The Nature of Differentiated Learning in The Perspective of Constructivist Educational Philosophy : A Systematic Literature Review

Anggi Umayrah*, Prana Dwija Iswara, Syifa Salsabila, Siti Silmi Azzahra, Mariana Jeujanan
Elementary Education Department, School of Postgraduate Studies,
Universitas Pendidikan Indonesia.
*Corresponding Author. Email: anggiumayrah06@upi.edu

Abstract: This study aims to examine differentiated learning from the perspective of constructivist educational philosophy, namely the application of differentiated learning and the relationship between constructivism and differentiated learning. This research used a qualitative approach, with a systematic literature review method using the PRISMA (Preferred Reporting Items for Systematic Review and Meta-analysis). This research used the Publish or Perish application to search for various relevant scientific articles taken from international journals, Scopus, with a range of 2014-2024. The data analysis technique for this research used thematic analysis. The result showed that the nature of learning differs from the perspective of constructivist educational philosophy regarding basically every student's knowledge. Constructivism includes a learning process where students must build their knowledge through knowledge and experience that has existed in students before. In learning, teachers help students reconstruct information by presenting meaningful learning. Meaningful in this sense, teachers must be able to organize learning by considering each student's uniqueness because each student is a different individual. The findings in this study showed that the application of differentiated learning based on the educational philosophy of constructivism can be a reference for teachers to direct students in constructing their knowledge independently by paying attention to all aspects of each student's learning. The implication of this study is to provide knowledge to teachers and prospective teachers, namely that the educational philosophy of constructivism can guide learning theory in the application of differentiated learning. Later, it can help improve the quality of learning, which will also increase human resources in Indonesia and help achieve national development goals.

Introduction

The curriculum is always changing from time to time, this represents the development of aspects of education in the world. Therefore, the reason why self-renewal and development are now a necessity in the face of all changing situations (Fatih Ayaz & Şekerci, 2015). Today, the system where learners receive all information (teacher centered) has shifted to (student centered) this interprets that students become active learning in an educational environment, teachers (educators) are only guides (Arik & Yilmaz, 2020). Students are expected to build their own knowledge through experiences that have been passed, or known in educational philosophy as constructivism. Based on constructivist learning theory, learning is a process of building relationships between new information and information that already exists in individuals (Nurfatimah, 2019).

In this aspect, teachers play an important role in constructivism theory where the core of learning is students. In this constructivism, the teacher does not directly provide information to students, but the teacher guides and helps students to achieve and construct information into a unified whole (Fatih Ayaz & Şekerci, 2015). The latest curriculum currently in force in Indonesia is based on Government Regulation Number 57 concerning National Education Standards in 2021 which contains the obligation to develop curriculum based on local characteristics, educational units, and students. Developing the curriculum of this education unit is carried out as a form of school independence by providing the greatest opportunity for education units to develop their respective operational curricula according to the needs and characteristics of the education unit, known as the "Independent Curriculum".

The implementation of the independent curriculum is carried out using a differentiated learning approach. Based on (Keuning & Van Geel, 2021), differentiated learning is a complex educational skill. Teachers need knowledge of themselves, student learning styles, student achievement levels, challenges, and students' educational needs. In addition, teachers need expertise to identify growth zones of incoming students, make decisions about curriculum materials and assignments, and know how to explain complex topics adequately. As it is known that every child is a value, and every child has the right to develop children's potential according to their abilities (Altintas & Ozdemir, 2014), meaning that the right for every child to get education according to his talents and should not be deprived, and forgotten that each child has a different level of intelligence.

In other words, differentiated learning provides a view that the implementation of learning focuses on the characteristics of each student as an individual with their own characteristics and learning needs. According to research, learning activities are only slightly differentiated to meet the needs and abilities of students (Brevik et al., 2018). That is because teachers are not trained in the differentiation of student groups. As a result, very few teachers and schools are still committed to implementing differentiated learning. Further research (Westbroek et al., 2020) reveals that differentiated learning assessment presents a challenge for teachers in that they must be able to predict a range of potential student responses by creating "formal AfL," which focuses on methods of monitoring conceptual understanding that can help with student response analysis.

Based on previous research, there has never been a study that discusses the relationship between differentiated learning and constructivist educational philosophy in one theme. Therefore, this is the novelty of this study. This study aims to examine the nature of differentiated learning from the perspective of constructivist educational philosophy, such as how the application of differentiated learning, as well as the relationship between constructivist learning and differentiated learning. It can provide insights that can assist teachers and schools in implementing differentiated learning effectively and appropriately in ensuring students receive quality education and the nature of differentiated learning so that later it can help improve the quality of human resources in Indonesia and help achieve national development goals.

Research Method

This research used a qualitative approach, with a systematic literature review method using the PRISMA (*Preferred Reporting Items for Systematic Review and Meta-analysis*), carried out systematically by following the correct research stages or protocols. Systematic review is a research method that aims to evaluate, identify, and analyze all previous research results related and relevant to specific topics, specific research, or current phenomena of concern (Wolor et al., 2021). Because pertinent study findings are synthesized through

systematic reviews, the data offered are complete and impartial. The following procedures were included in the systematic literature review: Create research questions, carry out a methodical search of the literature, filter and choose relevant research articles, carry out qualitative analysis, and synthesize the results. Using the search phrases "Differentiated Learning" and "Constructivist Learning," researchers used the Publish or Perish program to find a variety of pertinent scientific publications selected from worldwide journals Scopus with a period of 2014–2024. The application of constructivism and differentiated learning in education has been made more apparent by earlier research publications. The following are the stages of systematic literature review that researchers conducted, adopted from (Wolor et al., 2021).

Table 1. Literature Review Research Questions

No	Research Questions	Motivation
RQ1	How differentiated learning is applied	Identify the application of differentiated learning that has been done in previous relevant articles
RQ2	How is Constructivism in learning?	Identify related applications of learning with a constructivist approach that has been done in previous relevant articles
RQ3	How constructivism relates to differentiated learning	Identify the most significant articles discussing differentiated learning and constructivist learning theory

1) Literature search

This study was carried out in February-March 2024 in the city of Bandung. The search for research articles relevant to this research topic was carried out using the keywords: "*Differentiated Learning*" and "*Constructivist Learning*". Researchers use the *Publish or Perish* application taken from the international journal *Scopus* with a range of 2014-2024 to select articles.

2) Selection criteria

The selection criteria used as a guideline for searching and selecting articles are research in English and complete articles published in international *journals, Scopus,* with a range of 2014-2024, focusing on differentiated learning and the theory of constructivism approaches in education. After finding the selected research sample, it was then analyzed to collect relevant information. Analysis and synthesis of data taken from articles were carried out descriptively to observe, describe, and classify data to gather knowledge generated on the themes explored in meta-synthesis.
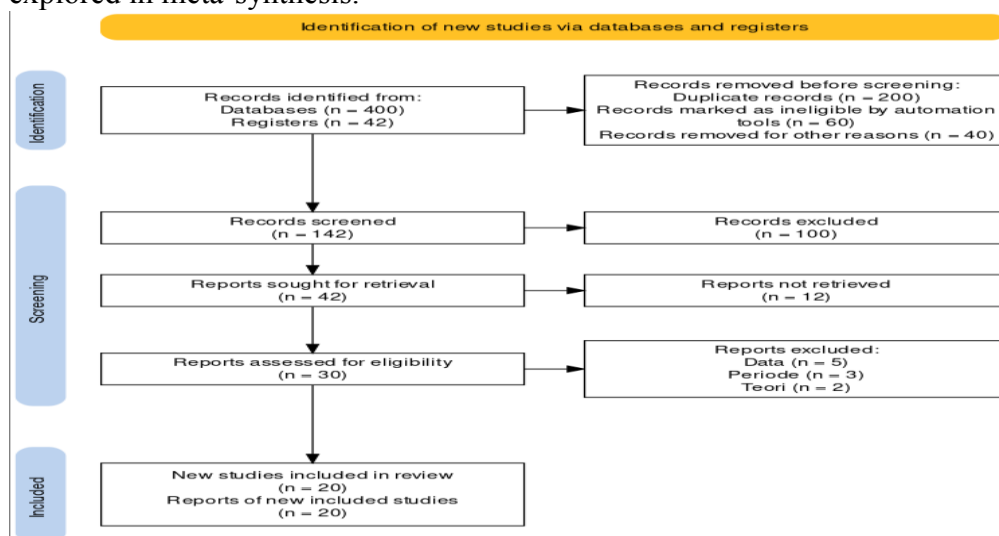

Figure 1. Prisma Flow Chart Drawing

3) Data Extraction and Data Synthesis

The selected primary studies were then extracted to collect data that contribute to answering the research question. Data synthesis is when evidence from chosen studies was compiled to address research questions. The data analysis technique for this research uses thematic analysis. Thematic analysis is a method for analyzing qualitative data. This method involved identifying and reporting patterns in data, which are then interpreted based on their meaning. Thematic analysis was carried out "systematically" because it follows a structured and sequential approach to interpreting research data. Each step builds on the previous step, resulting in a thorough understanding of the data (Naeem et al., 2023).

Results and Discussion

The aspects assessed in validating LKPD include format, content, language, presentation, and how LKPD supports innovations and improves the Teaching and Learning Activities (KBM). Before implementation, the developed LKPD must be validated by experts in Focus Group Discussion (FGD) activities. Validation was carried out by three experts in educational evaluation, biodiversity biology material, and language. The validation results by experts show that the model validation sheet developed was valid or suitable for use. The validation results of LKPD are listed in Table 1 below:

Twenty relevant papers spanning eight years from 2014 to 2022 were found, qualified, and examined in light of the research question's context (refer to Table 2). Analysis of the article will focus on differentiated learning and constructivism theory. Similarities are found based on important passages in the article and condensed into thematically broad categories by extracting the information about differentiation and constructivism that results from each article. A summary of the completed article is shown in Table 2.

Tabel 2. Tabel Literature Review

No	Types of Research	Country	Information	Source
1	DLED Model (Quantitative)	India	Subject: There were 26 kids with learning impairments and 26 kids without learning impairments. Result: The suggested model enables ITS (intelligent tutoring) to enhance the use of suitable learning strategies with high sensitivity and accuracy for users with and without learning disabilities.	(Thapliyal et al., 2022)
2	Qualitative	Dutch	Subject: Teachers in the Netherlands Result: Although teacher dashboards can assist educators in a variety of learning environments, the key to delivering individualized instruction is a strong focus on goals, ongoing observation, adaptation of instruction and practice, aspiration, and encouragement of students' self-regulation.	(Keuning &; Van Geel, 2021)
3	Experimental (Quantitative)	Saudi Arabia	Subject: 50 students of grade VI Result: The pupils in the group that used differentiated learning performed better academically. Participants were able to raise their degree of scientific critical thinking proficiency.	(Al-Shehri, 2020)
4	Qualitatively	Dutch	Subject:	(Westbroek et

Jurnal Kependidikan:
Jurnal Hasil Penelitian dan Kajian Kepustakaan
di Bidang Pendidikan, Pengajaran dan Pembelajaran
https://e-journal.undikma.ac.id/index.php/jurnalkependidikan/index

Vol. 10, No. 2 : June 2024
E-ISSN: 2442-7667
pp. 691-703
Email: jklppm@undikma.ac.id

			exploratory		Chemistry teacher and physics teacher Result: Teachers who participated in this study were generally able to employ the heuristics provided to combine formative assessment of conceptual comprehension (AfL) and overall task differentiation instruction (WTDI) in learning to make their learning more interactive.	al., 2020)
5	Qualitative and Quantitative	German	Subject: Teacher and Student Result: Individual teachers rarely use differentiated learning in the classroom.	(Pozas et al., 2020)
6	Systematics of Literature Review	Austria	Subject The literature deals with differentiated learning and inclusion Result: The didactic beginning point for both individualization and differentiation is the needs of the students. Planning is the process of differentiation lessons in a variety of ways and creating inclusive teaching strategies that are responsive to the requirements of the students.	(Lindner &; Schwab, 2020)
7	Case Studies	Singapore	Subject: Grade IV Elementary School Students Result: The practice of constructivist pedagogy that complements the theory of variation as a feasible and effective approach in the smooth learning of science, which deepens students' understanding through the construction of important aspects of a phenomenon. Involvement	(Voon et al., 2020)
8	Quantitative	Michigan	Subject: 95 Schools, 4,229 students, teachers, and principals Result: Teachers are more likely to use different teaching approaches when they are supported by strong teaching leaders regardless of the demographic composition of their school.	(Goddard et al., 2019)
9	Classroom Action Research	Indonesian	Subject: Grade V students of SD Inpres 4/82 Walian Result: The constructivist learning approach has a positive influence on science learning.	(Tuerah, 2019)
10	Quantitative	Philippines	Subject: 30 students of class V Result: Differentiated learning is essential because learners absorb information in their own style. Therefore, it is important to determine the way of teaching that students prefer with respect to the student's learning style.	(Malacapay, 2019)
11	Qualitative	Serbia	Constructivism is the idea that humans create systems for understanding the world and its experiences meaningfully through the experience of creativity involved in the process	(Pavlović &; Maksić, 2019)

			of making meaning.	
12	Quantitative and Qualitative	Canada	Subject: Teacher Result: Differentiated learning is an effective and promising learning approach in teaching and assessing students with a wide range of abilities and interests	(Whitley et al., 2019)
13	Qualitative	Norwegian	Subject: Norwegian Students Result: There are still many teacher education students who are not confident in implementing differentiated learning, therefore teacher education needs to pay more attention to helping students differentiate effectively to meet the needs of outstanding students with higher learning potential.	(Brevik et al., 2018)
14	Qualitative	Australia	Subject: 74 Teachers Result: Differentiation is an approach to teaching that centers on the needs of each individual student. It is supported by a set of interrelated concepts that address every facet of classroom operations and is influenced by the values and beliefs that educators bring to their work every day.	(Sharp et al., 2018)
15	Quantitative	Jordan	Subject: 136 students Result: There is an effectiveness of using the Constructivist Learning Model on students' science learning achievement, this is because constructivist learning helps students identify advantages and disadvantages in their previous knowledge, and through questions that allow teachers to identify previous knowledge.	(Qarareh, 2016)
16	Quantitative	Turkish	Subject: 60 ordinary fifth and sixth graders from public and private schools and 57 outstanding pupils Result: Curriculum differentiation activities and studies Creativity, original thought, and multiple intelligences boost students' academic performance.	(Altintaş &; Özdemir, 2015)
17	Quantitative	Malaysia	Subject: 150 grade IV students Research Results: Constructivist learning environments are more likely to be preferred by students than traditional classroom settings. Therefore, to increase student performance, science teachers are advised to implement a constructivist approach and modify their methods in accordance with the preferences of their students for their learning environments	(Ahmad et al., 2015)

18	Meta-Analysis	Turkish	Subject: Published or unpublished master's and doctoral dissertations on the "Constructivist Learning Approach" in Turkey between 2003-2014 Result: When compared to conventional teaching techniques, the constructivist approach to learning positively impacts students' academic performance.	(Fatih Ayaz, 2015)
19	Quantitative	German	Subject: 156 grade III students Result: Differentiation of self-perception of competence has a stronger influence on effort in elementary school students compared to perception of verbal competence	(Arens & Hasselhorn, 2015)
20	Quantitative and Qualitative	Turkish	Subject: 68 talented students and 144 untalented students Result: The differentiation approach developed improves student achievement	(Altintas & Ozdemir, 2014)

Differentiated Learning

The application of differentiated learning is a very complex teaching skill for teachers (Keuning & Van Geel, 2021).). Teachers must be able to map all the learning needs of students, be it from the learning environment, learning styles, learning interests; even teachers must know the characteristics of each student in the learning process because differentiated learning prioritizes "differences" in students. In fact, every individual has the right to develop themselves according to their abilities; in this case, students are individual learners who have the right to be able to learn according to their needs. Each class has students with different characteristics (Smale-Jacobse et al., 2019). Some students have an advantage in talent in a field, but the learning environment is not supportive, and some students are weak in a field but are required to master the field. It can certainly ignore important segments in the classroom and fail to meet the needs of students. Learners need support and help to overcome the learning process and overcome their shortcomings. On this basis, differentiated learning is present in the world of education.

In relation to differentiated learning (Thapliyal et al., 2022) explained that students have different academic learning problems with different intensities. Then India, developed an intelligent tutoring system (ITS) based on a differentiated learning environment (DLED) designed to develop a learner-centred learning environment with learning disabilities so they can improve the application of appropriate learning strategies with high accuracy and sensitivity both for users learning as well as non-learning disabilities. Another finding, according to (Al-Shehri, 2020) found that there was a significant increase between students who experienced differentiated learning and classes that did not experience differentiated learning (conventional). That is because learning activities that consider differences in learning styles and abilities in each student can increase student understanding in learning. Meanwhile, the findings of research conducted by (Altintaş & Özdemir, 2015) also explained the results that differentiated learning based on elaboration, creative thinking, and multiple intelligences increases student academic achievement.

In addition, it is seen that changes based on creativity strategies in content, processes, products, and learning environments increase student academic achievement. The use of this

differentiated learning method, in addition to facilitating the process of understanding information, also provides opportunities for students to want to think, expand their knowledge, conclude, and connect information contained in learning discussions. It is in line with the opinion (Lindner & Schwab, 2020) that differentiated learning has its didactic starting point in the needs of students who seek to ensure educational justice in the sense of student participatory justice in learning. Also, research (Arens & Hasselhorn, 2015) states that differences in self-perception of competence have a stronger influence on effort in elementary school students. Every child has values in himself and has the right to develop themselves according to their abilities (Altintas & Ozdemir, 2014).

Learners' learning style is a very important consideration when a teacher wants to implement differentiated learning in his classroom. It is in line with research conducted by (Malacapay, 2019) that differentiating teaching is very important because learners absorb information in their style. It aligns with research findings (Whitley et al., 2019) which state that teachers see differentiated learning as student-centred learning; they also believe that teaching should be based on student needs and interests and feel a responsibility to find ways to engage better and teach underachieving students, and illustrate positive beliefs regarding the effect of differentiated learning on student achievement. However, the large number of various differentiated learning practices makes some teachers experience obstacles in overcoming diversity in the classroom, as found in research (Pozas et al., 2020), resulting in teachers not being optimal in implementing this differentiated learning.

Assessing differentiated learning is also a challenge for teachers. It was found in research conducted by (Westbroek et al., 2020) that assessment for learning (AfL) and differentiated teaching (DI) both proved difficult to implement for teachers, one of the reasons being that teachers had limited time and resources. Research findings on (Goddard et al., 2019) suggest that differentiated learning is not enough to rely solely on teachers in its implementation, but schools, especially principals, also participate in influencing the success or failure of the application of differentiated learning. This is also supported by research (Brevik et al., 2018) that teacher education, schools, and teachers have a shared responsibility to ensure that students receive well-differentiated teaching and teachers should be allowed to identify students and their needs and more often plan and enact differentiated teaching.

As found in the results of the study (Sharp et al., 2018), explained that there has been a considerable increase in school leadership in awareness of the need for differentiation. It is reflected in changes in teacher recruitment and accountability policies. Meeting the needs of all students becomes a standard line in the description of the new teacher's position. The application of this differentiated learning allows students to develop their potential optimally. Based on the analysis of previous relevant articles, we can all know that the application of differentiated learning becomes a challenging learning method for teachers and schools as an aspect that supports the implementation of learning activities that prioritize the characteristics of "difference" in each student. In several studies that have been conducted, it can be seen that the application of differentiated learning is successful. However, some obstacles occur, such as teachers difficulties in learning the characteristics and diversity of each student and conducting differentiated assessments. It certainly makes enthusiasm for other researchers to study and review the application of differentiated learning so that it always raises updates related to overcoming obstacles previously experienced when implementing differentiated learning.

Constructivism in Learning

Constructivism is the work of Jean Piaget related to the theory of cognitive development, which states that in the learning process, students must build their knowledge

through knowledge and experience that existed in students before (Mohammed et al., 2020). Piaget emphasized that new knowledge builds on previous knowledge because learning is developed through exploration, constructing meaning and processing information to build understanding in its environment (Voon et al., 2020). Constructivism is a dynamic process in which small, localized changes in knowledge construction can lead to changes in overall understanding. *Constructivism* is a dynamic process in which small, localized knowledge construction changes can lead to overall understanding changes. Constructivism encompasses student-centered learning that emphasizes learner centrality. In learning, teachers will enable pupils to reconstruct information in a valid and meaningful way for students (O'Connor, 2022).

In addition, in constructivism, teachers must possess the ability to identify the individuality of every student in the class and create a lesson plan based on that knowledge. So that later, each student can be actively involved and bring up ideas from each student when they share stories and experiences. Constructivism has allowed educators to provide an environment in the classroom where students can become independent learners. Research findings in (Ahmad et al., 2015) show that the implementation of a constructivism learning environment requires many aspects to be considered. To effectively develop and construct a constructivist learning environment in schools, it is necessary to consider various factors, including educational facilities, physical learning settings, and technical requirements.

When adopting constructivist learning, five scientific skills are offered: observing, organizing, representing, experimenting, questioning, and sharing. Students need to be provided with an ideal classroom to allow them to explore their ideas. Making it possible for different seating patterns and configurations to accommodate different student learning styles. In addition, a learning environment that collaborates with technological developments can encourage active learning. It is also in agreement with the research studied(Qarareh, 2016) that every learner has a unique method of comprehension because students' learning cannot be copied or transmitted from the teacher's mind; rather, it must be predicated on comprehending a meaning.

A common understanding between the teacher and the student is crucial to the success of any learning and teaching process; to that end, interpretation and negotiation are necessary components of the learning process. It emphasizes the significance of drawing learning objectives from real life, learners' interests, and needs. So, in the study's findings, it was conveyed that constructivist learning models were effective in improving students' science learning achievements. Research reviewed (Tuerah, 2019) also shows that a teacher's learning management ability affects his performance. The role of the teacher in the learning process is vital, as it looks at classroom conditions and situations so that teachers can analyze teaching methods that can raise enthusiasm and involve students actively in the learning process.

Tuerah (2019) also shows that a teacher's learning management ability affects his performance. The role of the teacher in the learning process is very important by looking at classroom conditions and situations, so that teachers can analyze teaching methods that can raise enthusiasm and involve students actively in the learning process.

The research that lasted for 2 cycles resulted in research that the constructivism learning approach positively influenced science learning. Thus, teaching using constructivist learning models provides better opportunities for learners to participate actively in the teaching and learning process. Other findings in the study (Fatih Ayaz & Şekerci, 2015) show that learning approaches using constructivism contribute more significantly to students' academic achievement than traditional learning methods. Relation, the active involvement of students in improving the quality of the learning process can be done by involving the

experience of creativity in the process of making meaning in learning because creativity refers to the ability to produce new and useful works (Pavlović & Maksić, 2019). Therefore, teachers can use constructivist learning approaches to improve student academic achievement and the resilience of the information students learn. Regarding the analysis of previous relevant articles, we can know together that the application of constructivism in learning is constructivism as a cognitive framework that emphasizes how students generate their knowledge. In the constructivist, the teacher's primary responsibility is to help students build new knowledge through their own exploratory activities, connections, and conclusions.

The Connected of Differentiated Learning to Constructivism

Differentiated learning, which includes the implementation of learning by paying attention to the learning profile of each student, including the learning environment, learning style, and learning interests, means that students are individuals who have values. Every individual has the right to develop themselves according to their abilities. In this case, students are individual learners with the right to learn according to their needs (du Plessis, 2020). The relationship between constructivism and differentiated learning lies in the understanding that in learning, basically every student already has the basic provision of knowledge for him. Later, the knowledge will be built and developed by students when there is a reciprocal relationship in the learning process. The reciprocal relationship in question, such as teachers with students, the use of learning media or learning resources with students through exploration, meaning construction and information processing activities to build understanding in their environment (Tomljenović & Vorkapić, 2020).

As found in research (Ahmad et al., 2015) explained that constructivism includes student-centered learning that emphasizes students as the center of learning. In constructivist learning, teachers assist pupils in reconstructing information in a way that is valid and meaningful to students in a way the teacher must has the ability to acknowledge each student's individuality in the classroom and create a pedagogical plan based on their particular experience learning in a constructivism classroom. So that later, each student can be actively involved and bring up ideas from each student when they share stories and experiences. Constructivism has made it possible for educators to provide a learning environment in the classroom where students can become self-directed learners.

In agreement with this, research (Qarareh, 2016) also explained the same thing. Students have their way of understanding. Teachers need to achieve a common understanding with learners in any learning and teaching process. Students actively construct knowledge when interacting with external objects and adapting to external and internal reality. This reality is interpreted differently in different social and cultural environments, so different students have different knowledge (Koptseva, 2020). In other words, to arrive at such knowledge, the learning process must involve negotiation and interpretation. Being directed means that learners work to achieve specific goals by answering questions or contributing to the solution of problems they encounter and being an active process involving learners exerting mental effort to access knowledge. This emphasizes the significance of taking learning objectives from real life and the interests and needs of learners.

The nature of differentiated learning in the perspective of constructivist educational philosophy can be seen from the relationship between these 2 aspects that have a relationship in improving the quality of education. The educational philosophy of constructivism can be key in applying differentiated learning. Based on this constructivism, it can be a reference for teachers to direct students in constructing their knowledge independently by paying attention to all aspects of each student's learning.

Conclusion

Based on the analysis of the literature sources presented, it can be concluded that the nature of learning differentiates from the perspective of constructivist educational philosophy in terms of what every student knows. Constructivism includes a learning process in which students must build their knowledge through knowledge and experience that has existed in students before. In learning, teachers help students reconstruct information by presenting meaningful learning. Meaningful in this sense, teachers must be able to organize learning by considering each student's uniqueness because each student is a different individual. It is called differentiated learning. The implication of this study is to provide knowledge to readers, especially teachers and prospective teachers, that the educational philosophy of constructivism can be a guide for learning theory in the application of differentiated learning. So that later, it can help improve the quality of learning, which will also increase human resources in Indonesia and help achieve national development goals.

Recommendation

To raise the standard of instruction by applying differentiated learning based on the educational philosophy of constructivism, there are 2 recommended strategies. First, the government and schools need to organize educational seminars or teaching training to help teachers understand the implementation of differentiated learning based on the educational philosophy of constructivism. Second, further studies can focus on how the development of differentiated learning involves the philosophy of constructivism to provide new understanding and insight for prospective teachers, teachers, schools, and the government in organizing differentiated learning based on the philosophy of constructivist education.

References

Ahmad, C. N. C., Ching, W. C., Yahaya, A., & Abdullah, M. F. N. L. (2015). Relationship between Constructivist Learning Environments and Educational Facility in Science Classrooms. *Procedia - Social and Behavioral Sciences*, *191*, 1952–1957. https://doi.org/10.1016/j.sbspro.2015.04.672

Al-Shehri, M. S. (2020). Effect of differentiated instruction on the achievement and development of critical thinking skills among sixth-grade science students. *International Journal of Learning, Teaching and Educational Research*, *19*(10), 77–99. https://doi.org/10.26803/IJLTER.19.10.5

Altintaş, E., & Özdemir, A. (2015). The Effect of Developed Differentiation Approach On The Achievements of The Students. *Egitim Arastirmalari - Eurasian Journal of Educational Research*, *15*(61), 199–216. https://doi.org/10.14689/ejer.2015.61.11

Altintas, E., & Ozdemir, A. S. (2014). The evaluation of the developed differentiation approach: Students' achievements and opinions. *Anthropologist*, *18*(2), 433–446. https://doi.org/10.1080/09720073.2014.11891562

Arens, A. K., & Hasselhorn, M. (2015). Differentiation of competence and affect self-perceptions in elementary school students. Extending empirical evidence. *European Journal of Psychology of Education*, 405–419.

Arik, S., & Yilmaz, M. (2020). The effect of constructivist learning approach and active learning on environmental education: A meta-analysis study. *International Electronic Journal of Environmental Education*, *10*(1), 44–84.

Brevik, L. M., A.E, G., & Renzulli, J. (2018). Student's Teachers' Practice and Experience with Differentiated Instruction for Student with Higher Learning Potential. *Teaching and Teacher Education*.

du Plessis, E. (2020). Student teachers' perceptions, experiences, and challenges regarding learner-centred teaching. *South African Journal of Education*, *40*(1). https://doi.org/10.15700/saje.v40n1a1631

Fatih Ayaz, M., & Şekerci, H. (2015). The Effects of The Constructivist Learning Approach on Student's Academic Achievement: A Meta-Analysis Study. *The Turkish Online Journal of Educational Technology*, *14*(4), 143–156.

Goddard, Y. L., Goddard, R. D., Bailes, L. P., & Nichols, R. (2019). From School Leadership To Differentiated Instruction. *The Elementary School Journal*. www.journals.uchicago.edu

Keuning, T., & Van Geel, M. (2021). Differentiated Teaching with Adaptive Learning Systems and Teacher Dashboards: The Teacher Still Matters Most. *IEEE Transactions on Learning Technologies*, *14*(2), 201–210. https://doi.org/10.1109/TLT.2021.3072143

Koptseva, N. P. (2020). Constructivist pedagogy in context of modern philosophy of education. *Perspektivy Nauki i Obrazovania*, *48*(6), 40–54. https://doi.org/10.32744/PSE.2020.6.4

Lindner, K., & Schwab, S. (2020). Differentiation and Individualisation in Inclusive Education: A Systematic Review and Narrative Synthesis. *International Journal of Inclusive Education*. https://doi.org/10.1080/13603116.2020.1813450

Malacapay, M. C. (2019). Differentiated instruction in relation to pupils' learning style. *International Journal of Instruction*, *12*(4), 625–638. https://doi.org/10.29333/iji.2019.12440a

Mohammed, Husam, S., & Kinyo, L. (2020). The role of constructivism in the enhancement of social studies education. *Journal of Critical Reviews*, *7*(7), 249–256. https://doi.org/10.31838/jcr.07.07.41

Naeem, M., Ozuem, W., Howell, K., & Ranfagni, S. (2023). A Step-by-Step Process of Thematic Analysis to Develop a Conceptual Model in Qualitative Research. *International Journal of Qualitative Methods*, *22*, 1–18. https://doi.org/10.1177/16094069231205789

Nurfatimah, S. &. (2019). Implementasi Teori Belajar Konstruktivisme Dalam. *Humanika, Kajian Ilmiah Mata Kuliah Umum*, *19*(September), 121–138.

O'Connor, K. (2022). Constructivism, curriculum and the knowledge question: tensions and challenges for higher education. *Studies in Higher Education*, *47*(2), 412–422. https://doi.org/10.1080/03075079.2020.1750585

Pavlović, J., & Maksić, S. (2019). Implicit Theories of Creativity in Higher Education: A Constructivist Study. *Journal of Constructivist Psychology*, *32*(3), 254–273. https://doi.org/10.1080/10720537.2018.1477639

Pozas, M., Letzel, V., & Schneider, C. (2020). Teachers and Differentiated Instruction: Exploring Differentiation Practices to Addres Student University. *Journal of Research in Special Educational Needs*, *20*(3), 217–230. https://doi.org/10.1111/1471-3802.12481

Qarareh, A. O. (2016). The Effect of Using the Constructivist Learning Model in Teaching Science on the Achievement and Scientific Thinking of 8th Grade Students. *International Education Studies*, *9*(7), 178. https://doi.org/10.5539/ies.v9n7p178

Sharp, K., Jarvis, J. M., & McMillan, J. M. (2018). Leardeship for Differentiated Instruction: Teacher's Engagement With On-Site Professional Learning At an Australian Secondary School. *International Journal of Inclusive Education*.

Smale-Jacobse, A. E., Meijer, A., Helms-Lorenz, M., & Maulana, R. (2019). Differentiated

Instruction in Secondary Education: A Systematic Review of Research Evidence. *Frontiers in Psychology*, *10*(November). https://doi.org/10.3389/fpsyg.2019.02366

Thapliyal, M., Ahuja, N. J., Shankar, A., Cheng, X., & Kumar, M. (2022). A differentiated learning environment in domain model for learning disabled learners. *Journal of Computing in Higher Education*, *34*(1), 60–82. https://doi.org/10.1007/s12528-021-09278-y

Tomljenović, Z., & Vorkapić, S. T. (2020). Constructivism in visual arts classes. *Center for Educational Policy Studies Journal*, *10*(4), 13–32. https://doi.org/10.26529/cepsj.913

Tuerah, R. M. (2019). *Constructivism Approach in Science Learning*. *5*(5). www.ijicc.net

Voon, X. P., Wong, P. H., Looi, C. K., & Chen, W. (2020). Constructivism-informed variation theory lesson designs in enriching and elevating science learning: Case studies of seamless learning design. *Journal of Research in Science Teaching*.

Westbroek, H. B., van Rens, L., van den Berg, E., & Janssen, F. (2020). A practical approach to assessment for learning and differentiated instruction. *International Journal of Science Education*, *42*(6), 955–976. https://doi.org/10.1080/09500693.2020.1744044

Whitley, J., Gooderham, S., Duquette, C., Orders, S., & Cousins, J. B. (2019). Implementing differentiated instruction: a mixed-methods exploration of teacher beliefs and practices. *Teachers and Teaching: Theory and Practice*, *25*(8), 1043–1061. https://doi.org/10.1080/13540602.2019.1699782

Wolor, C. W., Nurkhin, A., & Citriadin, Y. (2021). Leadership style for millennial generation, five leadership theories, systematic literature review. *Quality - Access to Success*, *22*(184), 105–110. https://doi.org/10.47750/QAS/22.184.13