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A Literature Review: The Effectiveness of Differentiated Learning in Enhancing 21st Century Competencies

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ABSTRACT

The Industrial Revolution 4.0 blurs the physical boundaries between the digital, biological, and physical worlds, impacting the education sector, which faces significant challenges in preparing individuals with the 21st century competencies, such as critical thinking, creativity, collaboration, and communication skills. Differentiated learning emerges as a solution, adapting education to meet individual needs. Although effective, its implementation encounters challenges such as time constraints and teacher training. This research analyzed the effectiveness of this approach in enhancing 21st-century competencies and provides recommendations for its implementation. The study employed a Systematic Literature Review (SLR) method to evaluate the relationship between differentiated learning and the 21st century competencies. Literature searches were conducted with inclusion and exclusion criteria across various databases, with a sample range of articles from 2000 to 2024. Relevant data were thematically analyzed, ensuring the validity and reliability of findings through quality assessments of selected studies. The results of this literature review identify research findings regarding the effectiveness of differentiated learning in enhancing the 21st century competencies, such as critical thinking, creativity, collaboration, communication, digital literacy, and social-emotional skills. By reviewing articles from internationally indexed Scopus journals, the findings encompass definitions and frameworks of differentiated learning, its impact on the 21st-century competencies, supporting factors, and implementation challenges. Differentiated learning has proven effective in developing 21st-century skills, including enhancing students' critical thinking, creativity, communication, collaboration, and computational thinking.

Keywords: *differentiated learning, 21st century competencies, systematic literature review*

1. INTRODUCTION

The Industrial Revolution is the result of the development of science, technology, and culture of society, which is always marked by efforts to foster a disposition to improve human life and facilitate human work (Mumtaha & Khoiri, 2019; Syed et al., 2021). According to Elayyan (2021), each revolution has different characteristics and implications, where there are technological developments in each industrial revolution. Shahroom and Hussin (2018) said that the Industrial Revolution 4.0 is a stage of knowledge development where the physical boundaries between the physical, digital, and biological fields become blurred. One of the areas of life that is also affected is the field of education (Ghufron, 2018).

Amidst the global transformation in the era of the industrial revolution 4.0, marked by technological advances and social dynamics, education faces significant challenges in preparing individuals who are able to adapt and excel in various life contexts. The 21st century competencies, which include critical, creative, collaborative, and communicative thinking skills (4C), are key elements that students must have to face the complexity of the modern world (Ataizi & Donmez, 2020; Trilling and Fadel, 2009). However, traditional approaches to learning often fail to meet these needs due to the lack of flexibility in dealing with the diversity of students' abilities and needs. Therefore, a differentiated learning approach has attracted attention as a potential strategy to address these challenges.

Differentiated learning is a pedagogical approach that aims to meet individual learning needs by adjusting content, processes, products, and learning environments based on students' readiness, interests, and learning profiles (Tomlinson, 2001). This strategy recognizes that students have different backgrounds, abilities, and learning styles, thus requiring a flexible and adaptive approach (Tomlinson et al., 2003). In this context,

differentiated learning serves not only as a tool to improve academic outcomes but also as a means to develop essential 21st century skills.

Research shows that differentiated learning can have a positive impact on many aspects of education. For example, Subban (2006) stated that this approach increases student engagement, allows them to learn at their own pace, while challenging them to reach their full potential. Additionally, a study by Levy (2008) showed that differentiated learning allows students to develop critical thinking skills through tasks that are specifically designed to meet their needs. In the context of STEM education, Tyas et al. (2021) found that this approach is effective in encouraging student creativity through relevant and engaging projects.

Despite its great potential, the implementation of differentiated learning is not free from challenges. Research by Santangelo and Tomlinson (2009) identified several barriers, including teachers' limited time to design appropriate materials, lack of training, and resistance from students and parents. In addition, there is a gap in the literature on how this approach can be implemented effectively in various educational contexts, especially in developing countries. Therefore, it is important to conduct a comprehensive literature review to explore the effectiveness of differentiated learning in improving 21st century competencies.

This study aims to analyze the latest literature on differentiated learning and its contribution to the development of 21st century competencies. By reviewing research from Scopus-indexed international journals in the last 20 years, this article seeks to provide an in-depth understanding of the strategies, benefits, and challenges in implementing differentiated learning. This study also aims to identify best practices and provide recommendations for more effective implementation.

This differentiated learning is based on constructivism theory which emphasizes the importance of the active role of students in the learning process. Vygotsky (1978) through the concept of the Zone of Proximal Development (ZPD) emphasized that effective learning occurs when students are given challenges that are slightly above their current abilities, but still within their reach with adequate support. In the context of differentiated learning, the ZPD is used as a basis for designing learning experiences that are appropriate to individual needs.

Tomlinson (2001) identified four main elements in differentiated learning: content, process, product, and learning environment. Content refers to what is taught, process includes how students learn, product is the expected learning outcome, and learning environment includes the physical and emotional atmosphere of the classroom. By modifying these elements, teachers can create inclusive and adaptive learning experiences.

A study by Corno (2008) showed that a differentiated approach allows teachers to accommodate different learning styles of students, thereby increasing the effectiveness of learning. In addition, a study by Hattie (2008) through meta-analysis showed that differentiation strategies have a significant impact on student academic achievement, especially when implemented with adequate technology support and teacher training.

Differentiated learning is also relevant in the context of educational inclusion. Hall et al. (2004) highlighted that this approach can help students with special needs to reach their potential by providing tailored support. In this context, differentiation is not only a pedagogical strategy but also a form of educational equity that ensures all students have access to equal learning opportunities.

The Importance of 21st Century Competencies

The 21st century has brought about major changes in many aspects of life, including education, the workplace, and social interactions. These changes, driven by globalization, technological advances, and social dynamics, require individuals to have more complex and flexible skills than ever before. The 21st-century competencies refer to a set of skills needed to succeed in a rapidly changing world. These competencies include critical thinking, creativity, communication, collaboration, digital literacy, and problem-solving skills, often referred to as the "4Cs" (Trilling and Fadel, 2009).

The importance of 21st-century competencies lies in their ability to prepare individuals for the challenges of the modern world. In the workplace, for example, technological change has replaced many traditional jobs with

automation and artificial intelligence. This requires a workforce that is able to adapt quickly, learn throughout life, and master new, relevant skills (Nevrita et al., 2020; Sharp et al., 2020). In education, these competencies are important to help students become independent and productive learners in the digital age.

According to Binkley et al. (2012), the 21st century competencies also include social and emotional dimensions, such as leadership, cultural awareness, and empathy, which are essential for creating an inclusive and tolerant society. Digital literacy, as part of the 21st century competencies, plays an important role in helping students not only access information but also critically evaluate, analyze, and create content.

The 21st century learning must be oriented towards developing these competencies, with a student-centered, project-based approach that effectively utilizes digital technology. Differentiated learning is one relevant approach because it provides flexibility for students to learn according to their needs, interests, and learning styles (Tomlinson, 2001). By adjusting teaching methods and learning outcomes, differentiated learning supports the development of critical and creative thinking skills, which are at the heart of the 21st century competencies (Santangelo & Tomlinson, 2009).

In a global context, the integration of the 21st century competencies in education is essential to create a generation that is not only technically competent but also able to collaborate across cultures. OECD (2018) emphasized that education in the 21st century must be able to form individuals who think systematically and are able to solve complex problems involving many disciplines.

Differentiated learning has emerged as one innovative approach to achieving this goal. By paying attention to students' individual needs, differentiated learning allows for more optimal development of 21st-century skills. For example, by adjusting tasks and teaching methods to students' learning styles, teachers can help students learn effectively and efficiently.

In an era dominated by information and communication technology, digital literacy skills are also an important part of the 21st-century competencies. The integration of technology in learning allows students to become not only consumers of information but also creative and collaborative content creators. This competency is key in forming individuals who are able to contribute productively to society. Therefore, it is important for educational research and practice to continue to focus on developing 21st-century competencies. In this context, this article will explore how differentiated learning can contribute significantly to achieving these competencies.

Global Perspective and Best Practices

Globally, differentiated learning has been implemented in various countries with varying results. In Finland, for example, this approach is widely used as part of an inclusive education system that emphasizes the individual needs of students (Feser et al., 2023). Meanwhile, in the United States, differentiated learning is part of an education reform initiative to improve the quality of learning in public schools (Tomlinson et al., 2003).

Case studies from developing countries also demonstrate the potential of differentiated learning to improve learning outcomes. For example, research in South Africa showed that this approach was effective in addressing the challenges of classroom diversity and increasing student engagement (de Jager, 2023; Jeannin & Ojo, 2021; Moswane et al., 2021). In Indonesia, research by Suprayogi et al. (2017) highlighted that differentiated learning can improve student learning outcomes, although its implementation still faces obstacles such as a lack of teacher training and limited resources.

Differentiated learning offers great potential to enhance 21st-century competencies through an adaptive and inclusive approach. With the support of comprehensive literature, this article seeks to provide deeper insights into the effectiveness of this approach. The review also aims to provide practical recommendations for educators, policymakers, and researchers to maximize the benefits of differentiated learning in various educational contexts.

2. METHODS

This study used a systematic literature review (SLR) method because of its thorough and comprehensive approach. SLR aims to evaluate research related to differentiated learning and its relationship to developing 21st-century competencies. The SLR flow was carefully designed to find research relevant to the topic. The activity

began with determining the inclusion and exclusion criteria; hence, only high-quality sources were selected. Inclusion criteria included research published between 2000-2024, in the form of peer-reviewed articles, books, or conference papers. Research that was not relevant to the theme, outside the time frame, or not a scientific publication, was not included as review material.

Research searches were conducted in various academic databases such as Google Scholar, Publish or Perish, and Open Knowledge Maps using keywords, such as "differentiated learning", "the 21st century competencies", and other related terms. Boolean operators "AND" and "OR" were used to filter the results more specifically. The search was iterative and adjusted if necessary to cover more literature.

Two stages of screening were conducted after the initial search. The first stage involved reviewing titles and abstracts to exclude irrelevant studies. The second stage involved reviewing the full text to ensure studies met the inclusion criteria.

Data from selected studies were collected using a data extraction form. This form recorded information such as author, year of publication, study objectives, methodology, sample characteristics, key findings, implementation challenges, and recommendations. The collected data were analyzed using thematic analysis to identify key patterns and themes. This process involved re-reading the data, coding, and grouping codes into broader themes, which were then refined through discussion.

The reliability and validity of the findings were maintained by conducting a quality assessment of each selected study. This assessment included clarity of the research question, appropriateness of the methodology, accuracy of the data analysis, and relevance of the findings. High-quality studies were included in the final analysis, while studies with significant limitations were excluded or used with caution.

3. RESULTS & DISCUSSION

This systematic literature review aimed to identify and analyze research findings related to the effectiveness of differentiated learning in improving the 21st century competencies. The 21st century competencies include critical, creative, collaborative, and communicative thinking skills (4C), as well as digital literacy and social-emotional skills. By reviewing articles from Scopus-indexed international journals in the last 25 years, the results of this study are summarized in several main themes: definition and framework of differentiated learning, influence on 21st century competencies, supporting factors, and challenges in implementation.

3.1 Differentiated Learning Definition and Framework

Differentiated learning has become a major concern in the world of education, especially in facing the challenges of the Industrial Revolution 4.0 era. This concept aims to meet the individual needs of each student by considering their learning readiness, interests, and learning profiles (Tomlinson et al., 2003). This strategy is considered effective in improving the 21st century competencies that include critical thinking, creativity, collaboration, and communication skills.

3.1.1 Definition of Differentiated Learning

Tomlinson (2001) defined differentiated learning as a flexible teaching approach, in which teachers adjust the content, process, product, and learning environment based on students' readiness, interests, and learning profiles. Subban (2006) added that differentiated learning aims to create equal but not uniform learning experiences, so that each student can achieve learning goals in a way that suits their potential.

Differentiated learning is an approach to teaching that is based on students' individual needs, readiness, interests, and learning styles, with the aim of creating a more inclusive and effective learning experience. Tomlinson (2001), one of the main figures in this theory, defined differentiated learning as a set of practices that teachers use to adapt the content, process, products, and learning environment to suit the diversity of students in the classroom.

According to Subban (2006), differentiated learning allows teachers to accommodate different levels of student ability in one class, ensuring that all students have the opportunity to achieve the same learning goals through different approaches. This includes the use of various methods, tools, and strategies to support individual student success without sacrificing curriculum standards.

Hall et al. (2004) stated that differentiated learning aims to ensure curriculum accessibility for all students, including those with special needs or different learning styles. This definition is supported by research by Santangelo and Tomlinson (Santangelo & Tomlinson, 2009), which emphasized that this approach is rooted in the principles of inclusive education and diversity.

Differentiated instruction (DI) is essentially an attempt to teach in a variety of ways according to the needs of students, instead of a uniform teaching approach. Other frameworks, such as Universal Design for Learning, encourage teachers to provide students with a wide range of freedom and choice to meet their diverse needs and interests. Differentiated instruction specifically emphasizes the application of teaching methods that aim to enhance learning for students with different levels of readiness, interests, and ways of participating, influenced by their previous learning experiences (Dosch & Zidon, 2014).

3.1.2 Differentiated Learning Framework

Successful implementation of Differentiated Learning requires ongoing training, evaluation, and monitoring (Kahmann et al., 2022) and has been shown to be effective in accommodating diverse student needs, readiness levels, and interests (Al-Shaboul et al., 2021; Joyce & Showers, 2012; Smale-Jacobse et al., 2019). This article identifies six categories of DI instructional practices, including course design and direct instruction.

While some strategies are more effective when used together, not all strategies need to be implemented simultaneously. The flexibility that characterizes this approach allows for specific combinations of strategies depending on the context. For example, forming homogeneous student groups requires variation in activities and assessments, while heterogeneous groups can be optimized through peer mentoring (Pozas et al., 2020). In addition, the learning environment that instructors create together with students has been recognized as a critical element in successful DI implementation (Shareefa et al., 2019).

The differentiated learning framework includes four main elements that are integrated with each other, as follows:

a. Initial Assessment

Initial assessment is an important step in differentiated learning to understand students' needs and characteristics. Teachers can use various methods, such as diagnostic tests, interviews, and observations, to identify students' learning readiness, learning interests, and learning profiles. Students' learning readiness is determined through diagnostic tests to measure the level of initial understanding of the material to be taught. Research shows that understanding learning readiness can help teachers design more effective learning strategies (Santangelo & Tomlinson, 2009). In terms of learning interests, teachers can use questionnaires or discussions to identify students' interests. Well-identified interests allow teachers to create relevant and interesting materials. Meanwhile, learning profiles include students' learning styles, such as visual, auditory, or kinesthetic. Adapting teaching methods to students' learning styles increases the effectiveness of learning (Tomlinson, 2001).

b. Differentiation in Learning

Differentiated learning is done by modifying three main aspects: content, process, and product. Content differentiation involves providing materials with varying levels of difficulty according to student readiness. Teachers can provide materials in various formats, such as text, video, or images. A study by Subban (2006) showed that content adjustments increase student engagement. Furthermore, the learning process can be modified by offering a variety of activities that suit students' learning styles and interests. For example, students who prefer to work in groups can be given discussion tasks, while students who prefer to work independently can be given individual tasks (Tomlinson & Imbeau, 2010). The presence of

projects in differentiated learning offers the final product in a learning process. The product is the end result of the learning process. Teachers can provide a variety of final assignments, such as projects, presentations, or written reports, to allow students to demonstrate their understanding in a way that best suits their strengths. Research by Reis et al. (2011) showed that product differentiation can improve student learning outcomes.

c. Learning Environment

A supportive learning environment is an important element in differentiated learning. It includes flexibility and a positive atmosphere. Flexible classroom settings allow students to work individually, in pairs, or in groups according to their needs. Teachers must create an inclusive and supportive environment to encourage students to learn without fear. Research by Chapman & Gregory (2007) emphasized the importance of creating a supportive environment to enhance learning success.

d. Evaluation and Reflection

In terms of assessment, differentiated assessment is a component of Differentiated Learning that focuses on tailoring how students demonstrate their progress to suit their varying strengths and learning styles. Rather than simply testing for basic recall of information, instructors should focus on the application of higher-order knowledge and reasoning. Differentiation should not only affect how instructors design assessments, but also how they analyze the results and use them to develop more effective Differentiated Learning practices. In this regard, ongoing evaluation is essential to measuring the success of differentiated learning strategies. Teachers can use formative assessments such as quizzes or discussions, that help identify student progress in real time (Black & Wiliam, 2009). In addition, teachers should routinely reflect on the effectiveness of their approaches and make adjustments as needed (Tomlinson, 2001).

3.2 Influence on the 21st Century Competencies

Differentiated learning has been shown to have a positive impact on the development of 21st century competencies, including critical thinking, creative, collaborative, and communicative skills. Differentiated learning offers a framework that allows students to develop these 21st-century competencies through an approach that focuses on individual needs.

3.2.1 Improving Critical Thinking Skills and Creativity

One of the key competencies of the 21st century is critical thinking. Critical thinking refers to the ability to analyze and evaluate information objectively, while creativity involves the ability to generate new and innovative ideas. Differentiated learning plays a vital role in the development of both of these skills. By adapting teaching methods and materials to students' needs, this approach encourages students to think more deeply and creatively. For example, Levy (2008) suggested that differentiated learning enables students to develop critical thinking skills by providing challenging yet appropriate tasks at their level of readiness. Differentiated learning encourages students to analyze, evaluate, and create solutions to complex problems. Tasks designed for students' level of readiness enable them to think deeply about the learning material.

Furthermore, according to research conducted by Sari et al. (2024), the application of differentiated learning has been proven to improve students' critical thinking skills. In the study, students who received instruction that was more appropriate to their ability levels and interests showed significant improvements in critical thinking skills. An approach that focuses on the diversity of learning styles allows students to develop analytical and innovative thinking through activities that are relevant to their context, such as group discussions, problem-based projects, and case solving.

In addition, creativity also develops through differentiated learning. Students are given the freedom to explore various methods and approaches in completing tasks. This allows them to think openly and generate creative ideas. With variations in how to deliver material, students feel more empowered to express their ideas

freely. This is in line with the findings in a study conducted by Noviyanti et al. (2023), which found that this approach can increase student creativity in the context of mathematics learning.

Research by Blackley et al. (2017) showed that this approach is also effective in developing creativity, especially in the context of STEM education. In the context of STEM education, this approach is effective in encouraging student creativity through problem-based projects. By providing tasks that are relevant to students' interests, differentiated learning creates an environment that supports exploration and innovation.

3.2.2 Improved Communication and Collaboration Skills

In addition to critical thinking and creativity, communication and collaboration skills are also important competencies for the 21st century. Differentiated learning provides opportunities for students to work in small groups and discuss their ideas. Through these activities, students can improve their verbal and non-verbal communication skills, as well as their ability to work together in a team.

In a study conducted by Abaniel (as cited in Novita Jumiarti, 2023), it was found that the application of differentiated learning can improve students' communication skills. Students involved in group discussions or team-based projects have the opportunity to share ideas, listen to other people's perspectives, and negotiate to reach agreements. This allows them to improve their communication skills, which are very important in the professional world. In addition, collaboration in differentiated learning helps students learn to work with different types of people, improving their social skills, which are important in everyday life.

Collaborative and communicative skills can be enhanced through learning activities that encourage interaction and cooperation among students (Darling-Hammond & Friedlaender, 2008). This strategy allows students to work in heterogeneous groups, thus broadening their horizons about other perspectives. The interactions that occur during group activities also strengthen their communication skills. A study by Trilling and Fadel (2009) highlighted that differentiated learning can increase student engagement by providing relevant and meaningful learning experiences. In the context of global education, this approach is becoming increasingly important to prepare students for the complex and dynamic challenges of the future.

3.2.3 Computational Thinking Skills Enhancement

Computational thinking is the ability to solve problems using basic concepts in computing, such as algorithms and programming. In a world increasingly dominated by technology, this ability is an important skill that the 21st century-students must have. Differentiated learning provides opportunities for students to develop computational thinking through approaches that are tailored to their pace and learning style.

Research conducted by Noviyanti et al. (2023) proved that differentiated learning can improve students' computational thinking skills. In the study, students who were taught with a differentiated approach showed better abilities in solving computational problems and technology applications, because they received materials tailored to their level of understanding and needs. This approach not only improves technical skills but also helps students develop more systematic and logical ways of thinking, which are essential in a technology-based world.

Furthermore, differentiated learning also provides an opportunity to improve digital literacy, an important component of the 21st-century competencies. Research by Mishra and Koehler (2006) showed that technology integration in differentiated learning can enrich students' learning experiences by providing access to diverse resources and enabling personalization of learning.

3.3 Implementation Challenges

Despite its many advantages and benefits, the implementation of differentiated learning is not free from challenges. The implementation of differentiated learning often faces various challenges. Santangelo and Tomlinson (2009) noted that one of the main obstacles is the lack of time for teachers to design and implement differentiation strategies effectively. In addition, resistance from students and parents is also often an obstacle, especially if they do not yet understand the benefits of this approach. In addition, teachers often face limited time to design and implement differentiation strategies. Santangelo and Tomlinson (2009) noted that many teachers feel overwhelmed by administrative demands and other teaching duties. However, technology can play a

significant role in addressing these challenges. A study by Hall et al. (2004) showed that the use of a Learning Management System (LMS) can facilitate the delivery of materials tailored to individual needs. In addition, ongoing teacher training and collaboration between teachers can help improve the effectiveness of implementation.

Developing professional learning communities is also an effective strategy to support the implementation of differentiated learning. DuFour et al. (2010) highlighted the importance of collaboration between teachers to share best practices and resources. In this context, support from school leaders is also a key factor in determining success. In addition, it is important to consider the cultural dimension in the implementation of differentiated learning. Research by Hofstede (2011) showed that cultural values can influence how students respond to learning strategies. Therefore, local adaptation is needed to ensure that this approach is appropriate to each cultural context. Resistance from students and parents is also an obstacle in the implementation of differentiated learning. Subban (2006) showed that a lack of understanding of the benefits of differentiated learning can lead to distrust of this approach.

4. CONCLUSION

The results of this literature review indicate that differentiated learning has great potential to improve the 21st-century competencies through an adaptive and inclusive approach. Despite the challenges, support from teacher training, technology, and educational policies can improve the effectiveness of its implementation. This study makes an important contribution to the literature by providing in-depth insights into the strategies, benefits, and challenges of differentiated learning, as well as providing recommendations for best practices in various educational contexts. Differentiated learning is an effective approach to meet individual student needs and improve 21st-century competencies. With comprehensive initial assessment, differentiation in learning, supportive learning environments, and ongoing evaluation and reflection, differentiated learning can be optimally implemented. Despite the challenges, the benefits of this approach are far greater.

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