

THE EFFECTIVENESS OF DIFFERENTIATED LEARNING BASED ON LEARNING STYLES IN INCREASING INTEREST IN LEARNING SCIENCE: AN EMPIRICAL REVIEW 2021–2025

Suci Okta Mela Dwisa^{1*}, Farid Ahmadi², Bambang Subali³, Ellianawati⁴

^{1,2,3,4}Semarang State University, Indonesia

E-mail: sucieoktameladwisa20@students.unnes.ac.id

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Abstract

This study aims to review the effectiveness of differentiated learning based on learning styles in increasing interest in learning science through a systematic literature review. The research method used the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach, in which 1,264 initial articles were identified through various international and national databases, then screened through stages of eliminating duplication, screening based on title and abstract relevance, and feasibility testing based on full content. From this selection, 76 articles met the inclusion criteria and were analyzed in depth. The results of the study indicate that differentiated learning can significantly increase student interest in learning by increasing intrinsic motivation, active involvement in the learning process, and creating an inclusive and responsive learning environment to individual needs. In addition, differentiated learning is in line with the principles of the Independent Curriculum which focuses on personalized and flexible learning, thus providing opportunities for students to learn according to their styles and needs. Therefore, it is recommended that elementary school teachers implement differentiated learning strategies in a planned and sustainable manner by considering the variety of students' learning styles. This step is expected to optimize interest, motivation, and the quality of science learning, so that learning becomes more meaningful, enjoyable, and relevant for each student.

Keywords: *Learning Styles, Science, Interests, Differentiation*

INTRODUCTION

In recent years, literature reviews have become an essential method for obtaining a comprehensive overview of scientific findings in a field of study. A systematic literature identification and selection process is necessary to ensure the quality and relevance of the sources used in the research. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) diagram is used to illustrate the literature selection process in a transparent and structured manner. Based on the identification process, 1,264 initial records were obtained through databases (1,000) and registries (264). Of these, an initial screening was conducted to remove duplications (n = 150), automatic flagging as ineligible (n = 29), and deletions for other reasons (n = 38). After the initial screening stage, 34 records were screened and 94 were excluded for not meeting the criteria. Furthermore, 231 reports were searched for retrieval, but 126 were not retrieved.

A feasibility assessment was conducted on 80 reports. Several reports were subsequently excluded due to duplicate authors (n = 231), unavailable abstracts (n = 126), and missing access links (n = 80). After a rigorous selection process, 76 new studies met the criteria and were included in this literature review. This systematic selection process demonstrates the importance of a rigorous screening process to ensure that only relevant, credible, and accessible literature is used in the study. Therefore, the results of this literature review are expected to provide a comprehensive and accurate picture of research developments in the field under review. In the era of dynamic educational transformation, particularly in the 21st century, the learning paradigm in elementary schools is required to be more adaptive, creative, and student-centered. Learning Natural and Social Sciences (IPAS), as one of the core subjects in elementary schools, plays a crucial role in developing critical thinking skills, problem-solving skills, and scientific attitudes in students from an early age. However, the diverse characteristics of students, particularly in their learning styles, pose a serious challenge that must be addressed appropriately in the learning process. Students with visual learning styles find it easier to understand material through images, graphics, or color; auditory learners

tend to understand through verbal explanations; while kinesthetic learners prefer physical activities or hands-on practice. Mismatching learning methods with students' learning styles not only reduces the effectiveness of understanding but also has the potential to reduce their interest in learning subjects such as IPAS. In response to these challenges, differentiated instruction has emerged as a relevant and effective learning strategy. This approach is based on the principle that each student has unique learning needs, so the learning process must be tailored to their needs, interests, and learning profiles (Tomlinson, 2014). Differentiated instruction allows teachers to flexibly modify learning components such as content, processes, products, and the learning environment. This aligns with the implementation of the Independent Curriculum in Indonesia, which emphasizes freedom to learn and provides teachers with greater room to tailor learning to student characteristics. Several recent studies have shown that differentiated instruction not only improves students' cognitive learning outcomes but also positively influences their learning motivation, attitudes, and self-confidence, particularly in the context of science and social studies learning at the elementary school level.

One important indicator of successful learning is interest in learning. Interest in learning is a psychological factor related to a person's interest, attention, and drive to actively engage in learning activities. Students with a strong interest in learning tend to be active, intrinsically motivated, and demonstrate greater persistence (Slameto, 2013). With increasing attention to the affective and socio-emotional aspects of students in 21st-century learning, recent research shows that differentiated learning plays a crucial role in increasing students' interest in learning because it provides space for exploration according to their learning styles. This is increasingly relevant in science learning, which requires conceptual understanding based on concrete experiences, exploration, and observation of the surrounding environment. If the learning approach does not actively engage students according to their learning preferences, their interest in learning tends to be low. Meta-analyses conducted over the past few years have shown that differentiated learning is effectively implemented in science and social studies learning at various elementary school levels in Indonesia, particularly within the context of the Independent Curriculum (Curriculum Merdeka). This approach consistently increases intrinsic motivation, active participation, and positive interactions among students in the classroom. Through strategies such as dividing students into study groups based on their profiles, using a variety of learning media, and assigning interest-based assignments, students feel more valued and engaged in the learning process.

Considering the urgency and relevance of differentiated learning in supporting diverse learning styles and increasing interest in science learning among elementary school students, this study was conducted to examine the effectiveness of implementing differentiated learning based on learning styles in the context of science learning. A systematic literature review approach was chosen to comprehensively examine the latest findings from various relevant studies. Through this study, it is hoped that a clear picture of the positive impact of differentiated learning on increasing interest in science learning will be obtained, as well as contributing to the development of adaptive learning strategies in line with the spirit of Independent Learning. In the context of basic education in Indonesia, differentiated learning is strongly relevant to the implementation of the Independent Curriculum, which emphasizes student-centered learning (Ministry of Education and Culture, 2021). The Independent Curriculum provides teachers with the freedom to design flexible and adaptive learning activities, thus optimally developing students' potential. Through a differentiated approach, teachers can adapt teaching strategies and methods to suit students' varying learning styles, including visual, auditory, and kinesthetic (Fleming & Mills, 1992).

Differences in learning styles are a crucial factor influencing learning effectiveness. Each student has their own unique way of understanding and processing information. Visual learners understand material more easily through images, graphics, and color; auditory learners learn better through discussion or listening to explanations; and kinesthetic learners learn more easily through hands-on activities and movement (Bostrom & Lassen, 2006). Therefore, teachers need to understand and adjust learning strategies to align with the characteristics of students' learning styles to increase their engagement and interest in learning (Santrock, 2018). Interest in learning is a psychological factor that plays a crucial role in determining learning success. According to Slameto (2013), interest in learning is a person's liking and attraction to a learning activity, which motivates them to learn with pleasure. Students with a strong interest in learning tend to be active, persistent, and possess strong intrinsic motivation in participating in learning activities (Uno, 2016). Conversely, monotonous learning that is not aligned with students' learning needs will reduce their enthusiasm and participation. Based on various previous studies, the implementation of differentiated learning has been proven to increase student motivation and interest in learning at various levels of education. For example, research by Subali and Ellianawati (2020) showed that differentiated learning based on learning styles is effective in improving elementary school students' science learning outcomes. Similarly, a study

by Prastowo (2022) confirmed that differentiated learning aligns with the spirit of the Independent Curriculum because it prioritizes learning freedom and respects the uniqueness of each student.

Based on the title "The Effectiveness of Differentiated Learning Based on Learning Styles in Increasing Interest in Learning Science: An Empirical Review 2021–2025," the research questions can be formulated as follows. First, how is differentiated learning adapted to students' learning styles in science subjects during the 2021–2025 period? Second, how effective is this differentiated approach in increasing students' interest in science subjects based on their learning style characteristics, whether visual, auditory, or kinesthetic? Third, what are the supporting and inhibiting factors that influence the successful implementation of differentiated learning based on learning styles in efforts to increase student interest in science subjects. Considering this urgency, this study aims to review the effectiveness of differentiated learning based on learning styles in increasing student interest in science subjects through a systematic literature review. This study is expected to provide scientific contributions for teachers, education practitioners, and researchers in developing adaptive, inclusive, and student-oriented learning strategies in accordance with the demands of the Independent Curriculum.

METHOD

This study employed a Systematic Literature Review (SLR) approach, adhering to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. This method was chosen to provide a systematic, transparent, and structured framework for the literature search, selection, and analysis process, ensuring high validity and reliability. The first step was identifying literature sources. This stage involved searching through two primary sources: databases and registers. The search yielded 1,000 records from databases and 264 records from registers, resulting in a total of 1,264 initial literature identified. Before proceeding to the screening stage, a data cleaning process was conducted to eliminate duplication and irrelevant literature. Of these, 150 records were removed due to duplication, 29 were automatically eliminated by the system for not meeting eligibility criteria, and 38 were removed for other reasons.

This process is crucial to ensure that only unique and relevant literature proceeds to the next stage. The second stage is screening, in which researchers conduct an initial check of the eligibility of the literature based on predetermined inclusion and exclusion criteria. A total of 34 literatures were manually screened, while 94 others were excluded for not meeting the predetermined criteria. Subsequently, a search and retrieval process was conducted for 231 reports, but 126 reports were not retrieved due to access constraints or the lack of complete documents. The third stage is eligibility assessment. At this stage, the 80 successfully retrieved reports were further evaluated to ensure their suitability for the study objectives. The evaluation included checking for data completeness, abstract availability, methodological clarity, and full accessibility to the report content. During this process, several reports had to be eliminated due to duplicate authors (231), inadequate abstracts (126), and lack of links to the original documents (80).

The final stage is inclusion, which is the final determination of the literature to be included in the review. After a rigorous selection process, 76 studies were deemed to meet the criteria and were ultimately included in this literature review. The selected literature was then analyzed in-depth to obtain key findings relevant to the research focus. This entire process demonstrates the importance of applying the PRISMA method in literature studies. By systematically following the stages of identification, screening, eligibility assessment, and inclusion, this study ensured that the literature used was truly relevant, credible, and fully accessible. This also supported the creation of a comprehensive, objective, and scientifically accountable literature review. The analysis was conducted by examining learning models, research objectives, methods used, and results related to improving scientific literacy. Furthermore, bibliometric mapping was conducted using VOSviewer software to identify relationships between topics, keywords, and developments in research trends in the field of education.

RESULTS AND DISCUSSION

Result

This study uses *the Systematic Literature Review* (SLR) approach with PRISMA guidelines to examine the effectiveness of learning style-based differentiated learning in increasing interest in learning IPAS. Based on the initial identification process, 1,264 articles were found from various scientific databases. After the elimination of duplication, the screening of titles and abstracts, and the feasibility assessment of the complete manuscript, 76 articles were obtained that met the inclusion criteria and were analyzed in depth. The flow of research article selection from the identification to inclusion stage is as follows:

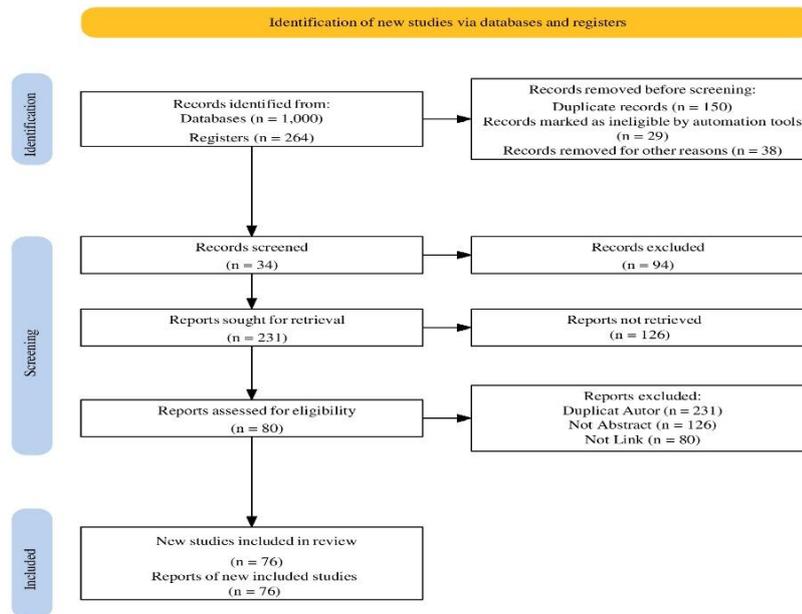


Figure 1 Results of the Prism Flow of Article Selection

The results of the synthesis of 76 articles show that differentiated learning style-based learning, both visual, auditory, and kinesthetic, consistently has a positive impact on increasing students' learning interest in science subjects. The increase in interest in learning is shown through increased intrinsic motivation, active involvement of students during the learning process, and enthusiasm in completing assignments and participating in class activities. A recapitulation of the main findings of all the articles analyzed is presented in **Table 1**, which illustrates the general pattern of differentiated learning effectiveness in increasing the interest in learning of social studies in elementary schools. In addition, the results of the analysis also show that there is a difference in the tendency to increase learning interest based on students' learning styles. Some studies report that students with visual and kinesthetic learning styles tend to show a more pronounced increase in learning interest compared to auditory students, although in general the entire learning style gains a positive impact from the application of differentiated learning. The distribution of increased interest in learning based on the learning style category is presented in the table as follows:

Table 1. Journal Review Results

No.	Author (Year)	Research Findings
1	Sari, N. (2021)	Content and process differentiation increases students' interest and participation with visual and kinesthetic learning styles.
2	Rahmawati, D. & Prasetyo, A. (2021)	Students with a visual learning style showed the highest increase in interest in learning after differentiation was applied.
3	Lestari, E. (2021)	There is a significant increase in science learning outcomes through content and product differentiation.
4	Handayani, T. (2021)	Learning styles influence engagement; differentiation reduces the saturation of learning science.
5	Wahyuni, R. (2022)	Wordwall media increases students' interest and motivation in science.
6	Nugraha, I. (2022)	There is a positive correlation between learning style suitability and learning outcomes.
7	Setiawan, B. (2022)	The project model enhances collaboration and responsibility for science learning.

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8	Amalia, (2022)	F.	Differentiation based on learning styles increases student activeness and participation.
9	Pratiwi, (2022)	Y.	Concrete media according to learning styles increase understanding of concepts and interest in learning.
10	Utami, (2023)	N.	Animated videos according to learning styles increase retention and interest in learning.
11	Mulyani, (2023)	A.	Incorporating local contexts strengthens students' emotional engagement.
12	Hidayat, (2023)	R.	Providing a selection of products increases students' creativity and motivation.
13	Anisa, (2023)	D.	Teachers are able to create an inclusive learning atmosphere according to students' learning styles.
14	Puspitasari, (2023)	M.	Students with learning styles according to the teaching model show increased interest.
15	Suryani, (2024)	L.	Kinesthetic concrete media enhances concept understanding and enthusiasm.
16	Rachman, (2024)	D.	Process differentiation strengthens the interests and learning outcomes of elementary school students.
17	Nurhayati, (2024)	E.	Digital platforms facilitate the personalization of students' learning styles.
18	Rahmat, (2024)	I.	Differentiation supports the spirit of learning according to the Independent Curriculum.
19	Wahyuningsih, T. (2025)		Differentiation has a positive impact on motivation to learn science.
20	Kurniawan, (2025)	R.	This approach is very effective in increasing interest in learning IPAS.
21	Fitriani, (2021)	L.	Students with learning styles according to the strategy showed an increase in learning outcomes.
22	Aulia, (2021)	M.	Content differentiation facilitates students' unique needs and increases participation.
23	Yusuf, (2021)	A.	Interest-based differentiation improves the focus of science learning.
24	Ningsih, (2022)	H.	There is an increase in active participation through the provision of learning options.
25	Cahyani, (2022)	R.	Digital media strengthens interaction and interest in learning science.
26	Widodo, (2022)	S.	Differentiated learning supports the principle of independent learning.
27	Hasanah, (2022)	R.	Teachers are able to design differentiated learning more on target.
28	Putri, (2023)	A.	Differentiation based on learning style increases learning motivation.
29	Hidayani, (2023)	R.	Creative teachers use media according to students' learning styles.
30	Salsabila, (2023)	F.	Interactive media improves learning outcomes and engagement.
31	Jannah, (2023)	S.	Students are given the freedom to learn according to their learning style, increasing creativity.
32	Dewi, (2023)	T.	Differentiation fosters interest in learning through elective activities.
33	Ramadhan, (2023)	F.	Evaluations show improved learning outcomes and student satisfaction.

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34	Amelia, (2023)	D.	Concrete media supports kinesthetic learning styles.
35	Fauziah, (2023)	R.	Providing flexibility in learning ways improves learning outcomes.
36	Hidayatullah, M. (2024)		Students are more excited if their learning style is facilitated.
37	Rini, D. (2024)		Science process skills are improved through differentiation.
38	Andriani, (2024)	L.	Projects according to learning styles increase learning responsibility.
39	Zulfa, (2024)	A.	Differentiation encourages independence in science learning.
40	Oktavia, (2024)	D.	Kinesthetic students have the highest increase in interest.
41	Yulianti, (2024)	H.	Varied learning outcomes increase student satisfaction.
42	Marlina, (2024)	N.	Kinesthetic and visual learning styles dominate the increase in interest.
43	Nugroho, (2024)	F.	Digital technology supports the flexibility of students' learning styles.
44	Hasan, (2024)	A.	Differentiation helps students understand difficult concepts of science.
45	Anggraini, (2025)	E.	Differentiation strengthens the role of teachers as facilitators.
46	Pramudita, (2025)	R.	Differentiation increases learning responsibility.
47	Wijayanti, (2025)	S.	There was a significant increase in interest and learning outcomes.
48	Zulfikar, (2025)	M.	There is a strong relationship between learning style and learning interests.
49	Nabila, (2025)	F.	Digital media fosters students' interest in learning ERAS.
50	Halimah, (2025)	T.	Differentiated models are effective in supporting self-paced learning.
51	Fadilah, (2021)	R.	Students showed significant improvement in learning outcomes after differentiation was applied.
52	Sulastri, (2021)	H.	Teachers understand students' learning styles and foster an interest in learning.
53	Kurniasih, (2022)	E.	Each learning style shows a different tendency to learn interests.
54	Riyanto, (2022)	A.	Learning provides a choice of activities to increase student motivation.
55	Anggraeni, (2022)	S.	Students are more enthusiastic about participating in activities according to the dominant learning style.
56	Laila, (2023)	D.	The kinesthetic learning style showed the most significant improvement in learning outcomes.
57	Hasanah, (2023)	N.	Teachers play an important role in regulating process differentiation so that students are active.
58	Putra, (2023)	R.	AR media helps visual students understand abstract concepts easily.
59	Arifin, (2023)	B.	Learning projects according to learning styles increases cooperation and responsibility.
60	Scott, (2024).	H.	Students with learning styles according to the teacher's method are more motivated.

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61	Pradana, (2024)	F.	Differentiation strengthens students' critical thinking skills.
62	Yuliana, (2024)	A.	Effectively accommodates different learning needs.
63	Nurfitri, (2024)	M.	Visual active discussion, kinesthetic active practice.
64	Aditya, (2025)	R.	Digital media fosters interest and strengthens learning outcomes.
65	Syafruddin, (2025)	A.	This model increases the interest, motivation, and learning achievement of elementary school students.
66	Scott, (2021).	D.	Visual and kinesthetic learning styles help to understand the concept of energy better.
67	Hartono, (2021)	Y.	A variety of learning styles fosters interest and reduces student boredom.
68	Melati, (2022)	R.	Content differentiation according to learning style strengthens concept mastery.
69	Santoso, (2022)	F.	Interactive technology reinforces the effectiveness of differentiation.
70	Hapsari, (2023)	T.	Process and product differentiation increases student motivation and confidence.
71	Darmawan, (2023)	I.	Experiments according to kinesthetic forces are effective in improving understanding.
72	Kurnia, (2024)	L.	Digital media strengthens engagement and information retention.
73	Dewantara, (2024)	A.	Students with differentiation experience are more independent.
74	Syafitri, (2025)	E.	Increase collaboration and interest in learning IPAS of elementary school students.
75	Maulana, (2025)	H.	Differentiation of learning styles increases creativity of thinking and interests b
76	Anjani, (2025)	P.	Differentiated learning that adjusts visual, auditory, and kinesthetic learning styles improves science literacy skills and significantly fosters interest in learning science.

The results of bibliometric analysis using the VOSviewer software show the relationship between the dominant keywords in the research related to differentiated learning and IPAS learning interests. Keyword mapping shows two main clusters, namely the English-language cluster that focuses on terms such as *student*, *learning*, *strategy*, and *interest*, and the Indonesian-language cluster that highlights the keywords *teacher*, *student*, *learning interest*, and *differentiation*. The network visualization and temporal distribution of those keywords are shown in Figure 2, Figure 3, and Figure 4,

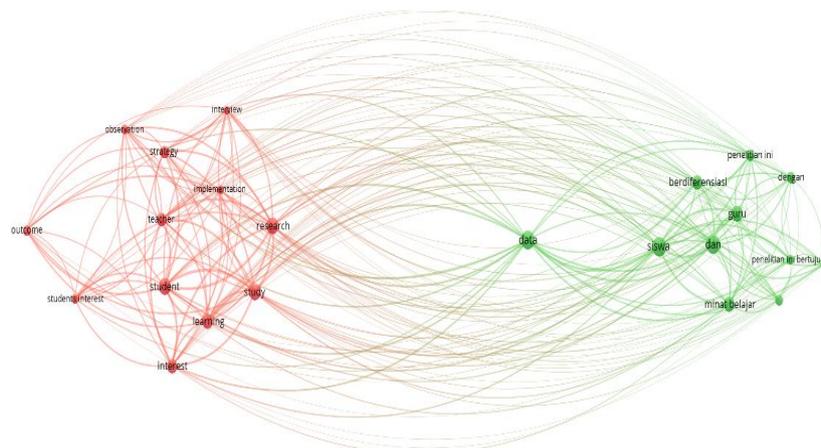


Figure 2. Visualize Research Keywords with VOSviewer

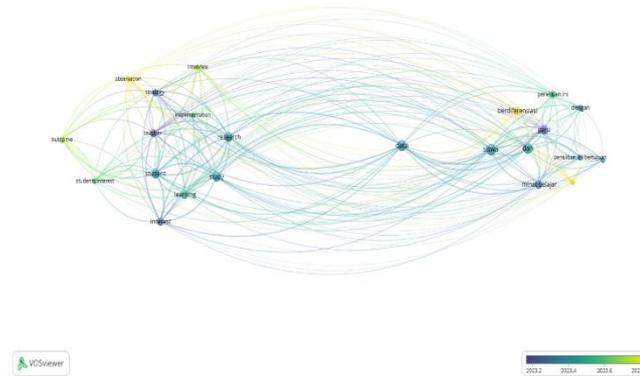


Figure 3. Visualization with VOSviewer

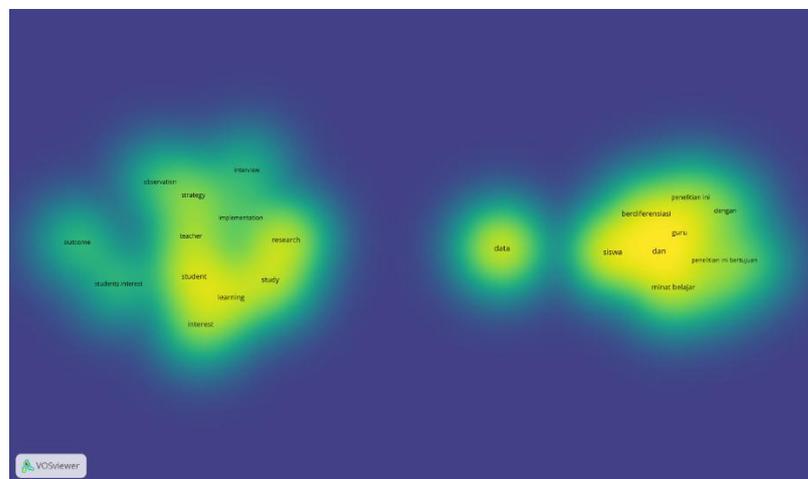


Figure 4. Visualization of Density Maps with VOSviewer

Based on Figure 2, Figure 3, and Figure 4 as a whole, it shows that differentiated learning topics and increased interest in learning social studies have become the focus of research that has grown in recent years. Overall, the results of this study confirm that learning style-based differentiated learning is an effective, relevant, and applicable approach in increasing the interest in learning science of elementary school students. These findings show that learning strategies that adapt to students' learning needs and characteristics are able to create a more meaningful, enjoyable learning experience, and encourage active student involvement in the learning process.

Discussion

The results of this study show that the effectiveness of differentiated learning in increasing the interest in learning of social studies is closely related to the suitability between learning strategies and students' learning styles. These findings are in line with Tomlinson's (2014) theory that learning that tailors content, processes, and products based on students' learning profiles can significantly increase engagement and motivation to learn. The increase in students' interest in learning occurs because differentiated learning provides space for students to learn according to the way that is most convenient for them. Students are visually aided through pictures, videos, and diagrams; auditory students better understand the material through oral discussions and explanations; while kinesthetic students are more involved through practice and experimentation. This supports the opinion of Bostrom and Lassen (2006) that the suitability of learning styles has a positive effect on students' attitudes and interest in learning. In addition,

differentiated learning also strengthens students' intrinsic motivation. When students feel valued for their differences and given choices in learning, they show a higher sense of confidence and responsibility for learning (Santrock, 2018). This condition creates an inclusive and humanist learning environment, where students do not feel left behind or pressured by uniform learning standards. In the context of the Independent Curriculum, the findings of this study reinforce that differentiated learning is a strategy that is in line with the principles of *student-centered learning*. The Independent Curriculum requires teachers to adjust learning based on student readiness, interests, and learning profiles. Therefore, differentiated learning not only increases interest in learning, but also supports the achievement of the Pancasila Student Profile, such as independence, creativity, and critical reasoning.

The success of the implementation of differentiated learning is also greatly influenced by the pedagogic competence of teachers. Teachers need to conduct diagnostic assessments, design flexible learning, and utilize varied learning media. Without teachers' understanding of the concept of differentiation, learning has the potential to become uniform and less meaningful. Thus, differentiated learning style-based learning not only serves as a strategy to increase learning interest in IPAS, but also as a pedagogical approach that supports a paradigm shift in learning in elementary schools towards adaptive, inclusive, and equitable learning.

CONCLUSION

Based on the results of the systematic literature review that has been conducted, it can be concluded that learning style-based differentiated learning is an effective learning strategy in increasing the interest and learning outcomes of elementary school students, especially in the subject of Natural and Social Sciences (IPAS). This learning provides opportunities for each student to learn according to their characteristics and learning styles, both visual, auditory, and kinesthetic, so as to be able to create a learning experience that is more meaningful, fun, and relevant to real life. The results show that the application of differentiated learning not only has an impact on increasing students' intrinsic motivation, but also fosters confidence, responsibility, and active participation in the learning process. This strategy creates an inclusive and adaptive learning environment, where each student is valued for their differences and given the opportunity to develop to their potential. Thus, differentiated learning becomes a tangible form of equitable and humanist learning in elementary schools. In addition, the results of the study also strengthen that differentiated learning supports the implementation of the Independent Curriculum which emphasizes student-centered learning. Through differentiated learning, teachers can carry out learning that is in line with the spirit of the Independent Curriculum in realizing a Pancasila Student Profile that is independent, creative, critically reasoning, and has high mutual cooperation.

Thus, the application of differentiated learning based on learning styles not only improves students' academic results, but also strengthens their learning character and independence. To achieve maximum effectiveness, teachers are expected to be able to identify students' learning profiles from the beginning, conduct periodic diagnostic assessments, and utilize various learning media. Support from educational institutions is also needed in the form of training and professional development so that teachers have adequate pedagogic competence to implement differentiation strategies in a sustainable manner. Overall, this study emphasizes that differentiated learning is a key strategy in improving the quality of basic education in the era of the Independent Curriculum, because it provides space for each student to learn according to their potential, style, and interests. With the right implementation, this approach will be a strategic step in building a generation of Indonesian students who are characterful, adaptive, and globally competitive.

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