



The Potential of Geoparks for Sustainability Learning Resources in Elementary Schools: A Review

Styo Mahendra Wasita Aji*

Herti Prastitasari

Miftha Huljannah

Nurul Julaifah

¹Department of Elementary Teacher Education, Faculty of Education, Universitas Negeri Surabaya –
Kampus 2 Unesa, Lidah Wetan, Kecamatan Lakarsantri, Kota Surabaya, East Java

²Department of Elementary Teacher Education, Faculty of Teacher Training and Education, Universitas
Lambung Mangkurat - Jalan Brigjen H. Hasan Basri, Kayu Tangi, Kota Banjarmasin, South East
Kalimantan

³Department of Madrasah Ibtidaiyah Teacher Education, Faculty of Tarbiyah and Education, Institut
Agama Islam Negeri Sultan Amai Gorontalo - Jalan Gelatik No.1 Kota Gorontalo, Gorontalo

⁴Department of Elementary Teacher Education, Faculty of Teacher Training and Education, Universitas
Muhammadiyah Mataram - Jalan KH. Ahmad Dahlan No. 1, Pagesangan, Kota Mataram, West Nusa
Tenggara

*Corresponding author, E-mail: styoaji@unesa.ac.id

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Abstract

The environment can be a source of learning that is relevant to elementary school students according to their developmental stages. The purpose of this study is to describe the role of geoparks for education so far, to describe geopark opportunities as a learning resource in elementary schools, and to describe the challenges of geoparks as a learning resource in elementary schools. The research is based on a systematic method of literature review that refers to the PRISMA flow. Systematic literature review consists of identification, screening, and included steps. The reviewed articles went through the screening and study of the PRISMA pipeline with the Scopus database between 2020 until 2025. The results of the study show that there is a role that has been carried out by geoparks as a place that contains knowledge and values about sustainability, the potential of geoparks as a sustainability-based learning resource, and challenges as a learning resource in elementary schools with sustainability values that require regulatory certainty as a form of community involvement in preserving geoheritage heritage. The next recommendation is the potential for the development of teaching materials or a geopark-based learning model that can be carried out.

Keywords: elementary school; geopark; learning resources

INTRODUCTION

Learning resources need to be adjusted to the peculiarities of developmental characteristics and potential around students. Because conformity with students affects the quality of learning (Dewanti et al., 2024; Evitasari, 2024). Elementary school students are children aged 6 to 12 years. In Piaget's view, it is a concrete operational stage which means that they are able to solve problems in a real context in the form of facts in the field (Hayat et al., 2024; Setiawan et al., 2020; Waty, 2024). These student characteristics are an initial consideration in determining learning resources that students can access. Accessible learning resources also open up opportunities to contribute to the quality of students in learning (Kusuma, 2018).

Determining the learning resources that will be accessible to students can come from anything. Learning resources for students based on their type can come from humans and non-humans consisting of messages, people, materials, tools, techniques, and the environment (Dwi Hasanah et al., 2024; Wulandari, 2020). Of the six types, the environment has a meaningful role as a source of learning. This is emphasized by the agenda of the Sustainable Development Goals which number 17 are closely related to the sustainability of protecting the environment (Fatmawati et al., 2025; Jimola & Omodun, 2023; United Nations, 2023). Basically, the environment can be designed specifically for learning or directly used for learning (Abas et al., 2023; Fatmawati et al., 2025; Herman et al., 2023). The environment as a learning resource contributes to various aspects of learning for students (Hidayat, 2024; Indriani, 2022; Suroso, 2021; Ulum, 2017).

The importance of utilizing the environment as a learning resource for elementary school students can be specifically reexplored. Exploration as a source of learning can be expected so that learning is meaningful, maintaining sustainability or mitigation by recognizing the environment (Herman dkk., 2023; Mahanani dkk., 2025). Further environments that can be explored are geoparks or known in Indonesia as "*taman bumi*". Geopark itself is an area that is protected and recognized as a geological, biology and cultural heritage that aims for sustainable development (Kazuhiro et al., 2014; Lanara et al., 2023; Megerle & Teuber, 2022; Naydenov, 2022). The United Nations through UNESCO has also created a global network of geoparks that now covers 50 countries that have rich their natural parks (UNESCO, 2025).

Geoparks as an area that is deliberately an area that has an earth heritage to be preserved sustainably has a close relationship with education. Significantly the geopark is managed for the concept of protecting, education, and sustainable development (UNESCO, 2025). Geoparks with heritage sites need to have distinctiveness that is in accordance with educational values (Poros & Sobczyk, 2021). Therefore, it is appropriate that existing geoparks with their peculiarities can be optimized for their potential through and for education. Indonesia itself already has 12 geoparks that have been recognized by UNESCO (UNESCO, 2025). The richness of this geopark should be maintained and continue to be promoted, including through education.

Education through this geopark has a target for both formal and informal education. This means that the educational value of geoparks targets all ages to have awareness of nature, culture, and heritage (UNESCO, 2025). Elementary school is the first formal education and has the closest access to geoparks. Elementary school teachers deserve support in promoting geoparks in classrooms. Because previous research shows that education from geoparks has relevance to the curriculum in elementary schools and can support learning, especially outside learning to understand the earth and local culture (Fernandes et al., 2023; Takenouchi, 2016). Education with geoparks also shows its role in increasing understanding of environmental conservation and sustainable development (Hartanti et al., 2024).

Previous studies have shown the relationship between geoparks and education. It is possible that this relationship can be further elaborated regarding the potential of geoparks for the most basic formal education in elementary schools. Literature studies are carried out to open up opportunities for environmental conservation and sustainable development through the promotion of geoparks as a learning resource in elementary schools. Especially in the Indonesian context, literature studies can open up opportunities to become a source of learning specifically in natural

and social sciences (IPAS) subjects or elaborated for other subject content. Because in the geopark, there has basically been a focus on geology, biology, and culture. This systematic literature review focuses on the potential of geoparks as a source of learning in elementary schools. The three research focuses/questions asked are: (RQ1) What is the role of geoparks for education?; (RQ2) What is the potential of geoparks as a learning resource for elementary school students? (RQ3) What are the challenges of geoparks as a learning resource for elementary school students?

METHOD

Research Design

The systematic literature review (SLR) method was chosen to study geoparks as a learning resource in elementary schools. The SLR method chosen is PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) which is guided by (Liberati et al., 2009). PRISMA's steps for this literature review are through identification, screening, eligibility, and presenting. The results of the study are presented objectively in line with the focus of the penalty question.

Inclusion and Exclusion Criteria

In this literature review, inclusion and exclusion are carried out through the following steps: (1) searching for articles as documents to be reviewed through the *Publish or Perish* application with the Scopus database, (2) in the search for restrictions for articles published between 2020 to 2025 sourced from Journals, (3) articles related to geopark education, (4) the same article, one (5) open access article is selected, so that the file (.pdf) is available or downloaded in the Zotero application system, and (6) the Article is in English.

Screening and Feasibility Assessment for Data Analysis

Screening and feasibility assessment for articles were carried out since the start of the document search in August-September 2025 Screening was carried out through a search in *Publish or Perish* 8 with keywords based on the focus of the research question. The search is also limited to the year of publication from 2020 to 2025. The following is a presentation of the search results articles based on the focus of the research.

Table 1. *Publish or Perish* Assisted Article Search Results

No.	Search Keywords	Paper Quantity	h-index Article
1	"Geopark" AND "Education"	35	7
2	"Geopark" AND "Elementary School" OR "Primary School"	1	1
3	"Geopark" AND "Learning"	14	5
4	"Geopark" AND "School"	8	4
Total		58	17

Based on the search results with the scopus database using *Publish or Perish* 8 found a total of 58 articles related to geoparks. Of the 58 articles, 16 articles were detected as the same, so there were 42 articles. Of the 42 articles, 12 articles can be accessed open-access. This means that these

12 articles can be downloaded as file type (.pdf) in the zotero application. The following is a distribution of articles that are open access based on the year of publication.

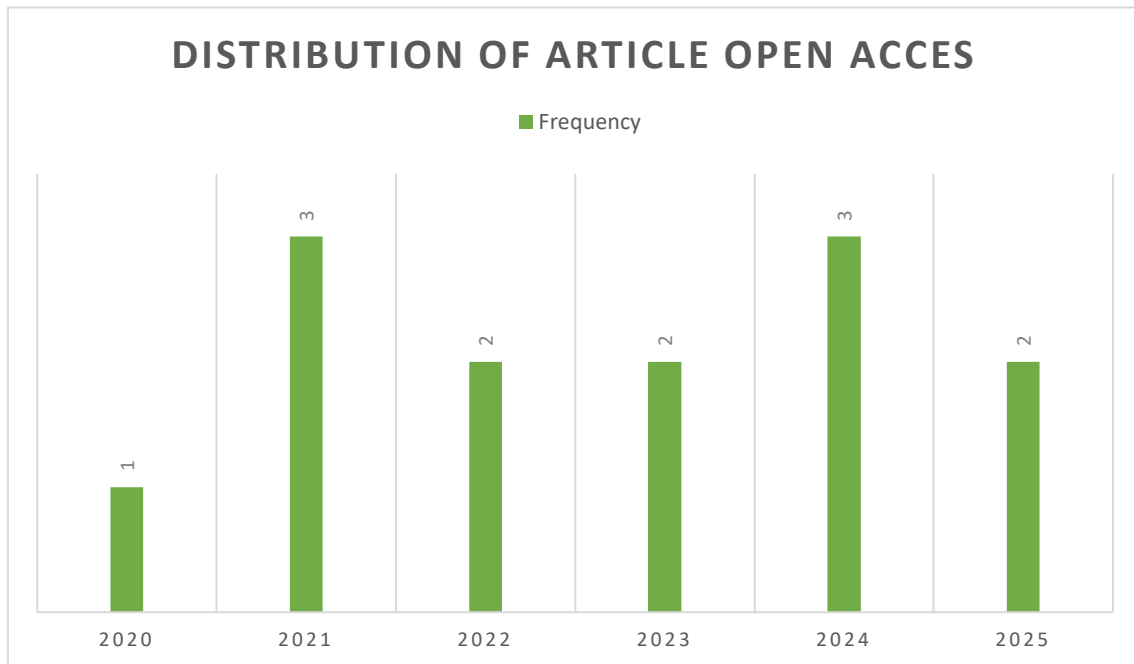


Figure 1. Distribution of Downloadable Open Access Articles on the Zotero App

PRISMA Flow

The study procedure refers to the PRISMA flow from Liberati et al. (2009) through the stages of identification, screening, and inclusion. As previously described from the scopus database through *Publish or Perish*, 58 articles were identified. Identification of the article removed 16 of the same article. Then the screening of the article is carried out. There were 42 articles identified, 30 articles were not open access through the *Zotero* application, so they were excluded. 12 Articles are selected for taking and checking their eligibility. There are 3 articles that are considered unfeasible, because they are not in English. At the included level, finally 9 articles were selected to be review material in this study. The article is then analyzed using the help of the atlas.ti data analysis application to facilitate the study based on the three focus of the research questions. The following is an overview of the flow of PRISMA in sorting and selecting articles for study, which is presented in Figure 2.

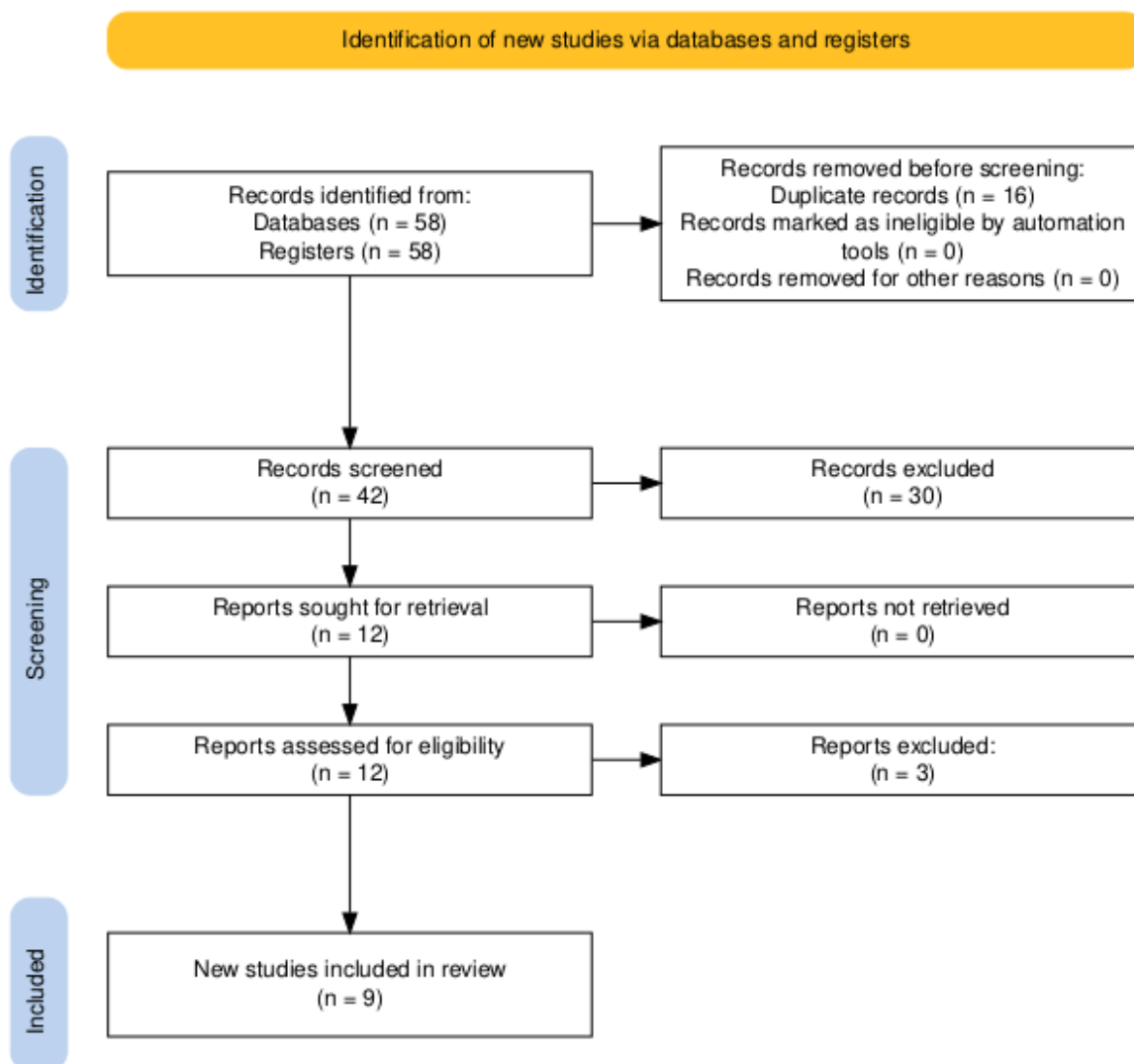


Figure 2. PRISMA Flow of Article Selection

RESULT AND DISCUSSION

Result

Based on identification, screening, and inclusion through the prism flow, 9 selected articles have been produced. The selection of articles to be researched as accessed and selected results to be studied. The review of the article will be carried out in the discussion section, after the presentation of the article results is accessed and selected. The selected articles are presented in the following Table 2.

Table 2. Selected Article Results

No.	Study (year)	Design	Source	Key Findings
1.	(Briggs, 2023)	Qualitative-Case Study	Journal of Tourism Futures	Geoparks offer a holistic and contextual learning framework ideal for primary schools, by integrating geological heritage conservation, education, and sustainable development principles into hands-on learning experiences in nature
2.	(Elfithri, 2021)	Mixed Method- Qualitative- Descriptive- Quantitative	Arabian Journal of Geosciences	Geoparks have a reputation as a natural landscape and an effective educational platform. Where the issues in it such as waste management and conservation become contextual materials to build awareness and understanding of sustainability for the community, including students in it.
3.	(Guimarães, 2022)	Quantitative- Exploratory	International Journal of Environmental Research and Public Health	Nature trails in the Unesco Global Geopark can be a source of education in elementary schools in order to populate environmental education, geoeducation, and lifestyle through structured nature exploration.
4.	(Ilgizovna, 2024)	Qualitative- Descriptive	Journal of Ecohumanism	The role of the Geopark as a "natural geoscience" laboratory that offers an innovative approach through programs that can be used as a direct learning resource for elementary school students to increase ecological awareness
5.	(Magliacani, 2025)	Qualitative- Single Case Study	Journal of Cultural Heritage Management and Sustainable Development	The program with a focus on cultural heritage through "Park Gateways" becomes a learning capital that engages students in workshops and historical exploration that fosters cultural awareness.
6.	(Mikhailenko, 2022)	Systematic Review	International Journal of Environmental Research and Public Health	Geoparks can be a source of ecological learning against the legacy of environmental pollution and increase environmental awareness for visitors, including elementary school students
7.	(Sallam, 2020)	Qualitative- Case Study	Arabian Journal of Geosciences	The phenomenon of rocks has the potential to be a direct learning resource for students to understand geological processes, natural heritage and environmental education
8.	(Sánchez-Cortez, 2024)	Mixed Method-	Earth Sciences Research Journal	The diversity of morphology in geoparks that are still preserved can be a direct lesson and make them aware of the importance of conservation.
9.	(Tobing, 2024)	Quantitative- Evaluative	Journal of Ecohumanism	There is an increase in the quality of education through the use of geoparks as a learning resource

Discussion

The Role of Geoparks for Education

The role of geoparks is connected to the overall scope around them. In its development, geoparks play a meaningful role in the development of welfare in the community (Elfithri, 2021). Geoparks show participation in development within an area that encourages a model of community involvement (Magliacani, 2025). The involvement that is built is not only in the initial planning, but also describes participation in its implementation and development. The concept that is built through connection with the community is a holistic and constructive concept in building with the community, including in the community (Briggs, 2023). Optimization in community-based regional development opens the way to aggregating different areas with the community (Guimarães, 2022). Primary school participation is an opportunity to empower communities that focus on education, especially the foundation of direct experience.

The fields that are aggregated include tourism, conservation, and especially education for the sustainability of the geopark itself. Because the science of sustainability is a new academic scientific study that can be studied (Elfithri, 2021). Geoparks form a shared space with the community for research, geoeducation, and geoconservation (Sánchez-Cortez, 2024). This means that Geoparks reaffirm how their role in sustainable development is connected to UNESCO's 2030 framework (Briggs, 2023). Education plays an important role in maintaining the sustainability of conservation in geoparks. Therefore, the role of education and its weapon geoparks is a mutual one. This role should not be separated from the participation of the basic school as the formal community closest to the geopark environment based on its location and distribution.

Geoparks stand for sustainability. This means that geoparks open opportunities for conservation with the main focus on geology, but also contribute to the fields of education and research (Sallam, 2020). The use of sites, also known as geoheritage, can provide meaningful value in education in the form of changes that occur in the region (Sánchez-Cortez, 2024). Heritage sites have a vital role in the development of local communities (Magliacani, 2025). Geoparks play a role in education to form a space of activity with the surrounding community as in education. Ultimately, Geoparks have a meaningful role in society that contributes to Education in building environmental awareness (Ilgizovna, 2024). Therefore, mapping the mitigation of development potential in formal schools to foster environmental awareness and meaningful geopark sustainability is a necessity.

Based on the study of the previous article, we can map that geoparks have a multidimensional and integrated role in education which is the framework for the sustainable role of geoparks in education. The idea is that the geopark can be developed as a natural laboratory that can play a role in meaningful learning with hands-on experience for elementary school students. Geoparks can be excavated as case study locations for formal school students for environmental education and conservation in building ecological literacy and environmental awareness. The existence of geosites that have survived over time has significant historical value that helps develop the narrative of local wisdom and culture for future generations. Finally, Geoparks with geosites and geoheritage are the framework for developing STEM in case studies and phenomena that open up opportunities for problem-solving with an integrated approach to sustainability.

The Potential of Geoparks as a Learning Resource in Elementary Schools

The potential of geoparks as a learning resource is related to the role of geoparks in education. Potential as a learning resource, because geoparks use a bottom-up approach in encouraging education, conservation, and sustainability (Briggs, 2023). Making geoparks a learning resource can open up opportunities to promote sustainable science about environmental issues (Elfithri, 2021). Sustainability science learning resources can be started from the sustainability culture itself. This means that culture in sustainability does not play a role as a driver, but as a foundation for all dimensions of sustainability itself (Magliacani, 2025). It is important to note that the bottom-up approach as the foundation capital for sustainability encourages schools as communities that are connected by location distribution with geoparks. The school encourages students to make geoparks a location for concrete learning directly about geological processes and science concepts that are integrated with nature, as well as about culture. Concrete learning that will be easy for elementary school students to remember and understand according to their developmental stages.

Culture as the foundation of learning resources makes geoparks have values that can be learned. Geodiversity contained in geoparks has a value consisting of intrinsic value and existence value, so philosophically it has a value of usefulness for human life and society (Sánchez-Cortez, 2024). In the geopark, there are also learning resources from the past. Mitigation in geoparks about environmental pollution, environmental monitoring, and about indirect awareness of its visitors (Mikhailenko, 2022). On the other hand, as a source of learning, these parks themselves have so far had the task of developing activities such as in Education in an effort to preserve, preserve, archive, and even develop museums about these parks (Magliacani, 2025). This importance cannot be separated from the efforts of geoparks in managing parks so that they have an appeal, especially for young people (Ilgizovna, 2024). Therefore, the management of geoparks as an effective and interesting learning resource can be an attraction for young people, including elementary school students. Cultural potential as the foundation of learning resources, shows the need to study geoparks to learn the value of character education. The values encourage students to build character values with a sense of responsibility, awareness, and pride in heritage in the form of geosites and geoheritage from an early age.

Geopark-based learning resources reaffirm geopark based learning. Returning to geoparks for elementary school students can mean rethinking nature (Elfithri, 2021). This statement is in line with learning to find the right model to re-emphasize the value as a multipurpose site that can be a learning resource for sustainable development that is culturally based on community heritage (Magliacani, 2025; Sallam, 2020). A learning resource that has the potential to be an inseparable part for elementary school students is its role as a geoscience laboratory, in which there is a location that shows the history of the earth's development, and the values contained in it (Ilgizovna, 2024). The relationship between geoparks and communities such as elementary schools and their students becomes a bridge of mutual reciprocity in building awareness to learn about the development of the UN's sustainable goals, including in quality education, sustainable cities and communities, and climate action (Briggs, 2023). The reciprocal relationship between schools and geoparks to make learning resources sustainable shows a roadmap for the development of scientific education in learning. Geoparks are contextual and relevant learning resources in connecting students with their environment, training their observations, and how to measure, predict and analyze sustainability in a real setting.

Based on a study of the previous article related to the potential of geoparks as a source of learning in elementary schools, it shows geopark maps in concrete learning. Where contextual concrete training has relevance to the stage of student development. Learning from geoparks provides the embodiment of meaningful learning that provides a memorable experience for students. Learning resources based on geological and cultural heritage are a valuable learning resource in learning character education to be responsible for nature, the environment, and have a proud awareness of their culture. Finally, developing as a learning center means presenting learning experiences for elementary school students in a multidimensional manner.

The Challenge of Geoparks as a Learning Resource in Elementary Schools

The study of the challenges of geoparks as a learning resource in elementary schools is based on the basic role of the geopark itself. So far, geoparks have been deliberately and planned closely related to their role as a place of conservation, education, and tourism that is closely related to sustainable development by the UN (Briggs, 2023). As a learning resource, geopark areas are included in the new area for many agencies such as schools (Mikhailenko, 2022). Therefore, attention to be explored and elaborated as a potential source of learning, especially for schools in the vicinity, is still limited. On the other hand, the important role of local residents, or we can directly refer to it as schools, can have an important war for the geopark itself (Tobing, 2024). These findings show that there are limitations of geoparks as a source of learning that still need further exploration. As a place that is still limited by elementary school teachers in their area, the existence of geoparks must be ensured for safety and logistics. Its potential as a learning location is directly related to its role as a natural laboratory that requires careful risk analysis and management to make it a source of learning. Then the analysis is no less important, namely about planning and conformity with the integration of the existing curriculum in elementary schools. Teachers must ensure that before conducting geopark-based learning, they have relevance to the elementary school curriculum for students.

As a cultural heritage, the participation of local stakeholders in the geopark is the driving force for the sustainability of the geopark. Implementation is indeed professionally managed by the geopark, but the success of the geopark does not depend on the manager (Mikhailenko, 2022). Its potential as a cultural heritage that can be used as a learning resource needs to be encouraged to become a project in maintaining it, so that its use as a learning resource as a form of community involvement becomes an interesting point in relation to community involvement in the theme of sustainable development (Magliacani, 2025). Moreover, there are also challenges to maintain the stability of visitor attendance to the geopark, the role as a learning resource opens up opportunities for sustainability with the participation of surrounding elementary schools (Ilgizovna, 2024). For teachers who show the role of schools as a local community, it is necessary to consider their own capacity. Teachers need to reflect on their understanding of geoparks. Teachers still need to consider the role of collaborators as co-educators from the geopark management. Collaboration needs to be balanced with synergy to determine what students will learn according to the curriculum and their developmental level.

The main challenge in managing geoparks as a learning resource is also related to regulations. Because basically, the government has an important role in encouraging stakeholder involvement around geoparks such as schools. There are still differences of views between

stakeholders and the government as the main stakeholders of geoparks (Briggs, 2023). The government needs to have firmness, so that it has clear regulations in its territory (Guimarães, 2022). The government's firmness on regulations provides certainty to the extent to which schools can use geoparks as a learning resource. Considering that one of the key roles of geoparks is public involvement, education, and increasing awareness about nature, conservation, biodiversity and socio-cultural inheritance, so that it has value for future generations (Elfithri, 2021; Ilgizovna, 2024). Policy is an important factor that can bridge schools and geoparks. Policies can encourage the acceleration of collaboration between schools and geoparks that synergize and partner in developing learning and learning resources for elementary school students.

Thus, challenges need to be noted in the use of geoparks as a source of learning in elementary schools. Policymakers need to encourage clear regulations so that schools participate in geopark education as a learning resource. The regulation also encourages teachers to have awareness to play a role in geoparks through geopark-based learning planning. Planning is also key in determining the relevance of geopark potential in the curriculum that already exists in elementary schools. The limitations of teachers in educating can need to be answered with a pattern of collaboration with the geopark, so as to open up relevant and meaningful learning opportunities.

CONCLUSION

Conclusion

This literature review has attempted to conduct a new conceptual study as a new model of the use of geoparks as a learning base in elementary schools by utilizing the Scopus database. This study shows the potential synthesis of geoparks in education, especially for elementary schools. Awareness of the existence of geoparks for elementary schools can open up opportunities as a learning resource based on sustainability values. Within the geopark, there are geology, biology, and cultural that play a role in quality, sustainable, and community-involved education. Its role as a learning resource in primary schools is connected to sustainable science and environmental issues. Other learning resources contained in it include environmental mitigation, environmental monitoring, and about raising awareness of socio-cultural values as a form of responsibility. Geoparks as a learning resource show their role as a multipurpose site. Thus, challenges such as clear regulations need to be pursued by the government, so that its potential as a source of learning is assured as a form of mutual involvement of the surrounding education community in maintaining, promoting and taking responsibility for the surrounding geoheritage. The conceptual study is the initial framework to encourage the analysis of the elementary school curriculum in an effort to explore the potential of geoparks as a base for learning resources.

Recommendation

This research is limited to the study of the potential of geoparks as a source of learning in elementary schools. Research is limited to conceptual studies based on scopus open access data sources that have not been empirically tested. The potential based on the results of the study, namely the development of geopark-based teaching materials or geopark-based learning models, can be carried out in future studies. Geoparks are specifically the basis for educational development research in elementary schools. Case study research in certain elementary schools

in the geopark area can also be done in terms of community involvement with schools in providing learning resources. Finally, the researcher can then analyze the suitability of the elementary school curriculum with geoparks in terms of geodiversity, biodiversity, and cultural diversity in it.

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