

Mathematics Teachers' Perception: Can Differentiated Instruction Lead the Way?

Yoga Dwi Windy Kusuma Ningtyas^{1,*}, Margaretha Madha Melissa¹ & Chusnul Khotimah Galatea²

¹Graduate School of Humanities and Social Sciences, Hiroshima University, Japan

²Faculty of Teacher Training and Education, Universitas Muhammadiyah Jember, Indonesia

*Correspondence: Yoga Dwi Windy Kusuma Ningtyas, Graduate School of Humanities and Social Sciences, Hiroshima University, Japan. Tel: 81-80-6092-4285. E-mail: d233565@hiroshima-u.ac.jp

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Abstract

This study explores mathematics teachers' perceptions of Differentiated Instruction (DI) through the framework of the Theory of Planned Behavior (TPB). A qualitative methodology was employed, involving semi-structured interviews with four senior high school mathematics teachers in Indonesia who were purposively chosen because of their participation in a teaching professional development program focused on DI. The data were thematically analyzed and interpreted based on the three TP constructs: attitude toward behavior, subjective norms, and perceived behavioral control. The results indicate that teachers generally possess a positive attitude toward DI in mathematics classrooms, considering it a way to address student diversity, promote educational equity, and support student engagement. Participants also noted strong support from professional learning communities and educational reform initiatives, which reinforced positive subjective norms for DI implementation. Nonetheless, perceived behavioral control was identified as an obstacle, as teachers often faced limitations related to infrastructure, instructional resources, and practical challenges in designing differentiated learning experiences. The study also discovered that teachers typically applied differentiation in mathematics by adjusting tasks, grouping methods, and learning activities, although the use of rich mathematical tasks with various entry points remained limited. These findings imply that the successful implementation of DI in mathematics classrooms relies not only on teachers' positive beliefs and professional support but also on sufficient resources and sustained professional development. This study contributes to the literature on DI by revealing that teachers' intentions to implement DI in mathematics classrooms are shaped by a combination of their pedagogical beliefs, social influences, and contextual limitations.

Keywords: responsive teaching, differentiated instruction, mathematics teacher, perception, professional development, case study

1. Introduction

1.1 Background

The focus on diversity, equity, and inclusion within educational settings has intensified, necessitating that teachers adapt their pedagogical methods to address the diverse needs of students. These needs span a wide range, including students' learning abilities, interests, motivation, profiles (Guberina, 2023), and cultural backgrounds (Benjamin, 2014). This shift aims to ensure equitable educational opportunities for all the students. Differentiated Instruction (DI) has emerged as a teaching approach to address the challenges presented by diverse classroom settings (Pozas et al., 2020). DI is a pedagogical approach that actively recognizes the diverse characteristics of students by valuing their strengths and tailoring teaching methods to accommodate their distinct needs and limitations (Tomlinson & Imbeau, 2023). This approach involves the adaptable alignment of content, processes, products, and learning environments to meet students' requirements (Tomlinson, 2014).

Differentiation is not a novel concept; however, it has recently become prominent in educational discourse. Teachers may categorize students based on their achievement levels or learning profiles, assign varied tasks, offer additional support to those experiencing difficulties, provide enrichment materials for advanced learners, adjust learning

objectives, modify the time allocated for tasks, or deliver personalized encouragement (Fox & Hoffman, 2011; Tomlinson & Imbeau, 2023). Furthermore, some students may be permitted to work independently rather than in groups (Heacox, 2012).

DI theory exerts a significant influence on educational practices globally, particularly in mathematics classrooms (Hackenberg et al., 2021). In Indonesia, research has demonstrated the implementation of DI and its impact on student achievement across various educational levels, including primary schools (Fitri et al., 2023), junior high schools (Jayantika & Santhika, 2023), senior high schools (Febriana et al., 2023), and higher education (Suprayogi et al., 2023). Despite the Indonesian curriculum's encouragement of DI adoption, there is a notable paucity of qualitative research exploring senior high school teachers' experiences transitioning from uniform teaching methods to DI (Sitorus, 2025). Existing studies have primarily concentrated on teachers' perceptions of DI implementation within higher education contexts (Subban et al., 2025). This study addresses this gap by investigating teachers' perceptions and practical implementation strategies specifically within mathematics classrooms in Indonesian senior high schools, thereby providing an essential perspective on the functioning of DI in current practices.

1.2 State of the Arts

Differentiated instruction (DI) has emerged as a solution to the drawbacks of the one-size-fits-all teaching approach, drawing significant influence from the constructivist theories of Piaget and Vygotsky. Piaget's cognitive constructivism emphasizes the role of culture in suggesting that students gradually construct knowledge through participation, whereas Vygotsky's social constructivism emphasizes the role of cultural context and social interaction (Suprayogi et al., 2017; Tomlinson, 2014). Vygotsky's concept of the Zone of Proximal Development (ZPD) is fundamental to DI, highlighting that optimal learning occurs when students are guided to extend just beyond their existing skill level with the assistance of a more knowledgeable individual (Demirbaga, 2018). Consequently, DI is regarded as a proactive and adaptive approach in which understanding is attained through individual construction and social collaboration.

Over the years, DI has progressed from a simple collection of tools to a comprehensive educational philosophy that emphasizes the importance of addressing individual student needs rather than adhering to a standardized curriculum (Hall, 2002; Tomlinson, 2000; Tomlinson & McTighe, 2006). Contemporary DI involves systematic adjustments to various curriculum components, such as content, process, product, and learning environment, to accommodate the diverse readiness levels, interests, and learning profiles of students (Tomlinson, 2014; Tomlinson & Imbeau, 2023). This approach is characterized by its flexibility, requiring teachers to consistently assess academic progress and modify the instructional pace or level of instruction as needed (Roy et al., 2013). DI ultimately serves as an approach for designing educational experiences, allowing students to demonstrate their skills in varied and meaningful contexts across different settings.

While DI has been discussed from pedagogical and constructivist perspectives, its implementation involves more than understanding its foundational concepts. It also requires teachers to continually modify their teaching methods, address students' diverse needs, and manage contextual limitations within schools (Pozas et al., 2020; Suprayogi et al., 2017). Consequently, differences in teachers' intentions and perceived abilities may influence their DI practices. Previous studies have indicated that while teachers often support DI conceptually, they encounter difficulties in enacting it in the classroom (Subban et al., 2025). Understanding these factors is important for explaining why teachers might support DI but implement it in varied ways in their classrooms. As implementing DI involves planned teaching actions, the Theory of Planned Behavior (TPB) provides a theoretical lens for exploring how teachers' attitudes, professional expectations and support, and perceived behavioral control shape their intention to implement DI.

1.3 Conceptual Framework

The theoretical basis of this study is grounded in the Theory of Planned Behavior (TPB), introduced by Ajzen (1991). This theory proposes that actions are not carried out impulsively; instead, they are guided by intentions. These intentions are shaped by three components: attitudes toward behavior, subjective norms, and perceived behavioral control. Attitude toward behavior involves an individual's positive or negative evaluation based on the anticipated results. Subjective norms pertain to the perceived social pressure to engage in a behavior. Perceived behavioral control is related to the perceived ease or difficulty of performing a behavior, considering past experiences, available resources and potential challenges.

When considering teachers as individuals and TPB views to specific behaviors such as differentiated instruction (DI), teachers' attitude toward DI refers to their evaluation of whether DI implementation will have a positive impact on

students learning. Thus, teachers who view DI as a valuable approach to support student success tend to have a stronger intention to enact it in the classroom. When considering subjective norms, teachers tend to tailor their teaching methods to students' needs because of their social and professional environment. Teachers tend to adopt DI when they feel strong support and expectations from principals, colleagues, and educational policies. While intention must also be supported by perceived behavioral control, which is the extent to which teachers feel ease or difficulty in implementing DI, without access to professional training or infrastructure support, teachers may be reluctant to move beyond traditional teaching methods.

Importantly, the three components are interconnected. The TPB suggests that teachers are more inclined to form a strong intention to enact particular behaviors when they maintain a positive attitude towards DI, feel supported by their professional and social environments, and believe they have adequate knowledge, skills, and resources to successfully enact DI. However, even if teachers acknowledge the educational benefits of DI, its implementation might be restricted if social support is lacking or if they feel that they lack the necessary instructional skills or contextual resources. Thus, the interplay between attitudes, subjective norms, and perceived behavioral control offers a thorough understanding of how teachers develop intentions that ultimately shape their classroom practices.

Using TPB, this study aimed to explore teachers' perceptions that encourage them to enact DI in mathematics classrooms. To this end, the following research question was formulated: To what extent do teachers' attitudes, subjective norms, and perceived behavioral control impact their intention to implement differentiated instruction in mathematics classrooms?

2. Method

2.1 Research Design

This study employed a qualitative approach to explore secondary school mathematics teachers' perceptions regarding the implementation of DI within their mathematics classrooms through the lens of the Theory of Planned Behavior (TPB). The qualitative approach was selected as it facilitates an exploration of participants' experiences, beliefs, and contextual interpretation, allowing a deeper understanding of the factors shaping their instructional choices and obstacles encountered during DI implementation (Marshall & Rossman, 2014). Additionally, examining a specific school setting enables a detailed investigation of the operation of DI within the constraints of the Indonesian secondary mathematics curriculum.

2.2 Participants

This study involved four mathematics teachers from senior high schools in Central and East Java, Indonesia. The inclusion of teachers from these regions was not intended to achieve geographical representativeness; instead, it was based on the availability of teachers who met the study criteria and were willing to participate in the interviews. The participants were mathematics teachers with prior experience in implementing DI or who had completed professional development activities related to DI through the *Guru Penggerak Program* (a transformational teacher program) or related workshops (see Appendix A). By examining teachers working in diverse educational settings, this study aimed to explore the commonalities and differences in their perceptions and experiences of implementing DI in mathematics classrooms.

2.3 Data Collection and Instrument

Data were collected through a video conferencing platform, chosen for its capacity to facilitate interviews with participants from different geographical locations. To obtain comprehensive data, semi-structured interviews were conducted with the participants (see Appendix B). Each interview, lasting one hour, was recorded and conducted in Bahasa Indonesia by the first author.

2.4 Data Analysis

Data analysis was conducted using thematic analysis, as outlined by Braun & Clarke (2006). Initially, the interview recordings were transcribed verbatim and read multiple times to become familiar with the content. During this stage of familiarization, initial notes were taken on the teachers' perceptions and experiences of DI. Next, the initial codes were manually created using Microsoft Excel. Meaningful text segments related to teachers' understanding of DI, recognition of students' differences, instructional strategies, indicators of success, collaboration, challenges, and necessary support were coded. In the third step, these codes were examined and grouped into broader categories. Since this study was guided by the TPB (Ajzen, 1991), the emerging categories were subsequently interpreted and organized according to the three TPB constructs: attitude toward behavior, subjective norms, and perceived

behavioral control. Finally, the themes were checked against the interview data to ensure consistency and coherence before being refined and presented in the Results section. The analysis combined the inductive coding of participants' responses with a deductive interpretation based on the TPB. To ensure the teachers' anonymity, a pseudonym system was used during coding and reporting.

3. Results

3.1 Attitude Toward Behavior

Teachers internally evaluate whether implementing Differentiated Instruction (DI) enhances students learning outcomes. Consequently, teachers who view DI as a beneficial approach for enhancing students' achievement are more inclined to adopt it in their classrooms. Key elements linked to this include understanding the concept of DI, recognizing student diversity, employing varied teaching strategies, and evaluating instructional success.

The participants shared a core belief that DI is a student-centered approach designed to move away from the traditional one-size-fits-all teaching model, thereby better addressing diverse students' learning needs. Bambang expressed his belief by stating:

"Differentiated learning is learning that aims to meet students' learning needs... because every child is unique, we cannot treat them all the same."

Dila supported this viewpoint by emphasizing the need to adapt teaching strategies:

"We can no longer use conventional methods that assume all students are the same... we must adjust to their competencies and interests."

Interestingly, Jelita emphasized equity and autonomy. She viewed DI through the lens of fairness, shifting the focus from teachers' responsibilities to students' active participation in the learning process.

"Providing fair service according to their respective portions... So, it's not the students following the teacher's will, but the teacher facilitating the student's needs"

Similarly, Kirun linked the concept of student agency. He believed that differentiation involves granting students the freedom to choose learning tools, including resources, as long as the fundamental logical objectives are met.

"A learning approach where our learning is not only related to one thing, but to various things, whether it be the content, the process, or even the final product. Therefore, the measurements and results also vary. So, the point is that we are independent and the students are also free to choose which one they want."

Although all participants viewed DI as a crucial approach for addressing each student's unique potential, their interpretations revealed notable differences. Bambang and Dila primarily viewed DI as a response to the diversity among students, emphasizing the importance of tailoring instruction to meet students' readiness, competencies, and interests. Their perspectives indicate a practical approach in which differentiation serves as a responsive approach to students' potential. Conversely, Jelita considered the DI from an equity perspective. Her focus on fair service suggests that differentiation is not merely a teaching method but a commitment to ensure that students receive support according to their individual needs, not uniform support. This view extends beyond mere instructional adjustments to encompass issues of educational justice. Kirun offered another perspective by highlighting student autonomy and choice in the learning process. Instead of focusing mainly on teacher adaptation, he viewed differentiation as a means of promoting student agency, enabling students to take charge of learning resources, processes, and products. This reflects a more student-centered view of the DI. Collectively, these interpretations indicate that attitudes toward DI may emerge from multiple pedagogical and philosophical bases.

This alignment is also evident in their identification of differentiation through diagnostic assessments, specifically mapping out students' learning styles (visual, auditory, and kinesthetic) and readiness as the starting point for differentiation. Bambang initiated this by utilizing data from the counseling unit to map students' learning styles and using previous tests to identify students' readiness for the next concept.

"The first step I take is mapping... I look at data from the counseling department regarding student learning styles, whether they are visual, auditory, or kinesthetic. To group them, I usually use the test results from previous lessons, but the linear ones."

Dila, Jelita, and Kirun employed a comparable methodology. Dila articulated:

"For initial needs, sometimes schools provide diagnostic tests in collaboration with independent

institutions to determine students' learning styles. With the results of such learning tests, I can determine students' learning styles. However, if the school does not conduct psychological tests to determine students' learning styles, I use initial ability tests... So, the tests given are basic ability tests or initial ability tests related to the material."

Jelita advocated for the implementation of diagnostic tests to assess students' readiness at the beginning of the learning process.

Therefore, when it comes to learning readiness, I usually use it at the beginning of my lesson. At the start of the lesson, I give them quizzes and tests and other things like that"

Notably, Bambang highlighted the necessity of ensuring that differentiation does not lead to labels that distinguish students based on their academic inclinations. He perceived differentiation as a means to offer appropriate educational resources without unfairly categorizing students' academic abilities.

A commonality among all participants was their use of diagnostic assessments as the initial step for differentiation. However, the objectives of these assessments varied. Bambang and Dila primarily utilized diagnostic information to categorize students based on learning styles and academic readiness, indicating a systematic method for instructional planning. In contrast, Jelita emphasized identifying readiness levels to determine the necessary support for students during instruction. These differences reflect varying beliefs about the purpose of differentiation. Some participants perceived assessment as a means to classify learners and create instructional strategies, while others saw it as a way to pinpoint where extra support was needed. Despite these differences, all participants agreed that diagnostic assessment is crucial for implementing DI, underscoring that instructional choices should be guided by evidence about students rather than by uniform assumptions.

In general, the participants mainly used teaching methods that focused on cooperative learning and the use of various media to teach mathematics. Group activities are commonly utilized as a method for peer tutoring, which participants regard as effective in addressing competency gaps in the workplace. For instance, Dila emphasized this by saying the following:

"I use peer tutoring more often because the competency gap among vocational students is quite wide."

Likewise, Jelita utilized grouping to provide specific support, stressing that her method involved focusing on assisting the group that still faced challenges while allowing advanced students to work on their own.

"Grouping is based on readiness, she said. I focus on assisting the group that is still struggling."

Moreover, the use of digital technologies such as videos and simulation applications is essential for content differentiation. Bambang applied this method for visual representation, specifically mentioning the Geogebra application for simulations.

"Using Geogebra application for simulation, so visual students can see the graph immediately."

Similarly, Jelita integrated visual elements, such as images and videos, into her teaching resources to enhance students' knowledge exploration.

"I use modules with pictures or instructional videos for those with a visual learning style."

Kirun promotes digital literacy by allowing students to interact with digital tools and utilize artificial intelligence during their learning process.

"... Students may use cellphone, may use chatGPT"

These varied methods provide flexibility and empower students to exercise their autonomy. Bambang proposed teaching strategies utilizing specific methods, such as "two stay, two stray," for forming student groups (process differentiation). He noted that students could be differentiated based on the tasks (content differentiation) assigned to each group.

"I prefer to use TSTS, to stay to stray. Therefore, in certain groups, I grouped them at the beginning to stay to stray based on what I made evenly, so it was heterogeneous so that there was no grouping of smart and not so smart. Later, when they explored the material to understand it, I differentiated them in the content I provided. In fact, that kind of thing is easier for children to understand."

Dila implemented instructional practices by indicating that she might employ only one type of differentiation; however, she occasionally utilized all types, such as content differentiation, which involved adjusting materials based on students' readiness.

"To differentiate, I adjust the material. Differentiation does not imply differentiating all the content. There are three types of differentiation, and I don't use all of them at once, but sometimes I use only one, and sometimes I use all of them."

Similar practices were implemented by Kirun, who designed student worksheets of matrices that accommodated various learning styles and permitted students to submit their tasks either as handwritten reports or through digital media.

"In the learning matrix, there are visual, auditory and aesthetic processes involved. For me, it is about differentiating between the processes. Later, based on the students' habits, I designed it that way... and thank God, the results are good, and they understand the material. Their products are also unique in this respect. For example, a matrix was created using the inverse matrix method. Some of them can use this technology to their advantage. Until it is pressed, that is what they have more of. The process is more visual. For the kinesthetic aspect, they can practice this, but make it simple, but they can do it with movement too."

The primary focus is the notable change in teachers' role, transitioning from being the exclusive source of knowledge to serving as a guide within an interactive learning environment. This transformation is achieved by adopting various teaching methods. In mathematics classrooms, teachers differentiate their instruction using multiple strategies: they might tailor tasks to meet students' readiness levels (content), adjust grouping methods (process), or let students decide how to present their findings (product).

Although all participants utilized collaborative learning structures, their motivations varied. Dila perceived peer tutoring mainly as a method to bridge significant competency gaps among students, emphasizing its instructional efficiency and academic support. In contrast, Jelita strategically organized groups to focus her attention on students who required more assistance, indicating a more targeted intervention strategy. Bambang's remarks highlighted another aspect concerning the social consequences of grouping. His intentional creation of diverse groups demonstrates his awareness of the potential dangers of categorizing students based on academic ability. Instead of viewing differentiation as dividing students into fixed categories, he aimed to maintain inclusivity while modifying instructional content. These differences illustrate that the participants were not just implementing similar strategies; they were driven by different educational priorities, such as academic support, effective classroom management, and maintaining students' social inclusion. These findings imply that teachers' positive attitudes toward DI are influenced by broader issues related to classroom equity and students' identity.

The four participants agreed that the success of DI was not solely reliant on students' cognitive performance. Rather, it is shaped by students' participation, individual progress in understanding concepts, and engagement in learning mathematics. Bambang and Hila emphasized students' engagement as a crucial factor. Bambang remarked:

"Students are much more enthusiastic... when they feel facilitated according to their style, they no longer feel burdened."

Dila's observation showed that students display significant enthusiasm when their learning preferences are accommodated, leading to a reduced sense of burden.

"The success is that children become happier learning mathematics; what they used to consider difficult, they are now excited about."

In the context of reflective practice, the participants engaged in self-reflection and collaborated with students to enhance their teaching strategies in subsequent sessions. Bambang noted,

Therefore, I asked students to write down their impressions and feelings after learning and then evaluate them. Perhaps there were things they wanted to say; for example, I asked if any of their friends were like this or like that. When I tried to prepare for learning, it turned out that the majority still felt that I couldn't do it, their friends in the same group were also not ready to learn."

Notable differences arise in Jelita's practices.

"My reflection is through discussions with peers, whether my method was appropriate or not."

All participants agreed that reflection is crucial for making differentiated instruction a valuable strategy for addressing classroom diversity rather than a hurdle. They acknowledged that the DI process is continuous. They have shifted from a fixed to a more adaptable teaching style by regularly collecting feedback from their students and colleagues.

One notable discovery was that participants rarely defined success solely in terms of academic performance. Instead, they frequently mentioned engagement, enthusiasm, participation, and self-confidence. This common perspective indicates that teachers assessed DI not only by cognitive results but also by considering students' emotional responses to mathematics learning. Interestingly, participants seemed to believe that students' willingness to engage and their comfort in learning mathematics were important indicators of successful teaching. Such beliefs likely reinforce positive attitudes toward DI, as teachers perceive observable benefits that go beyond mere test scores.

3.2 Subjective Norms

Teachers are more likely to adopt DI when they sense strong support and expectations from school leaders, fellow teachers, and educational policies. The key factors contributing to this tendency are collaboration, support, and the challenges encountered by teachers.

All four participants acknowledged that peer collaboration, whether in organized groups or casual interactions, is vital for sharing best practices in DI implementation and maintaining teaching motivation. Dila elaborated on her methods.

"Every school already has study groups, called learning communities... One part of the management team consists of guru penggerak... Usually, each school is different from the others. At our school, we conduct various good practices every three months. One of these is as follows. One of the good practices we share is differentiated learning for students. Discussions are usually conducted informally outside of the learning community meetings."

Bambang is also aligned with the formal community known as transformational teachers (*Guru Penggerak*), where he collaborates and provides oversight on the implementation of DI in schools.

"Guru penggerak, because in our activities there is a special module that is studied and reviewed for approximately two weeks, but its application is long-term. This differentiation is in Module 5, which creates lesson plans that include social-emotional learning, but differentiation is not mandatory. In the seventh module, coaching supervision involves supervising peers who are required to create differentiated modules with SE. This means that in our activities, we spend approximately 6 weeks working on differentiation."

Jelita ensured that she relied on the communal network's shared ethos.

"I am part of the Guru Penggerak, they share a lot about knowledge, seminars, and sharing best practices."

Although all the participants stressed the importance of professional collaboration, the perceived social influence differed in nature. Dila viewed learning communities as spaces for sharing classroom practices and discussing DI with colleagues. Her narrative implies that subjective norms are developed through consistent professional interactions within school settings. In contrast, Bambang emphasized the structured expectations of the *Guru Penggerak* program. His description suggests that DI was not just encouraged but systematically reinforced through coaching sessions, modules, and peer supervision. This points to a more robust form of normative influence, where professional expectations were institutionalized via formal professional development structures.

Similarly, Jelita saw the *Guru Penggerak* network as a crucial source of professional support. However, unlike Bambang, the focus is on accountability and implementation. Jelita concentrated on knowledge sharing and collective learning. These distinctions indicate that although all participants experienced positive social pressure to adopt DI, the source and nature of that influence ranged from collegial encouragement to structured, professional expectations.

Overall, the findings indicate that subjective norms were shaped not only by school colleagues but also by wider professional networks of teachers. These communities seem to legitimize DI as a standard teaching practice and reinforce teachers' intentions to continue its implementation.

Implementing DI in mathematics classrooms presented diverse challenges, such as selecting appropriate activities for students and managing the dynamics of group work. Bambang affirmed his perspective on the necessity of selecting mathematical activities that align with students' learning profiles.

"...I find it a bit difficult to apply learning methods for kinesthetic students. Kinesthetics is related to how they touch things directly... So, I prefer to combine with the use of IT, simulating what is in the material using applications, like some time ago when we were learning about spatial in geometry ..."

This aligns with Jelita's concern; she must exercise maximum creativity in designing the lesson.

".. As a teacher, I must be creative. I have to rack my brain every time I enter a classroom. What learning

resources should I provide to students?... I think it's a challenge for me to be more creative."

Dila notably mentioned her challenges regarding group dynamics with regard to students' achievement levels that seem inappropriate because they cause segregation and marginalization of students.

"One of the challenges is that when they are grouped based on ability, based on their cognitive abilities as I see from their initial competencies, there is a feeling of why the smart ones are grouped with the smart ones, Well, something like that."

Kirun also addressed Dila's challenges by asserting that segregating the "smart ones" and assigning them more advanced tasks can lead to arrogance or boredom among students. Meanwhile, students who struggle are given the opportunity to work at their own level without the fear of being judged by their peers.

"Then from the material side, the smart ones are better off if they are in class again. They are more critical and dismissive. They think it's easy here, but here they are already sweating and working really hard."

Participants perceived learning communities as essential for sustaining DI in their teaching practices. Interestingly, although the participants shared a commitment to DI, they identified distinct challenges. Bambang was particularly concerned with the practical difficulties of designing learning experiences for students with varied learning preferences, especially those who are kinesthetic learners. His response indicates that differentiation demands pedagogical creativity and instructional resources. Jelita shared a similar concern but viewed it as a professional responsibility. Her statement underscores the belief that teachers should continually adapt and innovate to address students' diverse needs. This perspective highlights how subjective norms can foster positive expectations while simultaneously increasing professional pressures. In contrast, Dila and Kirun focused on the social implications of grouping practices. They were both concerned that ability-based differentiation might unintentionally perpetuate student labeling, segregation, or unequal participation. Their remarks expose the tension between offering targeted support and ensuring classroom equity.

These distinctions imply that teachers' challenges extend beyond mere technical implementation. Participants also grappled with ethical issues related to fairness, student identity, and social inclusion. These findings suggest that subjective norms around DI encompass not only the expectation to implement the approach but also the expectation to do so in ways that preserve equity and foster positive classroom relationships.

3.3 Perceived Behavioral Control

Perceived behavioral control relates to teachers' views on how easy or challenging it is to implement DI, depending on the available resources. Four participants stressed the importance of aligning training requests with principal support, emphasizing the need for external control to facilitate DI implementation. Bambang highlighted that competency-based professional development is essential for teachers to enhance their skills concerning DI.

"...Training enables the development of competencies. So, the hope is that there will be training support, both from the community and from local government agencies."

Jelita, Dila, and Kirun agreed with Bambang, noting that by expanding their knowledge, teachers can exchange best practices in DI implementation with their peers. Jelita remarked:

"I prefer this one... it's more about upgrading knowledge, then sharing good practices so we can support each other."

A common theme among participants was the notion that professional learning enhances teachers' ability to effectively implement DI. Bambang considered training as a way to build instructional skills, indicating that confidence in applying these skills is closely related to the availability of professional development opportunities. His remarks suggest that when teachers have adequate pedagogical knowledge, their perceived control over behaviors is strengthened. Jelita expressed a similar view but highlighted the importance of learning collectively with colleagues. She viewed professional development not just as a means to improve individual skills but as a collaborative effort where teachers assist each other. This viewpoint implies that teachers' sense of control is shaped by their expertise and the availability of professional support networks.

The alignment of these views indicates that the participants regarded knowledge and training as important factors enabling DI. In terms of the TPB, professional development appeared to boost teachers' confidence in successfully enacting DI.

In the interview, Bambang and Dila offered further insights into how the sufficiency of resources supports mathematics teachers in implementing DI. Bambang pointed out that teaching aids can help make learning content

more concrete for students.

“One supporting factor is having sufficient tools and storage facilities. The second is the hope for support in the field of information technology. This way, when tools that are simulated but realistic are unavailable, teachers can use learning media like that..”

Dila emphasized that infrastructure deficiencies, such as the lack of LCO projectors, can greatly affect the delivery of educational content in the long term.

“.. There are videos that we have to provide, and although we can share them through social media, using a LCD screen would be more effective, but the equipment is still a bit lacking.”

In conclusion, the importance of educational facilities and principal support highlights the need for external regulations to facilitate the implementation of desired behaviors (DI).

In contrast to the generally positive attitudes and subjective norms among participants, perceived behavioral control was influenced by contextual limitations. Bambang stressed the necessity of teaching aids and technological resources to enhance students' understanding of mathematical concepts. His remarks imply that the successful implementation of DI relies not only on teachers' intentions but also on the presence of sufficient instructional tools. Similarly, Dila pointed out infrastructure challenges, especially the lack of LCD projectors and digital devices in the classroom. Her observations demonstrated that while teachers may appreciate the benefits of DI, they often face practical obstacles that hinder its implementation. Collectively, these insights reveal that participants viewed DI as theoretically attainable but not always practically feasible. Although teachers showed positive attitudes and experienced supportive subjective norms, infrastructure constraints diminished their perceived control over implementation. This pattern indicates that perceived behavioral control may be the most crucial factor in converting positive intentions into consistent classroom practice.

4. Discussion

This study aimed to investigate the factors shaping senior high school mathematics teachers' views on DI implementation using TPB as the framework for analysis. The results revealed that a positive attitude toward DI plays an important role in shaping teachers' intentions to enact DI in mathematics classrooms. The participants expressed a distinctly positive attitude toward differentiation. Some teachers viewed DI as a method to address diverse learning needs and enhance teaching effectively, while others highlighted its role in promoting educational equity, student autonomy, and student agency. These findings suggest that support for DI arises from various pedagogical and ethical perspectives rather than a single unified understanding.

Participants demonstrated a positive attitude toward DI, recognizing the uniqueness of each student and the challenges of standardization, thereby emphasizing the necessity of customizing strategies to meet students' individual capabilities. This viewpoint embodies the principles of fairness and autonomy, where teachers shift from enforcing their preferences to addressing students' needs, allowing them the freedom to choose their own learning tools and resources. The philosophical change observed among the participants is consistent with the theory of heutagogy (Self-Determined Learning). According to Hase & Blaschke (2021), in complex learning environments, it is essential for students to have autonomy to direct their learning paths. This approach, which empowers students to control their learning materials, exemplifies heutagogy by positioning teachers as designers of educational settings rather than mere transmitters of knowledge. This method surpasses traditional pedagogy, promoting independence in learning, which is essential in the 21st century.

Interestingly, the participants had varying conceptualizations of teachers' roles in DI. Some focused on tailoring teaching methods to align with students' readiness and skills, while others prioritized enabling students to select their learning materials and outcomes. This diversity indicates that DI is interpreted not just as an instructional method but as a comprehensive philosophy about teacher-student relationships. These distinctions highlight the adaptable nature of DI and clarify why teachers might implement similar practices based on different foundational reasons for doing so.

How is this positive attitude manifested through the recognition of student differences via systematic diagnostic assessments? All participants regarded mapping learning profiles, such as visual, auditory, and kinesthetic styles, as well as learning readiness, as crucial initial steps before starting the instruction. By comprehending students' conditions through diagnostic assessment, teachers can ascertain appropriate subsequent actions in the form of content, process, or product differentiation. Senyefia et al. (2020) found that DI was statistically positively related to

diagnostic assessment. Interestingly, one of the participants demonstrated a strong ethical stance to ensure that this differentiation did not create negative labeling but rather served as a means of providing appropriate resources without academic discrimination. Some researchers support the concept of natural differentiation in mathematics education, as described by Krauthausen and Scherer (2010), who highlight the value of engaging students through mathematical tasks. This method proposes that differentiation should not be limited to altering tasks (content) for each student, but should instead focus on creating tasks that are mathematically rich and adaptable to various teaching methods. This method also alleviates the challenges associated with providing different mathematical tasks for different groups of students.

Participants notably prioritized recognizing visual, auditory, and kinesthetic learning styles as the basis for differentiation. This reflects the common perception of differentiation in numerous professional development settings. However, contemporary discussions on DI are progressively focusing on students' readiness, interests, and meaningful engagement with subject matter rather than adhering to rigid learning style categories. Consequently, the findings indicate an ongoing requirement for professional development programs to expand teachers' comprehension of differentiation, moving beyond mere student classification to embrace more adaptable and responsive instructional strategies.

Furthermore, the participants showed adaptability in using various teaching methods. They were open to integrating various cooperative learning strategies to maintain group diversity while tailoring the content. Employing a broad spectrum of strategies in the classroom has generally proven beneficial, as it enhances the learning environment and actively engages students in the educational process (Tomlinson, 2014). Adapting teaching methods to fit students' learning profiles appears to support academic advancement (Roy et al., 2013) and lead to improved overall results (Haelermans, 2022), especially in mathematics (Prast et al., 2018).

The participants' views revealed that authentic success of DI in mathematics classrooms is measured by increased students' participation, the development of conceptual understanding, and emotional involvement. They noted that when students' learning preferences are accommodated, their academic stress decreases, and their enthusiasm significantly increases. This reflects the teachers' belief in prioritizing individual growth and student happiness in learning mathematics over merely achieving uniform test scores. The shift in success metrics from cognitive achievements to emotional well-being is supported by Social-Emotional Learning (SEL) theory, which has gained global attention in the post-pandemic era. The widely discussed OECD report in Learning Compass 2030 by Taguma et al. (2023) emphasizes that student well-being is essential for academic success. It also examines the implications for designing mathematics curricula, including how learning progressions and design principles can enhance effective and equitable mathematics education.

Engaging in continuous reflective practice appears to be a core aspect of participants' professional attitudes. Teachers recognize that DI is an ongoing learning process, prompting them to regularly seek feedback from their students and collaborate with their colleagues. This flexible attitude suggests that the participants have transitioned from being mere information providers to active facilitators, viewing reflections as crucial for addressing the challenges posed by diverse classrooms. This commitment aligns with the concept of Teacher Professional Agency (Türkoğlu & Cansoy, 2026). Enacting DI is seen as a task that cannot be accomplished by teachers alone, and participants' practice of engaging in discussions with peers was rooted in social-professional support.

Regarding subjective norms, participants recognized that teacher collaboration within learning communities served as a key driver that strengthened subjective norms in DI implementation, facilitating the sharing of successful practices and clinical supervision, which sustained high levels of teaching motivation. Donohoo (2016) noted that teachers' collective belief in their ability to tackle challenges through collaboration is the most reliable indicator of successful school innovation. Within this community, differentiation is perceived not as an individual challenge but as a shared responsibility embedded in the school culture, offering teachers the social and professional support necessary to continue advancing the transformation.

Despite the support collaboration offers, teachers still encounter significant challenges related to the complexities of instructional design and the group dynamics. Social issues may arise from the risk of segregation when students are grouped according to their cognitive abilities. This viewpoint suggests that labeling groups can result in varying levels of contribution to tasks and products among student groups (Bannister, 2016). This situation requires teachers to adopt more strategies in differentiating content and process to avoid harming students' self-esteem and ensuring equitable support for all students without making them feel excluded.

In the exploration of perceived behavioral control, participants were notably influenced by their sense of self-competence, which was enhanced through continuous training. They believed that enhancing knowledge and

competency-based training was vital in transforming perceptions of difficulty into ease when implementing DI. Scarparolo and Subban (2021) proposed that access to relevant training boosts self-efficacy for DI. When teachers feel adequately equipped with the knowledge to share best practices, they develop strong internal control. According to the Theory of Planned Behavior (Ajzen, 1991), internal control is the most critical factor in translating intentions into actual actions in diverse classrooms.

Beyond internal factors, participants emphasized that control over DI implementation heavily depends on the availability of external resources and managerial support. Just as physical reaching aids are necessary, LCD projectors and stable IT infrastructure are crucial for making abstract mathematical concepts more accessible to students. This aligns with Zivave et al. (2025), who stated that the success of adaptive and inclusive teaching practices relies on adequate infrastructure support from schools and the government. Thus, support from school leaders should extend beyond administrative responsibilities to include providing a sufficient technological ecosystem and storage facilities and facilitating external regulations that support the sustainable practice of DI.

In summary, the results suggest that the three TPB elements are interdependent. Participants generally expressed positive attitudes towards DI and strong encouragement from professional learning communities. However, these positive attitudes and supportive subjective norms did not automatically lead to implementation. Teachers frequently identified obstacles such as infrastructure instructional resources and the practical challenges of designing DI experiences. This implies that perceived behavioral control is crucial in determining whether positive intentions can be realized in practice. In other words, while valuing DI and receiving social support were necessary, they were not sufficient; teachers also required sufficient resources, training, and institutional support to maintain implementation.

5. Conclusion

This study examined Indonesian senior high school mathematics teachers' perceptions of differentiated instruction, utilizing the Theory of Planned Behavior as a framework. The results showed that teachers generally have a positive attitude toward DI and receive strong support from professional networks and educational programs. Nevertheless, positive attitudes and supportive subjective norms alone do not guarantee consistent implementation. Participants frequently reported difficulties related to teaching resources, infrastructure, and the practicalities of designing differentiated learning experiences, indicating that perceived behavioral control remains a major limitation. Additionally, the findings highlighted that teachers have varied interpretations of DI, viewing it as a way to address student diversity, enhance educational equity, and foster student autonomy. Although the participants were dedicated to accommodating student differences, many primarily used content modification, grouping strategies, or learning activities as their main differentiation practices. This implies that DI is frequently implemented by adapting teaching strategies rather than designing mathematically rich tasks that inherently cater to diverse students. Therefore, efforts to strengthen DI in mathematics classrooms should extend beyond policy mandates and professional expectations. There should be greater attention to ongoing professional development programs for mathematics teachers, sufficient infrastructure, and support for designing mathematically rich tasks with multiple entry points. Such support could help teachers progress from procedural differentiation to more inclusive mathematical learning environments that encourage meaningful participation by all students.

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Appendix A

Participants Details

Table A1. Participants details

Name	Gender	Region	Teaching experience (years)	Class size	Previous Professional Experience in DI
Bambang*	Male	East Java	14	33	Transformational teacher program (guru penggerak)
Dila*	Female	East Java	15	33	Transformational teacher program
Jelita*	Female	Central Java	18	33	Transformational teacher program
Kirun*	Male	Central Java	7	30	workshop

*Pseudonyms

Appendix B

Interview Guideline: Mathematics Teachers' Perception on Differentiated Instruction

Introduction

Previous experience with differentiated instruction: How often have you implemented DI in mathematics learning?

Individual attitude

1. What is your understanding of differentiated instruction in secondary school mathematics education?
2. What does differentiated instruction mean for your teaching in a mathematics classroom?
3. Tell us about what kind of “students’ differences” in your mathematics classroom?
4. How do you determine the need for differentiation in your students?
5. How do you ensure that differentiated instruction does not make students feel privileged or marginalized?

6. Can you describe the differentiated learning methods you use most often?
7. How do you evaluate the success of differentiated instruction in your mathematics classroom?
8. Reflective practice is essential for effective differentiation—how do you evaluate your approach? Do you have regular and structured evaluation methods?

Subjective norms

9. Inclusivity often depends on teamwork—how do you encourage staff, educators, and support personnel to actively contribute to inclusive practices?
 - What methods do you use to foster collaboration?
 - How often do you discuss differentiated instruction practices with your fellow teachers?

Perceived behaviour control

10. Differentiating instruction presents its own set of challenges. Could you tell us about the difficulties you encountered?
11. Teachers often require additional support and resources to implement differentiated instruction effectively in their classrooms. Can you share the support and resources you need and how accessible they are to you?

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Authors contributions

Yoga Dwi Windy Kusuma Ningtyas was responsible for drafted manuscript, data collection, and data analysis. Margaretha Madha Melissa was responsible for design the study and revised the manuscript. Chusnul Khotimah Galatea was responsible for data analysis and revised the manuscript. The final manuscripts received approval from all authors after being read by them and all authors had equal contributions to the study.

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Competing interests

The authors declare that there are no potential financial or non-financial conflicts of interest associated with this study.

Disclosure of AI Use

The authors employed OpenAI to brainstorm and enhance the readability of the manuscript drafts, utilized DeepL to translate interview excerpts from Bahasa Indonesia into English, and relied on Paperpal for grammar and language editing. These tools were not employed to produce research findings, perform data analysis, interpret results, or formulate the study's scientific arguments. All intellectual contributions, such as the study design, coding, interpretation, discussion, and conclusions were crafted by the authors. The authors have reviewed, edited, and assumed full responsibility for all the content included in this manuscript.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Sciedu Press.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

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The data that support the findings of this study are available on request from the corresponding author. The data are

not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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