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Exploration of Learning Style Preferences Among High School Students in the Context of Physics Education: An Empirical Analysis Using Kolb's Learning Style Inventory (KLSI)

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Abstract

This study aimed to analyze the distribution of students' styles in learning Physics using the Kolb Learning Style Inventory (KLSI) in two different classes, namely XD and XG. The analysis results reveal that the Converger learning style is the most dominant, with 55.17% of students in XD and 73.53% in XG. The Converger learning style, characterized by a tendency for logical thinking and the ability to apply theory in practical contexts, is highly relevant in Physics education, which requires strong conceptual understanding and problem-solving applications. In addition, Converger, Accommodator, Diverger, and Assimilator learning styles were also identified, albeit in smaller numbers, with varying percentages across the XD and XG classes. This study reveals that the dominance of the Converger learning style in both classes suggests a strong alignment between current Physics teaching methods and the learning preferences of the majority of students. However, the presence of other learning styles underscores the importance of adopting diverse teaching strategies to ensure that all students, regardless of their learning style, are engaged and achieve optimal learning outcomes. This study also supports previous findings which proved that the Converger learning style is particularly effective in subjects that require analytical thinking and practical application, such as Physics. The implications of these findings advocate for developing more inclusive and adaptive teaching methods, integrating approaches that cater to all learning styles in the classroom.

Keywords: learning style; physics learning; kolb's learning style inventory

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INTRODUCTION

Learning style is a fundamental concept in education that refers to the individual's unique ways of absorbing, understanding, and processing information (Azrai et al., 2017; Geiger et al., 1992; Mainemelis et al., 2002; Mawarni et al., 2020; Mpwanya & Dockrat, 2020; Reid, 2012; Werdhiana et al., 2024; Yulianci et al., 2019). Understanding students' learning styles is crucial for educators since it can help to design effective teaching strategies that enhance comprehension and

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memorization of knowledge. Different learning styles influence how students engage with materials, solve problems, and collaborate, making selecting appropriate teaching methods that meet these diverse needs essential.

David Kolb's theory of learning styles, introduced in 1984, categorizes learners into four types: Convergers, Divergers, Assimilators, and Accommodators. Each style has distinct characteristics, influencing how students learn and interact with educational content (Stice, 1986). For instance, Convergers excel in problem-solving, while Divergers thrive in reflective observation. Recognizing these categories aids educators in adopting varied teaching practices that address the diverse learning preferences in physics education (Cornwell & Manfredo, 1994). An understanding of these four categories not only enriches educators' insights into the diversity of learning methods available.

Physics, with its demand for conceptual understanding and practical application, often presents challenges in teaching due to its abstract and applied nature (Eko, 2018; Isna et al., 2018; Rizki et al., 2022; Werdhiana et al., 2024). These challenges are further compounded by students' varying learning styles, which can significantly impact their grasp of the subject. Therefore, understanding and accommodating different learning styles is crucial in improving students' engagement and success in physics. In this context, students' understanding and mastery of material can be significantly influenced by their learning styles; for example, Converger students may excel at solving quantitative problems, whereas Diverger students may be better at understanding concepts through discussion and reflection (Dykhne et al., 2021).

Challenges in Physics teaching often arise from the difficulty of bridging theory with practice, ensuring students not only remember facts but also understand the underlying principles and can use them creatively (Mahardika et al., f2023; Murdani, 2020; Renostini, 2019). This requires Physics education to adopt multifaceted and inclusive teaching methods that adapt to diverse learning needs. Integrating various teaching methods and techniques, such as hands-on experiments, simulations, group discussions, and problem-solving, can provide a more thorough learning experience and cater to students' different learning styles (Rizki et al., 2022; Werdhiana et al., 2024). By understanding students' learning styles, educators can be more effective in designing and implementing learning strategies that are not only engaging and motivating but also enhance students' understanding and mastery of Physics materials (Aikenhead, 1994; Kaur et al., 2021; Marpaung, 2016; Mawarni et al., 2020; Yulianci et al., 2019).

Kolb's Learning Style Inventory (KLSI) is a widely used tool in educational research to identify individual learning preferences (Geiger et al., 1992; Kolb & Kolb, 2013; Semken & Freeman, 2008; Wattanacharoensil et al., 2022; Yani & Wahyono, 2020). It allows educators to assess how students process information and interact with learning environments, providing insights into tailoring instructional strategies. Previous research has shown that KLSI can effectively guide the design of personalized teaching methods that enhance student engagement and learning outcomes (Dykhne et al., 2021; Mainemelis et al., 2002; Mawarni et al., 2020; Menaka & Nandhini, 2019; Reid, 2012).

In the context of educational research, KLSI has been widely used to understand how learning styles differ between individuals and how this knowledge can be applied to improve the learning and teaching process (Kolb & Kolb, 2013;

Mawarni et al., 2020; Menaka & Nandhini, 2019). Previous research has shown that the use of KLSI can assist educators in designing and tailoring learning strategies that are more personalized and responsive to students' learning needs, with the ultimate goal of improving learning effectiveness (Coffield et al., 2004; Felder & Henriques, 1995). By using appropriate identification and understanding of students' learning preferences, educators can design learning experiences that meet the diverse needs of students carefully, in order to create a more inclusive and effective educational environment.

Despite the broad application of learning style theories, more research still needs to focus on their impact on physics education. This study aimed to address this gap by examining the distribution of learning styles in a physics classroom and exploring how this knowledge can be used to optimize teaching strategies. By leveraging KLSI, the research aimed to provide actionable insights for improving physics education by aligning instructional approaches with students' learning preferences. The results of this study are expected to significantly contribute to the Physics education literature, offering recommendations that educators can use to enrich students' learning experiences and facilitate better learning outcomes.

The main objective of this study is to analyze the distribution of learning styles among high school students in the learning physics context using KLSI. The research aimed to identify the dominant learning styles—Convergers, Divergers, Assimilators, and Accommodators—and explore how this diversity can be served to enhance the effectiveness of physics teaching. The findings are expected to contribute to more inclusive and responsive educational practices, ultimately leading to improved learning outcomes in physics.

METHOD

This study used a quantitative approach to analyze the distribution of students' learning styles in Physics class (Creswell & Creswell, 2017). The research subjects consisted of 63 students from two different classes at the high school level, namely class XD, which consisted of 29 students, and class XG, consisted of 34 students. This research was conducted in December 2023/2024 academic year at one of the high schools in Palu. The selection of those two classes was conducted to obtain a diversity in students' learning style preferences, as well as accommodating variations in the learning environment (Gall et al., 2007; Gay et al., 2012)

The classes were randomly selected from schools with the same physics curriculum (Wiersma, 2009). This is expected to provide a broader view of students' learning style preferences in the context of physics learning, considering differences in classroom dynamics, teachers' teaching styles, and other environmental factors that might influence students' learning style preferences (Creswell & Creswell, 2017). By involving two different classes, this study is expected to provide a more holistic and representative understanding of students' learning style preferences at the senior high school level and enrich the analysis and research findings (Leedy & Ormrod, 2023).

The instrument used in this study was KLSI as a measurement tool used to identify students' learning style preferences based on Kolb's Learning Style Theory (Cornwell & Manfredo, 1994; Geiger et al., 1992; Kolb & Kolb, 2013; Laux, 1993), specially designed for Physics subjects. This instrument is a learning style perceptual questionnaire consisting of 40 statements for students to answer "Yes" or "No" according to their character. This questionnaire aimed to identify students' learning style preferences based on four main

dimensions in Kolb's theory, namely Convergence, Diverger, Assimilator, and Accommodator. In the context of physics learning, the KLSI questionnaire will be adapted to consider the material and learning context relevant to physics.

The KLSI questionnaire is in the form of a questionnaire, consisted of a series of statements or questions that describe various physics learning situations or activities. Student were asked to assess the extent to which they agreed or disagreed with each statement. Statements in the KLSI questionnaire for physics may include things like a preference for learning through experimentation, the ability to understand and formulate physics concepts in the abstract, a tendency to think creatively in physics problem-solving, and a pleasure in applying physics concepts in practical or real-life situations. After the students completed the KLSI questionnaire, the data were analyzed to determine their learning style preferences based on the scores obtained in each Kolb dimension. The KLSI questionnaire aspect is presented in Table 1.

Table 1 KLSI questionnaire grid

Learning Style	Indicator	Sub indicators	Statement
Converger	Abstract Thinking and Practical Problem Solving	1. Logical Problem Solving 2. Attention to Detail and Rationality 3. Communication Skills in Written Form	2,3, 5, 8, 11,16, 23, 24, 26, 28
Diverger	Creativity, Experience, and Observation	1. Use of Feelings in Learning 2. Interest in Exploring and Observing 3. Sikap Reflektif dan Kritis terhadap Opini Orang Lain	4, 9, 15, 20, 21, 12, 7
Assimilator	Understanding Logical and Systematic Concepts	1. Belief in Material Benefits 2. Careful Preparation in Learning 3. Organizing Information Systematically	1,6,13,14,17,25
Accommodator	Practical and Experimental Trends	1. Innovation in Problem Solving 2. Preparation and Exploration in Practicum Activities 3. Courage to Face Challenges	22, 27, 29, 30,34, 26, 40

The data on students' learning styles was collected through the implementation of the KLSI questionnaire in one controlled session in each class. The students were instructed to answer the questionnaire questions honestly and independently, without any influence from their classmates or teachers. In conducting quantitative data analysis based on the results obtained, descriptive statistical data analysis was relevant to the distribution of learning styles in XD and XG classes.

RESULT AND DISCUSSION

Based on data analysis from two classes that use the KLSI Questionnaire instrument for learning Physics, the distribution of students' learning styles can be observed in Table 2.

Table 2 Observe the distribution of students' learning styles

Learning Style	XD Freq	XD (%)	XG Freq	XG (%)
Converger	16	55.17%	25	73.53%
Accommodator	8	27.59%	3	8.82%
Diverger	4	13.79%	4	11.76%

Assimilator	1	3.45%	2	5.88%

Based on the analysis results, it was found that the Converger learning style is the most dominant in both classes, with 55.17% of students in class XD and 73.53% of students in class XG. For the Accommodator learning style, in class XD, 27.59% of students have this learning style, and only 8.82% of students in class XG. For the Diverger learning style, the percentage of students with this learning style was relatively consistent in both classes, with about 13.79% in XD and 11.76% in XG. Meanwhile, the Assimilator learning style has the least number of students, with only 3.45% in XD and 5.88% in XG. The analysis of learning style distribution data using the KLSI reveals that the Converger learning style dominates in both classes, namely XD and XG. This distribution indicates a consistent pattern in which most students in both classes think logically and apply theory in practical contexts. This distribution can be the basis for consideration in adjusting teaching strategies to suit the learning styles of the majority better and accommodate other learning styles that are more minority.

Converger learning style was found in 55.17% of students in class XD and 73.53% in class XG. The dominance of this learning style shows that most students excel in problem-solving and prefer activities with clear goals and real applications. This learning style is particularly relevant in physics learning, which often requires a strong conceptual understanding and the ability to apply the concepts in practical situations. The higher Converger dominance pattern in XG class compared to XD class can indicate differences in teaching approaches, class dynamics, or student characteristics in each class. It could also show that the teaching methods applied in physics subjects are more likely to support the Converger learning style, which focuses on analysis, application, and problem-solving.

In addition to the Converger learning style, there are students with the Accommodator, Diverger, and Assimilator learning styles in both classes, albeit in smaller numbers. In class XD, as many as 27.59% of students belong to the Accomodator group, while in class XG, only 8.82%. Students with the Accommodator learning style learn through hands-on experience and exploration, relying more on intuition and flexibility.

The Diverger and Assimilator learning styles are present in a smaller percentage, with Divergers around 11.76% – 13.79% in both classes and Assimilators only 3.45% in XD and 5.88% in XG. Diverger students prefer to understand problems from multiple perspectives and be more reflective, while Assimilators prefer to learn in a structured and theoretical format.

This diverse distribution of learning styles shows the importance of adaptation in teaching strategies to meet the needs of all students. Although the Converger learning style is dominant, the existence of students with other learning styles suggests that not all students will respond optimally to teaching methods that only support certain learning styles. Therefore, it is important to integrate various teaching approaches that can support the entire learning style in the classroom.

For Converger students, problem-based projects and practical applications are ideal. Accommodator students can gain more from experimental and simulation activities that allow them to learn through hands-on action. Meanwhile, Diverger students can develop in group discussion activities that allow them to reflect and explore ideas, while Assimilators require in-

depth theoretical explanations and conceptual analysis.

The dominance of this Converger learning style is very relevant in the context of physics learning. Previous research, such as those conducted by Mainemelis, Boyatzis, and Kolb (2002), shows that individuals with the Converger learning style often excel in environments where success is defined through technical ability and application of theory. Physics learning, which often requires a strong conceptual understanding and the ability to apply these concepts in practical situations, fits perfectly with the characteristics of Converger students who focus on analysis and problem-solving.

Research by Kolb and Kolb (2013) also proves that students with a Converger learning style are likelier to succeed in subjects requiring analytical skills and applying concepts, such as physics. Furthermore, the Converger learning style combines the ability to think abstractly and apply theory in practice, an essential skill in physics learning.

Furthermore, research conducted by Felder and Henriques (1995) found that the Converger learning style is very effective in facilitating learning in science and engineering subjects, including physics. Students with this learning style tend to enjoy problem-solving challenges and assignments that involve direct application of the theory learned.

The findings also show the diversity of other learning styles, such as Accommodator, Diverger, and Assimilator, in the studied class. Although the Converger learning style dominates, the presence of students with other learning styles shows the importance of implementing diverse teaching strategies.

Research by Kolb (1984) and Honey and Mumford (2006) suggests that while certain learning styles dominate the classroom, effective teaching should include a variety of approaches to accommodate the entire learning style. For example, while Convergers gain more from problem-based projects and practical applications, Accomodators are better accommodated with experimental and simulation activities that allow them to learn through hands-on experience. Divergers can develop in group discussions that allow reflection, while Assimilators require theoretical explanations and in-depth conceptual analysis.

Therefore, a teaching strategy incorporating these approaches will support Converger students and ensure that all students, regardless of their learning style, can engage and thrive in physics learning.

Implementing effective teaching practices in this regard requires adaptation and differentiation. This means enriching the learning experience with various activities that can support all learning styles—including reflection-provoking discussions for Divergers, in-depth theoretical and conceptual presentations for Assimilators, and hands-on activities that allow for exploration and experimentation for the Accommodators. This adaptation not only aims to balance the distribution of learning styles in the classroom but also facilitates a more inclusive and stimulating learning environment where students can explore and develop their potential to the fullest.

Research in educational psychology has shown that recognizing and responding to students' learning styles can increase motivation, improve learning outcomes, and promote greater involvement in the learning process (Felder & Silverman, 1988; Fleming & Baume, 2006). Therefore, a responsive approach to individual learning needs respects students' uniqueness and strengthens their learning process by ensuring that all students feel included

and valued in their learning environment. Integrating teaching methods is an important strategy in education to meet the needs of students with diverse learning styles. Adapting a comprehensive teaching style, such as group discussions, project-based learning, and independent exploration, can reach students more effectively. Group discussions encourage exchanging ideas and collaborative learning, helping Diverger and Assimilator students who value interaction and reflection. Project-based learning, on the other hand, provides opportunities for Convergence and Accommodator students to apply concepts practically and explore solutions to real problems.

Project-based learning emphasizes applying knowledge and skills in real-world contexts, allowing students to engage in a meaningful and contextual learning process. This method supports Convergence students in honing their problem-solving skills and Accommodator students in testing theories through actions. As part of this approach, independent exploration facilitates independent learning. It strengthens students' ability to take initiative and take responsibility for their learning, which is invaluable for all learning styles.

Integrating these diverse teaching methods in educational practice not only supports a diversity of learning styles but also promotes the development of essential skills such as critical thinking, creativity, collaboration, and independence. It creates a dynamic and interactive learning environment where students can holistically explore, discover, and develop their understanding. Therefore, an integrated and responsive teaching approach to various learning styles offers significant benefits, improving learning outcomes and preparing students for future challenges.

CONCLUSION

This study concludes that learning styles have a significant role in students' learning experience, especially in the context of Physics education. Using KLSI, this study has successfully identified the distribution of students' learning styles in two different Physics classes, finding the dominance of Converger learning style as well as the presence of Diverger, Assimilator, and Accommodator learning styles. The results reveal the need for a more inclusive and differentiated teaching approach that can adapt to students' diverse learning styles. Integrating various teaching methods, including group discussions, project-based learning, and independent exploration, proved essential to support all students effectively. Customization of learning materials and implementing multiple assessments were also emphasized as key elements in supporting well-rounded learning and responding to students' needs.

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