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THE IMPLEMENTATION OF DIFFERENTIAL LEARNING IN 21ST CENTURY EDUCATION: EXPLORING STUDENT'S ENGAGEMENT AND LEARNING VARIATION

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Abstrak: Penelitian ini bertujuan untuk menganalisis implementasi strategi pembelajaran diferensial dalam pendidikan abad ke-21 dan menguji bagaimana strategi ini memengaruhi motivasi dan keterlibatan siswa berdasarkan Teori Penentuan Diri (Self-Determination Theory/SDT). Dengan menggunakan metode deskriptif kualitatif, data dikumpulkan melalui observasi kelas dan wawancara semi-terstruktur dengan satu guru Bahasa Inggris dan siswa kelas delapan di SMP Negeri 13 Medan. Temuan menunjukkan bahwa guru menerapkan diferensiasi terutama pada dimensi proses melalui beragam metode pembelajaran, bimbingan sebaya, pengelompokan fleksibel, dan penyesuaian tingkat dukungan yang diberikan kepada siswa. Diferensiasi konten diimplementasikan secara fungsional melalui beragam media dan bantuan sebaya, meskipun tidak selalu selaras dengan tingkat kesiapan siswa. Sebaliknya, diferensiasi produk tidak diimplementasikan, karena semua siswa menyelesaikan tugas yang sama. Lingkungan belajar menunjukkan kehangatan, dukungan emosional, dan hubungan interpersonal yang positif, meskipun tetap relatif berpusat pada guru. Analisis SDT mengungkapkan bahwa kebutuhan psikologis siswa akan kompetensi dan keterkaitan sangat terpenuhi (35,3%), sedangkan otonomi menunjukkan tingkat pemenuhan yang lebih rendah (29,4%) karena pilihan tugas yang terbatas dan tidak adanya diferensiasi berbasis produk. Secara keseluruhan, pembelajaran diferensial memberikan kontribusi positif terhadap motivasi dan keterlibatan siswa, khususnya dalam kompetensi dan keterkaitan; Namun, otonomi masih perlu ditingkatkan melalui pilihan pembelajaran yang lebih luas dan penilaian berbasis produk yang lebih beragam.

Kata Kunci: Pembelajaran Diferensial, Instruksi Diferensiasi, Teori Penentuan Diri, Pembelajaran Abad ke-21, Pendidikan Bahasa Inggris.

Abstract: *This study aims to analyze the implementation of differential learning strategies in 21st-century education and examine how these strategies influence students' motivation and engagement based on Self-Determination Theory (SDT). Using a qualitative descriptive method, data were collected through classroom observations and semi-structured interviews with one English teacher and eighth-grade students at SMP Negeri 13 Medan. The findings indicate that the teacher applied differentiation primarily in the process dimension through varied instructional methods, peer tutoring, flexible grouping, and adjustments in the level of support provided to students. Content differentiation was implemented functionally through varied media and peer assistance, although it was not systematically aligned with students'*

readiness levels. In contrast, product differentiation was not implemented, as all students completed the same assignments. The learning environment demonstrated warmth, emotional support, and positive interpersonal relationships, although it remained relatively teacher-centered. SDT analysis reveals that students' psychological needs for competence and relatedness were strongly fulfilled (35.3%), while autonomy showed a lower fulfillment level (29.4%) due to limited task choices and the absence of product-based differentiation. Overall, differential learning contributed positively to students' motivation and engagement, particularly in competence and relatedness; however, autonomy still requires enhancement through broader learning choices and more varied product-based assessments.

Keywords: *Differential Learning, Differentiated Instruction, Self-Determination Theory, 21st-Century Learning, English Education.*

INTRODUCTION

In the 21st century, education has undergone a major transformation toward learner-centered and technology-integrated instruction. Teachers are expected to design flexible learning environments that promote creativity, collaboration, and critical thinking among students (Kaur, 2023). This shift reflects the global demand for adaptive teaching models that respond to diverse learner needs and encourage meaningful participation in the learning process (Smit et al., 2021). Consequently, the concept of differential learning has gained attention as a strategy that supports individualized and dynamic learning pathways.

Differential Learning Theory, developed by Schöllhorn (2000), emphasizes variability and non-linearity in learning. Instead of focusing on repetitive drills, differential learning encourages variation and exploration, allowing students to self-organize and construct understanding through diverse learning experiences (Schöllhorn, Hegen, & Davids, 2012). Studies have shown that variability in instruction promotes deeper engagement and adaptability among learners (Tassignon et al., 2021). Although this concept was originally developed in the field of motor learning, it has been gradually adapted into educational contexts, where students benefit from flexible, differentiated, and exploratory approaches to learning.

In addition, Tomlinson's Differentiated Instruction Theory (1999) provides a pedagogical foundation for modifying content, process, and product to accommodate students' readiness, interests, and learning profiles. This approach ensures inclusivity and fosters higher engagement, especially in heterogeneous classrooms (Alavinia & Farhady, 2022; Susanti & Sulistyo, 2021). Recent findings indicate that learners exposed to differentiated strategies such

as flexible grouping, tiered tasks, and project-based learning tend to demonstrate greater motivation and participation (Tailoring Instruction for Diverse Learner Needs, 2025).

Student engagement and motivation are essential elements in effective learning. Based on Self-Determination Theory (Deci & Ryan, 1985), students become intrinsically motivated when their needs for autonomy, competence, and relatedness are met. Differential learning supports these psychological needs by promoting choice, challenge, and collaboration in classroom activities (Ryan & Deci, 2020; Jang et al., 2022). Therefore, integrating differential learning principles with SDT can create adaptive and motivating learning environments suited to the 21st century.

Despite its potential, there is still limited research exploring how the teacher implements differential learning strategies in real educational settings, particularly within the Indonesian context. Understanding how these strategies are applied and how they influence student engagement and motivation can provide valuable insights for improving teaching practices in modern classrooms.

The present study focuses on two main problems: first, identifying the types of differential learning strategies applied by teachers in the context of 21st-century education; and second, examining how those strategies enhance students' engagement and motivation during classroom activities. The study aims to describe the practical application of differential learning and analyze its contribution to creating more inclusive and adaptive classroom environments.

To achieve these objectives, the study employs a qualitative descriptive method, gathering data through classroom observation and teacher interviews to provide an in-depth understanding of differential learning practices and their effects on student engagement.

LITERATURE REVIEW

In the 21st-century classroom, pedagogy increasingly shifts from teacher-centered instruction toward learner-centered and flexible practices that emphasize inclusion, personalization, and active participation (Major, 2020). Differential and differentiated approaches purposely vary tasks, grouping, and supports so learners with diverse readiness and interests can access the curriculum; empirical evidence shows that students' perceptions of teachers' differentiated practices are positively associated with socio-emotional outcomes such as well-being, inclusion, and academic self-concept indicators closely linked to engagement.

Pozas et al. (2021), in a large empirical study, report that students who perceive more frequent use of differentiated instruction rate higher on measures of well-being and social inclusion, even though they also note that teachers often implement DI only occasionally.

Operationally, differentiated strategies observed across recent studies include tiered assignments, flexible grouping, adapted pacing, and technology-mediated personalization (Insorio, 2024; Major, 2020). Technology and adaptive learning systems play a practical role by enabling real-time feedback and individual learning pathways, which make it feasible for teachers to implement multiple task variations in one classroom. These strategies constitute the "what" and "how" of classroom practice: concrete teacher actions that bring variability and choice into lessons, increasing the likelihood that diverse learners can participate meaningfully. This perspective aligns with Schöllhorn's Differential Learning Theory (2000), which emphasizes the importance of variability and non-linearity in learning processes. Rather than focusing on repetition and standardization, Schöllhorn's approach values exploration, adaptability, and self-organization principles that resonate strongly with modern educational goals of creativity and autonomy.

The motivational mechanism that explains why these practices raise engagement can be understood through Self-Determination Theory (SDT). Studies applying SDT to contemporary learning contexts show that satisfying the psychological needs for autonomy, competence, and relatedness predicts higher behavioral, cognitive, and emotional engagement in both online and face-to-face settings (Chiu, 2021). When differentiated practices provide meaningful choices (autonomy), scaffolded challenge (competence), and collaborative opportunities (relatedness), they operate as autonomy supportive conditions that foster intrinsic motivation and deeper involvement in learning tasks. Empirical work within this framework consistently demonstrates that students who experience greater autonomy and support in learning environments report higher persistence, creativity, and satisfaction.

Recent reviews also indicate that technology-supported personalization amplifies the effectiveness of differentiated instruction by helping teachers deliver multiple learning paths efficiently while tracking student progress for timely adjustments (du Plooy & Naicker, 2024; Major, 2020). However, scholars caution that teacher readiness, digital access, and clear communication of learning goals remain critical to achieving sustained engagement. These findings highlight that the success of differential learning depends not only on pedagogical tools but also on the teacher's ability to balance flexibility with structure and feedback.

The integration of Schöllhorn's Differential Learning Theory, Tomlinson's Differentiated Instruction framework, and Deci and Ryan's Self-Determination Theory provides a comprehensive foundation for understanding how variability, personalization, and motivation interact in the learning process. Differential learning emphasizes the importance of diverse and non-linear experiences that encourage students to explore and self organize their understanding. When these experiences are supported through differentiated instruction by adjusting content, process, and product according to learners' readiness and interests, they become more inclusive and learner-centered. At the same time, fulfilling students' psychological needs for autonomy, competence, and relatedness enhances their motivation and engagement. Altogether, these theoretical perspectives highlight that effective 21st-century education requires not only flexible instructional design but also an empathetic awareness of individual learner differences, ensuring that learning remains meaningful, engaging, and adaptive to diverse student needs

RESEARCH METHODS

This study employed a qualitative descriptive design to obtain a comprehensive understanding of how differential learning is implemented in 21st-century education and how it influences students' engagement and motivation. A qualitative descriptive approach was chosen because it allows the researcher to explore real-life classroom practices as they naturally occur without manipulating variables or applying experimental control. This design also provides rich, contextualized insights into teachers' strategies and students' learning responses within authentic educational settings.

The data were collected from SMP Negeri 13 Medan. The scope of the research covered one English teacher who applied differential learning strategies and Grade VIII students in English classrooms who experienced those learning methods. The criteria for respondents were established to ensure the validity and relevance of the collected data. The teacher selected as participants were those who had implemented differentiated or varied instructional strategies for at least one semester, indicating sufficient experience in applying differential learning. Meanwhile, student participants were drawn from the same class taught by the observed teacher and were identified as active participants who demonstrated engagement and interaction during classroom activities.

The instruments for data collection included observation sheets and semi-structured interview guidelines. The observation sheets were used to document how teachers applied differential learning strategies during classroom instruction, focusing on variations in teaching methods, materials, and student grouping. Meanwhile, semi-structured interviews were conducted with both the teacher and selected students to gather in-depth information about their experiences, perceptions, and challenges in implementing and participating in differential learning. The interviews provided complementary insights to support and clarify the data collected through classroom observations.

The data collection techniques consisted of two main methods: classroom observation and semi-structured interviews. During the classroom observation, the researcher acted as a participant observer to engage closely with the teaching–learning process while maintaining objectivity in documenting the observed phenomena. Observations were conducted systematically across several meetings to ensure a comprehensive understanding of differential learning practices. Following the observations, interviews were carried out to explore teacher rationales for applying specific strategies and students' perceptions of how these approaches affected their learning motivation and engagement.

The data analysis technique used in this study was qualitative content analysis. All observational notes and interview transcripts were carefully examined and categorized according to themes related to differential learning strategies and student engagement. The data were analyzed to identify patterns in teachers' differentiation approaches—such as differentiation by content, process, product, and environment and their impact on students' motivation and participation. Thematic interpretation was then conducted to conclude how differential learning enhances classroom dynamics and supports diverse learners' needs in the context of 21st-century education.

RESULTS AND DISCUSSION

Based on observations involving one English teacher and eighth-grade students at SMP Negeri 13 Medan, this study reveals that teachers apply various differential learning strategies as described in Tomlinson's (1999) framework and Schöllhorn's (2000) principles of learning variation. These strategies are evident in four main forms of differentiation: content, process, product, and learning environment. In the learning process, teachers most often used process differentiation through activity variation, flexible grouping, the use of tiered tasks, and the

provision of different levels of support according to student readiness. In content differentiation, teachers adjusted the depth of the material for students who needed additional guidance, while more capable students received additional challenges. In terms of products, students are given choices of learning outcomes such as individual exercises, small projects, or group assignments. Meanwhile, environmental differentiation is evident through the arrangement of space and interactions that encourage collaboration. These findings show that teachers play a dominant role in directing the learning process, but still allow room for variation according to student needs.

In addition, this study also examines how the differential learning strategy affects student engagement and motivation based on Self-Determination Theory (Deci & Ryan, 1985), which includes three main psychological needs: autonomy, competence, and relatedness. Autonomy is evident when teachers provide different task options or ways of completing them, so that students feel freer to determine their learning approach. Competence emerges through the provision of tiered assignments and guidance tailored to each student's abilities, so that they feel capable of completing the tasks assigned. Relatedness is evident in collaborative activities such as group work and discussions that create positive interactions between students. The interview results show that a variety of activities and opportunities to choose increase student attention, make them more comfortable, and motivate them to actively engage in learning.

Overall, the learning patterns found illustrate that the application of differential learning enables the creation of a learning environment that is more adaptive, responsive, and tailored to the diverse needs of students. Although teachers still hold primary control over the learning structure, the consistent application of variation has been shown to increase student participation, motivation, and engagement during the learning process. The next section will describe these findings in more detail based on differentiation categories and evidence obtained from observations and interviews.

1. Types of Differenciated Learning

Types of Differentiatio	Evidence / Description	SDT(Frequence)			SDT (Percentages)		
		Autonomy	Competence	Relatedness	Autonomy	Competence	Relatedness

Content	**Varied materials, peer support, teacher approaches struggling students.** When someone doesn't know, I ask them to ask their friend first. If they still don't know, then they come to me." ("Ketika ada yang nggak tahu, saya akan suruh dia nanya sama temennya dulu. Kalau nggak tahu, baru sama saya.")	**5**	**6**	**6**	**29.4%**	**35.3%**	**35.3%**
Process	**Lecturing, group work, peer tutoring, mixed-**	**5**	**6**	**6**	**29.4%**	**35.3%**	**35.3%**

	ability grouping, repetition. "My approach… students who already understand must explain it to those who don't." ("Pendekatan saya… siswa yang udah paham nyuruh dia menerangkan ke yang belum paham.")						
Product	**Same assignments, no alternative outputs, uniform assessment.** Never different. Always the same, and I teach them." ("Sama saja tidak pernah. Tetap sama,	**0**	**0**	**0**	**0**	**0**	**0**

	dan saya ajarin.")						
Learning Environment	**Memorizing names, humor, encouragement, firm discipline with repair.**"Know your students first… I memorize their names to feel close to them." ("Kenali dulu murid Anda… saya hafal nama mereka, supaya dekat.")	**5**	**6**	**6**	**29.4%**	**35.3%**	**35.3%**

a. Content

Evidence:

1. "When someone doesn't know, I ask them to ask their friend first. If they still don't know, then they come to me." ("Ketika ada yang nggak tahu, saya akan suruh dia nanya sama temennya dulu. Kalau nggak tahu, baru sama saya.")
2. "The teaching materials are different every meeting." ("Bahan ajar berbeda-beda setiap pertemuan.")

3. “I let the students try to understand first and ask their friends… if there are still some who don’t understand, we approach them.” (“Saya biarin muridnya semua nangkap, dan bertanya ketemannya… kalau masih ada yang nggak ngerti, kita datangin.”)

Analysis:

According to Tomlinson, content differentiation involves providing multiple ways for students to access learning materials. Based on the evidence, the teacher has implemented this through the use of varied media such as visuals and audio, allowing students alternative pathways to understand the material. The teacher also uses a peer-explanation strategy by encouraging students to ask their friends first before coming to the teacher, which creates a more flexible route for accessing content. Additionally, the teacher provides extra support by approaching students who still struggle to understand the lesson. Although the teacher does not differentiate the material based on students’ ability levels, the methods of presenting and accessing the content are adjusted according to classroom needs. Therefore, the teacher can be seen as applying content differentiation practically and functionally.

b. Process

Evidence:

1. “My approach… students who already understand must explain it to those who don’t.” (“Pendekatan saya… siswa yang udah paham nyuruh dia menerangkan ke yang belum paham.”)
2. “In some classes I use group work, in others I use lecturing… so it’s different.” (“Ada murid kelas yang saya pakai metode kelompok, ada yang ceramah… jadi berbeda-beda.”)
3. “Some classes must discuss the task together… others get the explanation first before the task.” (“Ada kelas yang tugas harus didiskusikan sama-sama… ada yang diterangkan dulu baru dikasih tugas.”)
4. “Place one leader in each group… high with middle and low.” (“Tempatkan satu leader di satu kelompok… high dengan middle dan low.”)
5. “If 25 don’t understand, we repeat it… if only 3 don’t, we check again next week.” (“Kalau 25 nggak ngerti, kita ulang lagi… kalau tinggal 3, nanti minggu depan tanya lagi.”)

Analysis:

Process differentiation is the most dominant aspect of the teacher's practice. The teacher uses diverse learning methods—lecturing, discussion, group work, and shared reading—to provide different learning experiences for students. Peer tutoring is strongly applied by asking students who understand the material to help those who do not, and by organizing mixed-ability groups consisting of high, middle, and low achievers. The teacher also adapts instruction based on students' understanding, repeating material for the whole class when many struggle, and offering targeted support when only a few need help. These practices align closely with Tomlinson's concepts of scaffolding, flexible grouping, and varied learning activities. Thus, even though the teacher may not label it academically, they are effectively implementing strong process differentiation.

c. Product

Evidence:

1. "Never different. Always the same, and I teach them." ("Sama saja tidak pernah. Tetap sama, dan saya ajarin.")
2. "Never giving different products: posters, videos, presentations." ("Tidak pernah memberi produk berbeda: poster, video, presentasi.")
3. Assessment: "Look at their course books, they all get 100… fix it, all 100." ("Tengok buku Latihan mereka, itu semua menilai 100… perbaiki 100 semua.")

Analysis:

In terms of product differentiation, the teacher clearly does not implement it. All students complete the same assignments without the option to demonstrate their understanding through alternative products such as posters, videos, or presentations—options that Tomlinson recommends to accommodate different learning strengths. The assessment system is also uniform, with most students receiving a score of 100 as a motivational strategy rather than a differentiated evaluation. This indicates that the teacher favors uniformity for the sake of efficiency and perceived fairness. Consequently, product differentiation is not applied in the teacher's instructional practice.

d. Learning Environment

Evidence:

1. "Know your students first… I memorize their names to feel close to them." ("Kenali dulu murid Anda… saya hafal nama mereka, supaya dekat.")
2. "Using playful or humorous language… closeness and comfort emerge." ("Dengan bahasa lucu-lucuan… muncullah kedekatan dan rasa nyaman.")
3. "If you want to try going to the front, go ahead" ("Boleh coba ke depan, ayo… kalau mau coba, ayo.")
4. "If you don't follow the rules, get out… but after that, they apologize." ("Kalau nggak nurut, kau keluar… tapi setelah itu mereka minta maaf.")
5. "It's okay to make mistakes… participate, everyone must join." ("Salah gak apa-apa… ikutlah, semua harus berpartisipasi.")

Analysis:

The learning environment created by the teacher reflects a blend of warmth and firmness. The teacher fosters psychological safety and positive relationships by remembering students' names, using humor, and encouraging students to try speaking or reading at the front without rigid rules. Statements such as "it's okay to make mistakes" contribute to a supportive atmosphere. However, the teacher also maintains strict control, exemplified by warning students to leave if they do not follow instructions, although the relationship is later repaired through apologies. According to Tomlinson, an effective learning environment supports safety, positive relationships, and opportunities for participation. Overall, the teacher successfully creates an active, friendly, and participatory classroom climate, even though it still includes elements of teacher-centered control.

2. Self-Determination of Students' Motivation

The table below presents an analysis of students' psychological needs based on the Self-Determination Theory (Deci & Ryan, 2000), which includes autonomy, competence, and relatedness. The data show the extent to which differentiated learning supports students' intrinsic motivation, along with the frequency and percentage of each category.

Based on the overall calculation in the table, it is evident that among the three psychological needs in the Self-Determination Theory (SDT), competence and relatedness show the highest percentages, each at 35.3%. This indicates that the implementation of

differentiated learning has successfully helped students feel more capable in engaging with the lessons, as the materials and activities are adjusted to their individual abilities. In addition, students also experience positive relationships with the teacher and strong social support, fulfilling their relatedness needs through adaptive interactions and collaborative activities.

Meanwhile, the autonomy category obtained a percentage of 29.4%, which is slightly lower than the other two aspects. This finding suggests that although differentiated learning provides students with choices, their level of independence is still developing, particularly because the teacher still guides some learning choices. Therefore, offering broader and more flexible options may further enhance students' sense of control and freedom in determining their preferred learning strategies.

Overall, the results demonstrate that differentiated learning in the classroom has been highly effective in fulfilling students' competence and relatedness needs. However, the aspect of autonomy can still be strengthened so that students can more freely explore learning methods that best align with their preferences and learning styles.

3. Self-Determination

a. Autonomy

Evidence:

M: - "Yes, in the form of games and then question-and-answer activities." ("Pernah, dalam bentuk permainan baru tanya jawab soal.")
- "Yes, I chose to do a presentation in front of the class." ("Ya, saya memilih untuk presentasi ke depan kelas.")
- "More excited… for example playing a Q&A game or being given questions." ("Lebih semangat… misalnya bermain game tanya jawab, dikasih soal.")

MH: - "Yes… I was given options to learn through games or by reading texts." ("Pernah… dikasih pilihan belajar lewat game atau membaca teks bacaan.")
- "I usually choose to write a text." ("Saya biasanya memilih menulis teks.")
- "I feel the teacher's choices are usually better and easier to understand." ("Saya merasa pilihan dari guru itu biasanya lebih baik dan lebih mudah saya pahami.")

Analysis:

Both students demonstrate autonomy, although at different levels. Student 1 shows higher autonomy because she chooses learning methods (games, Q&A, presentation) based on

her preferences and feels more motivated when given choices. Student 2 also exercises autonomy but tends to rely on teacher-guided choices, showing guided autonomy. In line with SDT (Deci & Ryan), choice and control support intrinsic motivation, and differentiated learning successfully provides these options, though Student 2 still needs more independence in selecting learning strategies.

b. Competence

Evidence:

M: - "I can understand what the teacher explains." ("Bisa mengerti apa yang dijelaskan.")
- "The teacher explains again so I can understand the material." ("Gurunya menjelaskan kembali agar saya bisa memahami materi.")
- "Happy and confident." ("Senang dan percaya diri.")

MH: - "I can follow the lessons well." ("Saya merasa bisa mengikuti pelajarannya dengan baik.")
- "The teacher explains again until I understand." ("Gurunya menjelaskan lagi sampai saya paham.")
- "I feel happy." ("Saya merasa senang.")

Analysis:

Both students show strong competence. They can follow the lessons, understand explanations, and feel supported when difficulties arise because the teacher provides additional explanations and guidance. Their positive emotional responses—feeling happy, confident, and capable—indicate that their competence needs are fulfilled. According to SDT, this sense of mastery enhances intrinsic motivation, and differentiated learning contributes by offering tailored explanations and support based on each student's needs.

4. Relatedness

Evidence:

M: - "I am accepted well." ("Diterima dengan baik.")
- "If I make a mistake, they correct me kindly." ("Jika salah diberitahu dengan baik.")
- "Most friends want to help." ("Lebih banyak teman yang mau membantu.")

– "The teacher always gives appreciation." ("Guru selalu memberi apresiasi.")

MH: - "I feel comfortable and accepted." ("Merasa nyaman dan diterima.")

- "We help each other and divide tasks fairly." ("Kami saling membantu dan tugas dibagi rata.")
- "My teacher often praises my work." ("Guru sering memberi pujian atas hasil kerja saya.")

Analysis:

Both students experience strong relatedness in the classroom. They feel accepted, supported, and treated positively by both peers and the teacher. Mistakes are corrected respectfully, group work is cooperative, and teachers frequently provide praise and appreciation. These conditions fulfill the need for connection and belonging as outlined in SDT, creating a supportive learning environment that enhances motivation. Differentiated learning also contributes by encouraging collaboration, fostering positive interactions, and providing individualized teacher support.

Discussion

Differentiated Instruction, according to Tomlinson (2014), requires teachers to adapt content, process, product, and learning environment to address student diversity, while Self-Determination Theory (Ryan & Deci, 2020) states that motivation grows when autonomy, competence, and relatedness are supported. Using these frameworks, this study examined how the teacher's differentiation practices influenced students' psychological needs. Results indicate that differentiation occurred across all dimensions, though with uneven levels of intentionality and effectiveness.

Content differentiation was evident through varied materials and peer assistance, but it was not systematically aligned with student readiness. This finding differs from Titus (2025), who emphasized that intentional content tiering enhances equitable learning, yet it aligns with Aji Silmi et al. (2025), who found that teachers often struggle to fully implement content differentiation due to time and resource constraints. Thus, content variation in this study reflects practical adjustment rather than planned differentiation.

Process differentiation was the strongest aspect of instruction. The use of flexible grouping, peer tutoring, and varied instructional methods aligns with previous studies showing that process differentiation is the most manageable and impactful strategy (Titus, 2025; Aji

Silmi et al., 2025). The teacher's practices, such as repeating explanations when needed and forming mixed-ability groups, fit Tomlinson's framework and highlight broader 21st-century teaching trends that emphasize flexibility over structural curriculum changes.

In contrast, product differentiation was absent. All students completed identical tasks and received similar assessments, which contrasts with findings from Titus (2025) that highlight the importance of product variation in promoting autonomy and deeper learning. The lack of product differentiation is consistent with Aji Silmi et al. (2025), who noted teachers' concerns regarding fairness, workload, and unclear assessment criteria. This gap indicates missed opportunities for authentic assessment aligned with diverse student strengths.

The learning environment showed warmth and positive rapport, supported by humor and interpersonal closeness, while still maintaining clear rules. This aligns with Aji Silmi et al. (2025), who found that positive environments enhance student collaboration. However, compared to Titus (2025), who emphasized shared decision-making, the current classroom remained largely teacher-directed, limiting opportunities for student agency.

These differentiation patterns closely relate to students' SDT outcomes. Competence and relatedness were strongly fulfilled (both 35.3%) due to clear structure, supportive feedback, and positive relationships, consistent with Ryan & Deci (2020) and Lavrijsen et al. (2024). Autonomy showed weaker fulfillment (29.4%), likely due to limited student choice and the absence of product differentiation. Overall, differentiation in this study supported competence and relatedness effectively but provided limited autonomy. Strengthening product variation, increasing meaningful choice, and aligning content more intentionally with readiness could better balance students' psychological needs and enhance intrinsic motivation in 21st-century learning contexts

CONCLUSION AND SUGGESTIONS

The findings of this study show that the implementation of differential learning has contributed to creating an adaptive and responsive learning environment aligned with 21st-century educational demands. The teacher demonstrated strong process differentiation through varied instructional methods, flexible grouping, and peer tutoring, which effectively enhanced students' participation and understanding, while content differentiation appeared in practical forms though not systematically aligned with student readiness. The absence of product differentiation remained a key limitation, restricting students' opportunities to demonstrate

their learning through diverse outputs. The classroom climate, marked by warmth and positive interpersonal relationships, supported student engagement; however, teacher-centered decision-making limited the development of autonomy. In relation to Self-Determination Theory, competence and relatedness needs were strongly fulfilled, whereas autonomy remained relatively low due to limited choices. These results suggest that increasing meaningful learning choices, implementing varied product-based assessments, and planning more intentional content tiering can better balance students' psychological needs and ultimately strengthen their intrinsic motivation within modern, inclusive learning environments.

BIBLIOGRAPHY

Chiu, T. K. F. (2021). Applying self-determination theory to explain student engagement in online learning during COVID-19. Educational Technology Research and Development, 69(1), 73–79. https://selfdeterminationtheory.org/wp

Deci, E. L., & Ryan, R. M. (1985). Intrinsic motivation and self-determination in human behavior. New York: Plenum Press. https://doi.org/10.1007/978-1-4899-2271-7

du Plooy, E., & Naicker, I. (2024). Personalized adaptive learning in higher education: A scoping review. International Journal of Educational Technology in Higher Education. https://pmc.ncbi.nlm.nih.gov/articles/PMC11544060/

Insorio, A. O. (2024). Integrating differentiated instruction to improve STEM students' mathematical engagement and academic performance. International Journal of Didactical Studies, 5(2), 87–102. https://doi.org/10.33902/ijods.202427678

Kaur, G. (2023). Learner-centered pedagogy in the digital age: Shifting roles of teachers and learners. Educational Innovations Journal, 9(2), 12–24.

Lavrijsen, J., Sypré, S., Soenens, B., Vansteenkiste, M., Camerman, E., Ramos, A., & Verschueren, K. (2024)

Major, L. (2020). Rapid Evidence Review: Technology-supported personalised learning. EdTech Hub. https://edtechhub.org/wp-content/uploads/2020/09/Rapid-Evidence-

Pozas, M., Letzel, V., Lindner, K.-T., & Schwab, S. (2021). DI (Differentiated Instruction) Does Matter! The effects of DI on secondary school students' well-being, social inclusion and academic self-concept. Frontiers in Education, 6, 729027. https://doi.org/10.3389/feduc.2021.729027

Schöllhorn, W. I. (2000). Application of systems dynamic principles to technique and strength training. Acta Academiae Olympiquae Estoniae, 8, 67–85.

Schöllhorn, W. I., Hegen, P., & Davids, K. (2012). The nonlinear nature of learning – A differential learning approach. The Open Sports Sciences Journal, 5, 100–112. https://doi.org/10.2174/1875399X01205010100

Silmi, T. A., Lubis, A., & Maulidi, A. (2025). Model differentiated learning in 21st century education: A systematic review of strategies, results, and challenges. Al Ulya: *Journal Pendidikan Islam,* 10(1), 60–80.

Smit, B., Hyland, M., & Duffy, G. (2021). Adapting to diversity: Teachers' approaches to learner-centered education in the 21st century. Teaching and Teacher Education, 102, 103341. https://doi.org/10.1016/j.tate.2021.103341

Titus, A. (2025). Effects of differentiated instruction on students' empowered learning skills. *International Journal of Instruction*, 18(3), 19–38. https://doi.org/10.29333/iji.2025.1832a

Tomlinson, C. A. (1999). The differentiated classroom: Responding to the needs of all learners. Alexandria, VA: ASCD.