

Integration of Local Potential in Science Learning to Improve 21st-Century Skills

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ABSTRACT: Science learning that integrates local culture and wisdom is an important approach that is to continue to be developed in the current educational context. Along with the growing need for qualified and competitive human resources, adjustments in learning are crucial to prepare students with 21st-century skills. This research aims to evaluate how integrating local potential in science learning to improve 21st-century skills. The method used in this study is a Systematic Literature Review (SLR), with an analysis of 13 articles selected based on relevant research criteria and focus. The study results show that using learning media based on local potentials such as cultural traditions and natural resources has an important role in improving 21st-century skills, especially critical thinking and problem-solving skills. These findings underscore the importance of integrating local potential in science curricula to facilitate the development of essential skills in the modern era.

Keywords: local potential, science learning, 21-st century skills

INTRODUCTION

Today's global education is designed to prepare students to face the complex challenges associated with life in a competitive and high-tech world. Schools need to provide an environment where their students can develop knowledge, skills, and characteristics that will support them in becoming successful, economically productive, and actively engaged individuals as citizens [1,2]. One of the efforts to meet this goal is to utilize learning resources that are integrated with local potential [3].

Learning that is integrated with regional potential aims to create a learning environment and design learning experiences that combine local potential with learning activities. Regional potential can be used both as a learning medium and a resource. By utilizing local potential, students can gain direct experience through learning resources around the school environment [4]. The integration of local potential in learning helps students understand the subject matter in the context of daily life, increases interest in learning, and makes it easier to achieve learning goals. Therefore, teachers need to take advantage of local potential in the teaching and learning process, as this supports students in understanding contextually relevant concepts, as well as improving knowledge, skills, and attitudes [5].

Science learning is closely related to the environment, so local potential-based education can be applied to science learning. Thus, it is hoped that after studying science, students can be actively involved in efforts to preserve the environment, so that the existing local potential can be maintained [6]. Science education based on local potential has several advantages, such as making learning more realistic, encouraging creativity, and increasing collaboration with the community. In addition, this approach also functions as a contextual learning tool, utilizing and preserving local potential, and helping to form good student character, especially in terms of concern for the environment [7].

Despite the benefits of integrating local potential into learning, schools often fail to provide opportunities for students to explore and interact with their cultural heritage, local games, and traditions. Furthermore, teachers may not fully utilize local potential as a medium for contextual learning, which can lead to students losing interest in their local culture and environment [8].

Science learning that integrates local culture and wisdom is an approach that needs to be continuously developed. By linking science learning with local culture, the learning process becomes



more meaningful for students. Educators can integrate cultural elements from various regions into science learning [9]. Local potential in this context includes cultural and artistic aspects such as songs, games, dance, music, fairy tales, and folklore. In addition, regional potential also involves local wisdom that includes human values such as cooperation, sportsmanship, and creativity [10]. However, today's children are more familiar with modern games that are individual, such as the Play Station, compared to traditional games that prioritize social interaction. Schools often do not provide space or experience to explore local games and arts. Therefore, incorporating local elements into learning tools is an important effort to preserve culture and instill a love for culture and regional noble values in the younger generation.

In line with these developments, the next direction of education is faced with the demand for the importance of quality human resources who can compete. Therefore, in today's world of education, there is a need for learning adjustments that equip students with 21st Century Skills. 21st-century learning emphasizes the development of creativity, critical thinking, cooperation, problem-solving, communication, social, and character skills. The ability to solve problems shows that a person can overcome the challenges he faces. In the context of learning, students who can solve problems are considered to have critical thinking skills. All of these skills are interrelated and mutually supportive of each other in the teaching and learning process [11,12]. Current educational practices focus on developing students' 21st-century skills, which include creativity, critical thinking, problem-solving, communication, and collaboration. These skills are crucial for overcoming challenges in a rapidly evolving world. Research shows that integrating local culture into science learning not only makes the subject more relatable but also enhances students' engagement, creativity, and environmental awareness [13].

Based on the background that has been described, this study aims to evaluate how integrating local potential can be applied in the context of science learning and how this can contribute to the improvement of 21st-century skills. By evaluating how this integration impacts students' learning outcomes, the study will provide new insights into the effectiveness of local potential in fostering not only academic achievement but also character development in line with modern educational goals. By conducting this analysis, it is hoped that a better understanding of the effectiveness of using local potential in learning can be obtained, as well as how this integration can support the development of skills relevant to the demands of modern times.

RESEARCH METHODS

This study applies the Systematic Literature Review (SLR) method which involves five stages, namely theme determination, data search, selection, analysis, and conclusion drawing. The main focus of this article is on the integration of local potential in science learning to improve 21st Century Skills. The flow of the research process using the SLR method is presented in Figure 1.

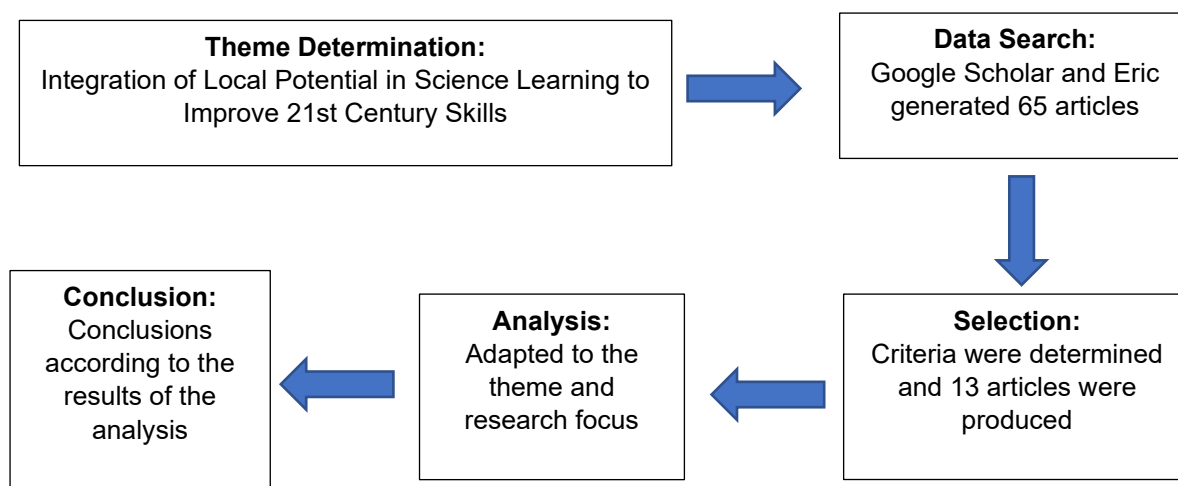


FIGURE 1. SLR Method

This study applies the Systematic Literature Review (SLR) method. The data search was conducted using Google Scholar and ERIC, yielding 65 relevant articles published between 2019 and 2024. These articles were selected based on criteria such as relevance to the theme, the focus on 21st-century skills, and article quality, resulting in 13 selected articles. The analysis was carried out using two approaches: content analysis of the abstracts and a thorough analysis of the full articles as needed. The results were

then categorized and mapped to provide a clear understanding of how integrating local potential in science education can enhance students' 21st-century skills.

RESULT AND DISCUSSION

This research aims to explore the application of local potential-based science learning, emphasizing enhancing 21st-century skills. What sets this research apart is the focus on utilizing local resources and culture to directly improve students' critical thinking, creativity, and environmental responsibility, especially in science education. By evaluating how this integration impacts students' learning outcomes, the study will provide new insights into the effectiveness of local potential in fostering academic achievement and character development in line with modern educational goals.

The results of the Systematic Literature Review (SLR) are presented in several parts, namely research trends, types of local potential, forms of integration in learning, 21st-century skills, and the level of education in this study. Based on the results of the analysis, 13 articles have criteria for this study. The results of the analysis of research trends are presented in Figure 2.

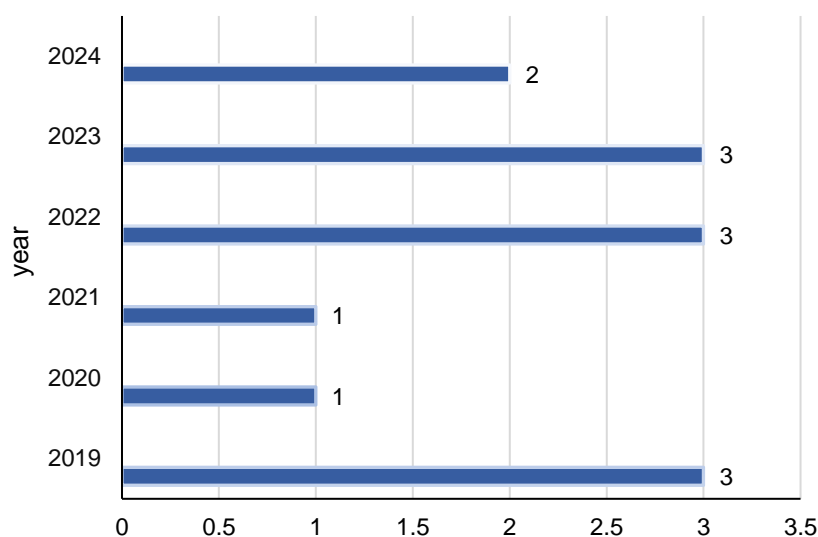


FIGURE 2. Research Trends from 2019-2024

Based on Figure 1, it can be seen that the research trend regarding the integration of local potential in science learning to improve 21st-century skills has increased in 2019 and in the range of 2022 to 2023 has experienced a significant increase with the number of articles being 3 in each year.

Each region in Indonesia has unique characteristics that are influenced by its geographical location and local potential. This local potential includes various aspects such as available natural resources, quality and skills of human resources, cultural wealth, geographical position, and historical background of the area [14]. In addition, local potential also involves the diversity of flora and fauna in the region and the accompanying sociocultural aspect [15]. The mapping of articles in this study is divided into 3 types which are presented in Figure 3.

In Figure 2, it can be seen that the type of local potential that is widely integrated in science learning is in the form of natural resources and traditions from the region [16]. Natural resources such as coastal areas, mountains, and other natural potentials can be used as learning resources. In addition, as a learning resource, tradition has significant potential to enrich educational and learning experiences. Traditions encompass a wide range of practices, customs, rites, and values that have been passed down from generation to generation, and can serve as a bridge between local knowledge and scientific concepts [17].

Indonesia's abundant natural resources are a valuable asset for developing science education that reflects real-world scenarios, intending to make science learning more impactful. By incorporating natural resources into the context of science education, the aim is to provide lessons that are both more meaningful and relevant [18]. This method strengthens the link between the scientific concepts taught and the practical knowledge available within the community (science in the community) [19].

In addition, traditions or cultural elements integrated into science education include types of dance, batik culture, local wisdom, and regional traditions. Integrating these traditions and cultural aspects into science lessons not only enhances the relevance between traditions and scientific concepts but also raises awareness about the importance of preserving nearly forgotten local traditions due to modern

developments. Incorporating community traditions into science education can foster an understanding of the local context, increase sensitivity to the surrounding environment, and aid in managing community knowledge [20].

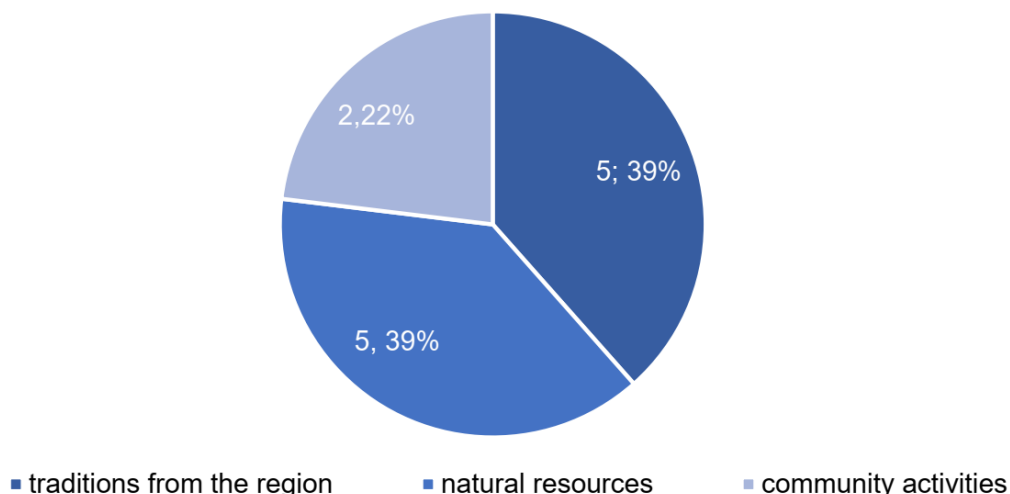


FIGURE 3. Types of Local Potential

In conclusion, incorporating natural resources and local traditions into science education enriches the learning experience by aligning scientific concepts with real-world contexts. This integration enhances the relevance of science lessons and fosters a deeper understanding of the local environment and cultural heritage. Additionally, it raises awareness about the importance of preserving endangered local traditions and encourages sensitivity to environmental and cultural contexts. Overall, this approach makes science education more meaningful and contributes to the preservation and appreciation of local traditions and knowledge.

The integration of local potential in learning can be carried out in various forms that are flexible and adaptive, depending on the specific characteristics and needs of each region. The results of the analysis of the form of integration in science learning are presented in Table 1.

TABLE 1. Analysis of the Form of Integration of Local Potential in Science Learning

No	Author's Name	Research Title	Forms of Integration in Science Learning	Research result	References
1.	L. Fitriah and I. Ita	Development of BioPhy Magazine Containing Local Wisdom to Improve Problem Solving Ability and Promote Environmental Awareness Campaign	Learning Media	The results of this research explain that BioPhy Magazine containing local wisdom was valid, effective, and successful in encouraging students to carry out environmental awareness campaigns.	[21]
2.	J. Saptaningrum and Ade Cyntia Pritasari	Integrasi Potensi Lokal Purworejo Terhadap Kompetensi Dasar Muatan IPA SD Guna Meningkatkan Kompetensi 4C	Learning Media	The results of this research explain that integration of Purworejo's local potential into the science content of elementary school classes 4, 5, and 6 can improve 4C	[22]

No	Author's Name	Research Title	Forms of Integration in Science Learning	Research result	References
				competencies in students	
3.	A. Fitriani, D. Dharmono, and B. Badruzsaufar	The practicality of popular scientific book of aquatic plant on mangrove habitat in the form of flipbook to college students' critical thinking skill	Learning Media	The results of this research explain that scientific book on aquatic plants in the mangrove habitat in the form of a flipbook is stated to be very practical for use in learning, especially in learning Botany.	[23]
4.	A. S. Putri and N. Aznam	The Effect of The Science Web Module Integrated on Batik's Local Potential Towards Students' Critical Thinking and Problem Solving (Thinking Skill)	Learning Media	The results of this research explain that Web science module integrated with local batik potential has a significant influence on students' thinking skill	[24]
5.	T. Y. S. Ningrum, H. Habibi, and L. F. Azizah	Learning Cycle 7E Terintegrasi Potensi Lokal Ekosistem Mangrove Untuk Meningkatkan Berpikir Kritis Peserta Didik	Learning Model	The result of the gain score indicate an increase in learning in the experimental class by 0.85 (high) compared to the control class by 0.51 (medium).	[25]
6.	K. T. Tamimiya and I. G. P. Suryadarma	Potensi lokal Gunung Ijen untuk pemahaman konsep dan berpikir kreatif pengurangan resiko bencana	Learning Media	The results of this research explain that Science LKPD effectively improves conceptual understanding and creative thinking	[26]
7.	K. Aditia, A. Muhlisin, and S. Singgih	The Development of a Local Wisdom-Based Natural Science Comic Through a Webtoon to Improve Students' Critical Thinking Skills	Learning Media	The study concludes that the developed natural science learning medium is feasible to be used in improving students' critical thinking skills in natural science learning.	[27]
8.	S. Mahmudah,	Development of Physics Teaching	Teaching resources	The results of this research explain	[28]

No	Author's Name	Research Title	Forms of Integration in Science Learning	Research result	References
	A. S. M, and D. Dewantara	Materials Containing Local Wisdom to Train Students Critical Thinking Skills		that electronic teaching materials containing local wisdom to train critical thinking skills are suitable for use in learning	
9.	M. Supandi and S. Senam	Development of science learning media-based local wisdom Batui to improve critical thinking ability	Learning Media	The implementation of learning media in the classroom can increase students' active participation so that it has an impact on improving critical thinking skill	[29]
10.	I. P. O. Indrawan and I. G. J. Mahendra	E-Learning Terintegrasi Kearifan Lokal Bali Berbasis 4C pada Mata Pelajaran IPA	Teaching resources	The study results show that the e-learning design has integrated Balinese local wisdom comprehensively and developed 4Cs with very good quality entry qualifications based on the assessment of material experts and e-learning	[30]
11.	L. E. Laos and M. Tefu	The Development of Physics Teaching Materials Based On Local Wisdom To Improve Students' Critical Thinking Ability	Teaching resources	The result revealed that the local wisdom-based physics teaching material was effective to improve students' critical thinking skill with 0.80 of N-gain score (high) and 89.91% of students' responses toward learning using the material.	[31]
12.	S. A. Cahayu, J. Siburian, and A. Hamidah	The Effect of Problem Based Learning (PBL) Model Based on Local Wisdom to Improve Students' Critical Thinking Skills	Learning Model	The results of this research explain that the problem-based learning (PBL) model based on local wisdom in making lemang kancung	[32]

No	Author's Name	Research Title	Forms of Integration in Science Learning	Research result	References
				beruk has a significant and moderate effect on improving students' critical thinking skills.	
13.	J. Syahfitri	The Utilization of Local Wisdom-based Interactive Digital Module to Improve Students' Critical Thinking Skills	Learning Media	The results of this research explain that Local wisdom-based interactive digital module could significantly improve students' critical thinking skills for all indicators.	[33]

Table 1 shows that the integration of local potential in science learning is most commonly applied in the form of learning media. Learning media is a tool or resource used to deliver teaching materials and facilitate the student learning process. This media can take many forms, such as textbooks, images, videos, computer software, and interactive models. The main purpose of using learning media is to make teaching materials more interesting and easy to understand, as well as to increase student engagement and motivation in the learning process [34,35].

Educational media encompasses all tools and resources that can convey messages through various channels, such as stimulating students' thoughts and feelings. These media aim to foster an effective learning process, facilitating the acquisition of new information and helping students achieve learning objectives successfully. Well-designed educational media can enhance and advance learning, offering support in teacher-centered instruction. The effectiveness of educational media largely depends on the teacher's ability to utilize these tools effectively. Additionally, educational media assists teachers in presenting lesson material to students, ensuring that the content is easily understandable and making the learning experience engaging and enjoyable [36,37].

By utilizing appropriate media and integrating it with local potential, science learning becomes more contextual and engaging and more effective in facilitating the mastery of 21st-century skills. The results of 21st-century skill improvement are presented in Figure 4.

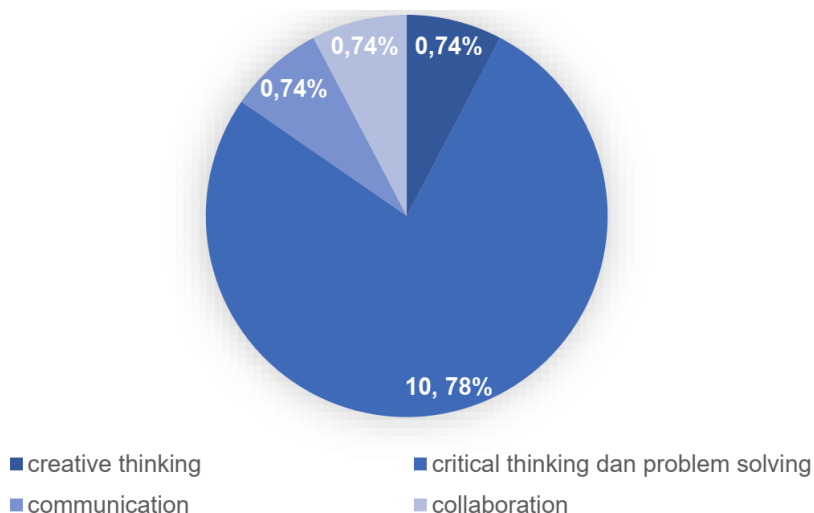


FIGURE 4. 21st Century Skill Enhancement

Based on the results of the analysis, the most improvement in 21st-century skills is critical thinking and problem-solving skills in as many as 10 articles. The development of critical thinking skills is

essential for students. Through critical thinking skills, students are trained to become proficient in analyzing, synthesizing, applying, and evaluating the information obtained, as well as being able to make decisions and solve problems independently, creatively, and responsibly [38].

Education is fundamentally an endeavor aimed at nurturing and developing the full range of human potential in students. This encompasses not only their physical abilities but also their intellectual capacities and volitional traits, ensuring that these potentials are realized and effectively utilized throughout their lives. To achieve the skills necessary for the 21st century, it is crucial to enhance the quality of educational practices. The role of educators in this process is paramount, as their involvement in delivering 21st-century education plays a significant part in preparing students for a more promising future. Furthermore, teachers are required to continually update their skills and adopt innovative approaches to meet the evolving demands of modern education effectively. This continuous professional development is essential for addressing the complexities and opportunities presented by the educational landscape of the 21st century [39,40].

Local wisdom encompasses the idea that local cultural contexts are essential in preparing high-quality human resources who remain deeply connected to their cultural roots. This wisdom aids students in addressing and resolving challenges they encounter with a sense of discernment and understanding. In the context of the 21st century, recognizing the potential of local wisdom is increasingly important. Integrating the values of local wisdom into educational and societal frameworks not only contributes to the preservation and enrichment of national cultural heritage but also serves as a vital mechanism for filtering and moderating the impact of external cultural influences. By doing so, it ensures that the cultural identity and traditional knowledge of a community are maintained while adapting to global changes [41].

CONCLUSION

Based on the results of a comprehensive systematic literature review, it was observed that from 2019 to 2024, a total of 13 articles explored the integration of local potential into science education as a means to enhance 21st-century skills. The analysis of these studies reveals that the most commonly addressed aspects of local potential include regional traditions or cultural practices and natural resources. These elements are frequently utilized in the development of educational media. The findings highlight the significant role that learning media, grounded in local traditions and natural resources, plays in enhancing 21st-century skills, particularly in fostering critical thinking and problem-solving abilities. This underscores the importance of incorporating local potential into science curricula. By doing so, educators can enrich students' learning experiences and better equip them with the essential skills needed to navigate and address the challenges of the modern era. This approach not only connects students with their cultural and environmental heritage but also supports the development of competencies that are crucial for their success in a rapidly evolving world.

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