinking skills, including problem-solving, collaboration, independent learning, project-based learning, challenge-based learning, and research. Learning activities aligned with the STEAM approach include project-based learning. Project-based learning is based on the assumption that problem-solving will not be complete unless viewed from multiple perspectives [12].

STEAM combines the arts with STEM learning to increase student engagement, creativity, innovation, problem-solving skills, and other cognitive benefits, and to enhance work skills (e.g., teamwork, communication, adaptability) necessary for career and economic advancement [13].

Yakman states that STEAM learning is contextual learning, where students are encouraged to understand phenomena close to them. The STEAM approach encourages

students to explore their full potential in their own ways. STEAM also fosters diverse work from each individual or group. Furthermore, collaboration, cooperation, and communication are fostered in the learning process because this approach is conducted in groups. Grouping students in STEAM requires personal and interpersonal responsibility for the learning process. This process builds students' understanding of the material being studied. STEAM can be defined as a teaching and learning approach between two or more components or between one STEAM component and another discipline. The term STEAM (Science, Technology, Engineering, Art, and Mathematics) and the integration of art with other disciplines have long been used. Art is considered a counterbalance to science. Plato even wrote, "The object of education is to teach us the love of beauty" [14]. The integration of art into STEAM is expected to make learning more meaningful, as students are involved in realizing the learning competencies they must achieve in a tangible form through their work. According to Gigliotti, whose perspective was shaped by his career as a professor of art and design, education means providing an environment where students feel genuinely compelled to participate in creating their futures, understanding the importance of their presence. This requires teachers who "expect students to contribute something significant and unique to a project."

Cunningham explores this compulsion in terms of art, explaining how participatory learning can foster civic engagement and expand the capacity for imagination: we need citizens who can imagine a different world. According to Guy A. Boy and Yakman, STEAM (Science, Technology, Engineering, Arts, and Mathematics) is an integrated approach to fostering creativity. Enhancing STEAM elements in learning can encourage students to explore the connections between them. The inclusion of arts in STEAM can develop students' aesthetic abilities [15].

Buincontro defines STEAM as the integration of artistic disciplines into the curriculum and learning of science, technology, engineering, and mathematics (STEM). The artistic elements will undoubtedly have a positive impact on anyone who experiences them. The integration of artistic elements in STEAM can provide students with opportunities for creativity and innovation through artistic creativity integrated into learning outcomes. STEAM products not only encompass cognitive aspects but also foster other aspects, such as affective and psychomotor, that can be developed generally by students in facing the era of the 4.0 industrial revolution. The complexities of the 21st century today demand skills from various fields, and STEAM-based learning can provide preparation and practice for all of them [16]. Therefore, cognitive and creative abilities must be continuously developed in various forms, one of which is through STEAM-based learning that integrates design, creativity, innovation, engineering, and mathematics, thereby developing the skills needed to face globalization and the development of science and technology [17].

3. The Shift from STEAM to LSTEAM?

Established pedagogical models have long recognized three primary domains of learning: cognitive, affective, and psychomotor—as the basis for curriculum planning. However, in the context of education aimed at shaping character transformation, this

structure remains inadequate. The educational philosophy of Sheikh Al-Zaytun, AS Panji Gumilang, and Aminulloh, which emphasizes that "education is the habituation of good things," necessitates an expansion of the paradigm [18].

The LSTEAM Learning Model—which synergizes legal thought, scientific innovation, and ethical values—requires a taxonomy that measures not only "what students know or do" but also "who they become through their learning process." This article introduces the Habitative Domain as the fourth pillar in the educational taxonomy: a domain that focuses on consistent and valued ethical behavior.

The LSTEAM curriculum aims to produce students who think legally, innovate scientifically, and act ethically. The habitative domain enables this synthesis by assessing not only cognitive, affective, and motor aspects, but also ethical consistency in real life.

The LSTEAM (Law, Science, Technology, Engineering, Art, and Mathematics) approach in boarding education provides a transdisciplinary foundation that supports character building, global competence, and strengthening of local culture that is ideal for integrating the values of law, technology, science, and art in students' lives.

4. Implementation of LSTEAM (Law, Science, Technology, Engineering, Arts, and Mathematics) in 21st-Century Learning Through a Boarding School Approach

Learning using the STEAM approach is contextual, where students are encouraged to understand phenomena close to them. This approach encourages students to be curious, eager to learn, and understand what is happening, its causes, and its impacts, as well as to strive to address them [19]. This occurs because students can directly relate, connect, and even find solutions to emerging problems. In this learning model, students are taught to think critically. The STEAM approach encourages students to explore all their abilities in their own ways. STEAM also fosters diverse and unexpected work from each individual or group. Furthermore, collaboration, cooperation, and communication are fostered in the learning process because this approach is implemented in groups. Grouping students in STEAM requires personal and interpersonal responsibility for the learning process. This process will build students' understanding of the material being studied. Students actively create strategies independently for their learning process. The STEAM approach guides students in developing skills such as problem-solving, critical thinking, and collaboration [20].

The STEAM approach encourages students to construct their own understanding of the learning process by integrating multiple subject areas into real-life contexts. STEAM also explores students' abilities using relevant technology, which can be chosen by the students or their interests, and communicated in engaging ways, such as art. Understanding in STEAM learning can also be achieved through group work and inquiry (Susan Blackley and Rachel Sheffield). In this approach, students learn to independently explore and discover concepts being studied, both individually and in groups.

The government has made various efforts to prepare for 21st-century education. One such effort is changing the national curriculum to the 2013 Curriculum (K13), which

is based on 21st-century learning.

21st-century learning prepares the 21st-century generation with three main subjects: (1) learning and innovation skills, (2) information, media, and technology, and (3) life and career skills. The thinking skills that students must master in 21st-century education are creative and critical thinking, problem-solving, and decision-making. Working in a global and digital world requires students to be able to communicate and collaborate, both with individuals and with communities and networks. Students must also be able to master the tools and technology needed for work.

STEAM-based learning is needed by students in Indonesia as an effort to train their skills and talents to face 21st-century challenges. The complexity of the 21st century today demands skills from various fields, and STEAM-based learning can provide preparation and practice for all of them. Design, creativity, and innovation are elements of art combined. Initially, STEM (Science, Technology, Engineering, and Mathematics) became STEAM (with the addition of Art elements), which was then added to LSTEAM (Law, Science, Technology, Engineering, and Mathematics). This is an interdisciplinary learning approach that combines law, science, technology, engineering, arts, and mathematics. These six disciplines form a comprehensive educational approach that provides problem-solving patterns through 21st-century learning experiences [21].

LSTEAM is a cooperative learning model as part of constructivism, where students construct their own knowledge and understanding through projects. These projects require students to pay attention to ethics, think legally, understand the material being studied as knowledge, and utilize emerging technology to help discover concepts. The results are then presented with aesthetics as art, and display forms of material with mathematical manifestations.

The development of 21st-century education demands a comprehensive transformation in learning approaches, including a recontextualization of the boarding school system. The boarding school environment enables the implementation of holistic, transformative, and sustainable interdisciplinary learning. The LSTEAM approach offers a balance between global demands (digital literacy, collaboration, innovation) and local roots (spirituality, culture, and social ethics) [22].

5. Stages of STEAM Learning Implementation

STEAM is a form of cooperative learning as part of constructivist learning, where students construct their own knowledge and understanding through projects. These projects require students to understand the material being studied as knowledge, utilizing emerging technologies to aid conceptual discovery. Each stage of STEAM, integrated with project-based learning, is expected to foster 21st-century skills.

In general, STEAM, integrated with project-based learning, involves six stages, as follows:

- a. Providing Essential Questions: Essential questions are used to provide an overview of students' prior knowledge.
- b. Project Plan Development: Students discuss in groups the project completion stage plan, gather information on the project's completion and obstacles, the maximum

time required to complete the project, and design the project to be undertaken by integrating LSTEAM components.

- c. **Schedule Development:** Students are able to complete the project within the agreed-upon timeframe. They can discuss this schedule with their group.
- d. **Project Progress Monitoring:** Teachers must ensure the project is on track. Monitoring student activities during the learning process and observing project progress is carried out to determine the extent to which they have completed the assigned project within the established timeline.
- e. **Testing and Evaluation of Results:** This stage is carried out by teachers testing and evaluating the products produced by students.
- f. **Experience Evaluation:** The experience evaluation stage is carried out by students expressing their feelings and experiences during project-based learning. Teachers and students reflect on the learning activities and project results.

6. LSTEAM Educational Concept in a Boarding School Environment

Learning using LSTEAM in 21st-Century Learning with LSTEAM integration in a boarding school environment allows each discipline to coexist and complement each other both during school hours and in the residential dormitory environment, such as:

- a. **Law:** Instilling ethical values, introducing local cultural, spiritual, and legal roots through the concept of Ijab Kabul (contract of marriage) education from Islamic boarding schools, trial simulations, discussions of customary norms, and human rights analysis.
- b. **Science & Engineering:** Problem-based projects such as waste management, hydroponic farming, and the development of appropriate technology.
- c. **Technology:** Implementing IoT, community coding, and digital applications for social benefit.
- d. **Art:** Utilizing traditional artistic expressions such as wayang and digital batik as interdisciplinary learning media.
- e. **Mathematics:** Modeling student behavior, social statistics, and data-driven decision-making.

LSTEAM is not only a learning approach, but an educational paradigm that facilitates the development of whole individuals. In boarding school education, the presence of teachers as interdisciplinary facilitators is key. Challenges faced include resistance to new approaches, limited teacher capacity, and a lack of interdisciplinary evaluation tools. Recommended strategies include:

- a. Intensive teacher training in LSTEAM curriculum design.
- b. Developing modules that integrate legal and scientific knowledge based on cultural values.
- c. Collaborating with universities and local communities to enrich content and approaches.

In line with Suherman, this approach is not only academic but also rooted in humanitarian and spiritual values.

The implementation of LSTEAM in a boarding environment allows for continuous

learning that addresses the cognitive, affective, and psychomotor domains, which is expected to demonstrate significant potential in developing students who think critically, ethically, and innovatively.

Collaboration between teachers, supervisors, counselors, and parents is essential to ensuring the success of this approach. The main challenges lie in the readiness of teaching human resources and the development of a contextual curriculum that incorporates local-global curriculum updates.

CONCLUSION

Fundamental Finding : The integration of the LSTEAM (Law, Science, Technology, Engineering, Art, and Mathematics) approach in boarding school education is an innovative educational model that aligns 21st-century skills with spiritual values and local cultural roots. It offers a holistic development framework for students, emphasizing ethics, creativity, and innovation. **Implication** : This approach provides a strategic pathway for addressing the global demands of education while ensuring relevance to local cultural contexts. By incorporating LSTEAM, students gain not only knowledge but also practical life skills and ethical wisdom, making them better equipped to face global challenges. **Limitation** : The study is limited by its conceptual nature and the lack of empirical data to support the model's implementation and outcomes in real-world educational settings. **Future Research** : Future research should explore the practical application of LSTEAM in boarding schools, assessing its impact on student outcomes such as creativity, ethical reasoning, and global competence. Comparative studies across different educational contexts and geographical regions could further validate the effectiveness and adaptability of this mode

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* **Mahdi Sudrajat** (Corresponding Author)

Indraprasta PGRI University Jakarta, Indonesia

Email: mahdisudra@gmail.com
