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Assessing the differentiated learning practice within islamic primary schools: challenges in the absence of technology

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ABSTRACT

The concept of learning that accommodates students' learning needs has become a pedagogical concern. In today's classroom, Differentiated Instruction (DI) plays a pivotal role in addressing students' needs. However, DI is a lot of work that needs technology support to implement structurally. This study elaborates on the practice of DI based on Ann Tomlinson's concept and examines the challenges faced by Islamic primary schools in East Java, in implementing DI with a lack of technological support. Adopting a multi-site phenomenological approach, data were collected through data documentation, in-depth interviews and focus group discussions with teachers and principals in five Islamic primary schools in East Java province. Findings revealed that the challenges in implementing DI were inadequate professional trainings in technology-enhanced learnings, a lack of teachers' skill in assessing and identifying students' learning progress, and lack of technological learning resources. Consequently, the practice of DI within Islamic primary schools failed to address students' learning need. This research suggests a practical recommendation for Islamic educational institutions to improve the quality of DI practice through technology-enhanced learning.

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Background of the study

The twenty-first century has been characterised as the century of superdiversity (Arnaut et al., 2015). In the current context, we find that our world today is highly diverse, and worldwide classrooms reflect this reality (Pozas & Letzel-Alt, 2023). Students' heterogeneity has only intensified by the recent global issues, such as the Covid-19 pandemic and ever-expanding mobility which have caused unpredictable situations, such as the increase of individual learning demands in the future. In this ongoing situation, the increase in individual learning requires teachers to meaningfully address student heterogeneity in their daily teaching practice. Students with their various uniqueness, both physical and non-physical characteristics are different from one to another. Students of the same age and grade have different interests, hobbies, characteristics, and intelligence (Pozas & Letzel-Alt, 2023; Qorib, 2024). These differences have implications for the learning process that occur in the classroom (Pozas & Letzel-Alt, 2023). The diversity of students addresses one-size-fits-all learning as no longer relevant for all students (Bondie et al., 2019; Tomlinson, 2001). Students' heterogeneity remains a unique challenge in learning, therefore teachers should accommodate students' learning needs in terms of their academic abilities, learning interests, and other needs through differentiated learning (Hogan, 2014; Ziernwald et al., 2022). A promising inclusive teaching approach that caters to students' learning needs is DI.

DI is a learning approach that focuses on students' diversity and flexible classroom management (Karst et al., 2022). DI is a learning approach that gives students the opportunity to learn at their own pace and to actively participate. The concept of DI was introduced by Ann Tomlinson, which identifies

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four areas that we can differentiate, including instruction, grouping, assessment, and classroom culture (Pozas et al., 2020; Tomlinson, 2014). Numerous studies have been published and demonstrate that DI is an effective learning approach in improving student learning outcomes (Adare et al., 2023; Puzio et al., 2020; Yavuz, 2020). Likewise, Krishan and Al-Rsa'i (2023) found that DI had positive implications in enhancing students' learning motivation.

Research related to DI has increased significantly based on Scopus databases from 1961 to 2022 (Asriadi et al., 2023). Other research publications show that DI has emerged as a prominent research trend since 2011 (Fauziyah et al., 2024). These findings indicate the scholarly recognition of DI to address transformative education. Even though research on DI in Indonesia has emerged, the main findings reveal that the significant contribution of Indonesian authors has not been synchronized with global issues towards DI, such as the integration of artificial intelligence in the practice of DI (Nurjanah et al., 2024). In Indonesia, DI practices are massively established through the *Kurikulum Merdeka*-Independent Curriculum (IC). Despite showing a significant trend, the socio-cultural environment and the readiness of educational institutions remain challenges in the implementation of DI in Indonesia.

One study published that the main obstacle on DI practice in Indonesia is the difficulty of teachers and education staff in measuring students' learning progress (Habib et al., 2023). The assessment process and scoring the results is time consuming and difficult to implement (Mills et al., 2014). Therefore, applying technology-enhanced DI in the digital era plays a pivotal role in building a learning environment that is adaptive, dynamic, and provides authentic feedback on student learning progress (Batubara et al., 2024). The rapid advancement of technology in the era of the Industrial Revolution has significantly accelerated the digitization of education. This trend became even more pronounced during the COVID-19 pandemic in 2019, when digital learning shifted from being optional to essential, continuing even after the pandemic subsided. This shift aligns with the characteristics of current learners as digital natives and the rapid evolution of the knowledge era in the 21st century. In recent years, research on technology-based learning methods, such as Massive Open Online Courses (MOOCs) has gained momentum (Shaw & Patra, 2022). The implementation of technology-based learning has shown positive impacts on enhancing students' learning experiences both inside and outside the classroom (Nja et al., 2022).

Numerous studies show that the integration of digital technology provides benefits in increasing student engagement, providing personalized learning opportunities, and adequately varied learning resources, and building digital readiness (Haleem et al., 2022; Khan et al., 2022). Therefore, this research promotes a significant contribution to educational institutions in developing an effective and sustainable technology-based DI learning. This study fills the research gap by identifying the use of technology in implementing DI that is still at an early stage in Indonesia (Nurjanah et al., 2024). In reviewing some of the studies, there are contradictory results in prior studies that examined the role of technology in DI practice. The plethora of research on the effectiveness of DI gap in practice and the different operationalizations of DI often daunts to teachers, which causes difficulty in implementing adaptive learning (Smale-Jacobse et al., 2019). Another research suggests that the implementation of DI should be clear and detailed to allow the optimal impact of DI in accommodating students' need. To support it, the adequate use of technology in the DI practice is a pivotal aspect (Deunk et al., 2018). Therefore, it is important to integrate technology into the educational process in order to allow students to learn anywhere, anytime, and at their own pace. In this regard, differentiated learning technology-based approaches can be one of the potential approaches to facilitate students' learning process.

Combining technology within differentiated learning represents a transformation of traditional pedagogy towards transformative education. Pedagogy plays a vital role in enhancing students' knowledge and curiosity (Kporyi et al., 2020). Teachers' ability to design effective learning experiences correlates with students' academic achievements (Arifmiboy et al., 2024). Pedagogical competence also positively influences students' motivation and learning outcomes (Najmi et al., 2021), underscoring the inseparability of pedagogy from any educational process. Teachers' readiness in integrating technology within DI positively impacts the quality of learning (Hidayati et al., 2023). Furthermore, incorporating technology can provide students with a personalized learning and self-learning pathway that meet at their learning needs (Janssen & Kirschner, 2020). By integrating technology, students can benefit from a comprehensive learning that addresses various learning needs (Nawas et al., 2024).

Problem statements

The urgency of this research underscores the importance of transforming education through the use of technology. Research on technological use in learning in Indonesia, specifically in East Java, is pivotal because this province has the largest number of madrasah (Islamic schools) in Indonesia. East Java region, at 25% of all provinces in Indonesia, has a total number of 87.065 madrasah (Kementerian Agama RI, 2025). However, preliminary findings show that none of the schools sampled from the five schools with an education index above 0.7 in the East Java region that were identified as maximally utilizing technology in DI practices (Farisia, 2024).

The absence of technology utilization in DI practices within Islamic Primary School (IPS) in Indonesia needs to be followed up because technology plays a pivotal role in the pedagogic transformation in the digital era to encourage personalized learning. Therefore, this study aims to describe the lived experiences of teachers in IPS in implementing DI and to examine the challenges faced by IPS in integrating technology into DI practices within IPS in Indonesia. Through this investigation, this study aims to provide practical recommendations from various perspectives for educational institutions, especially IPS in Indonesia, for a more qualified DI design that caters to students in the digital era. For this reason, the research questions in this study are: (1) How is the enactment of DI as an inclusive teaching practice in IPS in Indonesia? (2) What are the challenges that hinder the implementation of technology-enhanced DI within Islamic primary schools?

Theoretical perspectives

DI refers to a wide variety of learning activities where the students learn according to their learning needs (Godor, 2021; Tomlinson & Imbeau, 2010a). DI means the variation of design created by applying a variety of learning models, instruction, and environments to achieve the intended learning (Moye, 2019). The foundational belief for DI is that every student is unique and they learn differently from others. The type of DI teaching practices within inclusive classrooms setting are implemented by considering five categories: (1) collaboration and team work, (2) instructional practice, (3) organisational practice, (4) social emotional and behavioural practice, and (5) determining progress (Lindner & Schwab, 2020). By tailoring to learning activities based on students' needs, teachers can increase students' motivation and effectively engage students in achieving their academic success (Jay Hendel, 2022).

There are some vital pedagogical foundations of the differentiation approach, they are: (1) student-centred learning, (2) flexible instruction, (3) assessment for learning, (4) flexible grouping, (5) respect for diversity, and (6) teacher expertise and reflection (Goyibova et al., 2025). DI is student-centred, stemming from the belief that learning experiences are most effective when students are engaging, relevant, and interesting. Therefore, instruction should accommodate students' unique characteristics and promote autonomy in learning. Therefore, teachers should adjust purposeful lesson plans for students' diversity, with improvisation as needed. The use of instructional strategies, materials, and assessments to address students' individual needs is a form of flexible instruction. This might include modifying content, adjusting the pace of instruction, or providing alternative assignments. As this implies, there is no right way to differentiate instruction. It is because no single work fits all students, as Ismajli and Morina stated that all learners did not make progress at the same speed, with the same behaviours and interests, or with the same learning techniques (Ismajli et al., 2018).

A hallmark of an effective DI practice is the use of flexible grouping, which accommodates students' diversity (Tomlinson, 2001). The teacher may group students based on readiness, interests, or learning styles, and these groups may change frequently based on specific learning goals and activities. There are different ways to think about grouping that result in flexibility, such as peer support and jigsaw grouping. The effectiveness of differentiated-based learning can be developed by conducting a flexible grouping model, varied learning activities, the use of diverse media, the utilization of various learning resources, and the flexibility of learning time. In heterogeneous classrooms, teachers could facilitate teaching and learning by dividing students into groups based on academic readiness. Teachers could also organize homogeneous groups by implementing a peer tutor. The teachers' attitudes during

teaching and learning take a pivotal role in their inclusive and instructional practice (Pit-Ten Cate et al., 2018).

In the DI-based learning, assessment and instruction are inseparable. This ongoing assessment allows teachers to tailor to their teaching to effectively cater to students' learning needs and respect for diversity within the classroom. Implementing DI requires skilled teachers who can effectively assess students' needs, design, and reflect on the effectiveness of DI practice. Therefore, continues professional development and reflection are essential for teachers to refine their DI practices. Tomlinson's comprehensive model of DI was selected as the theoretical framework of this research because it is well established and frequently cited within the professional literature (Santangelo & Tomlinson, 2012). The framework highlights ways teachers can differentiate content, process, product, and learning environment to address students' interests, readiness, and learning profiles.

The formula of DI by process can be implemented by tiering complex activities. In the classroom, the teacher implements process and product differentiation by facilitating diverse learning activities and assigning tasks tailored to students' abilities. In terms of process differentiation, the teacher divides students into heterogeneous groups with a focus on strengthening their ability. Content differentiation in this study is evident in the teacher's efforts to present material in various forms and offer learning through multiple modes that students can access at any time. For students with varying abilities, the teacher is able to prepare different materials on the same topic. Through varied learning activities, students have ample opportunities to develop their interest in learning and creativity. According to Suliawati et al. (2020), diverse learning activities positively impact the development of students' creativity. This finding emphasizes the importance of providing varied learning activities to optimize the quality and outcomes of learning. Students who develop their creativity continually strive to try new things to achieve meaningful learning. The constructive learning process, as outlined above, aligns with the constructivist theory, which serves as one of the foundational frameworks in this study. From the constructivist perspective, learning is a process where students actively engage in building a system of meaning to construct knowledge through discovery, analysis, interpretation, and connecting prior knowledge with new experiences (Setyosari, 2022).

DI in a large scope of education is a pedagogical concept that cannot be separated from contextual factors, such as school culture and leadership, educational systems, and educational policies. The principal's supports influence teachers in implementing flexible instruction within diverse classrooms (Eikeland & Ohna, 2022). In Indonesia, the implementation of DI was established through IC and facing global challenges in the digital era, there are several challenges between expectations and realities (Rizaldi & Fatimah, 2020). Although the IC is implemented nationally, particularly at grade 1 and grade 4 in the first year of implementation, the government encourages the educational units to apply the curriculum according to their readiness. This has led to various best practices in the implementation of the IC, including in DI practices in Islamic elementary schools (Habib et al., 2023).

In the digital era, teachers' pedagogical expertise in designing digital-based learning is expected to foster students' independence and metacognitive skills. Educators must employ pedagogical approaches aligned with the characteristics of 21st-century learners. One of the effective approaches is technology-enhanced DI, which supports students' learning needs in the digital era. Furthermore, the incorporation of technology-enhanced learning is strategic to promote effective teaching practice (Dinçer, 2024). The incorporation of technology into teaching and learning processes is not merely a tool but rather a fundamental component of the teaching process (Mishra & Mehta, 2017).

Technology integration can be an effective method to increase students' engagement (Vahedi et al., 2021) because it turns from a means of distraction into a valuable active learning. Integrating technology into learning is a comprehensive way to place students in the right pathway in their learning. Furthermore, teachers can harness technology to identify students' learning progress and challenges to determine appropriate intervention. Technology integration within DI is a critical component in implementing inclusive learning to cater to students' individual needs based on their strengths and weaknesses. The DI has its didactic starting points to fulfil students' needs that shift a methodological teaching from the one-size-fits-all model to a transformative pedagogy.

Methods

Research approach

This study employed a multi-site phenomenological approach to gain an in-depth understanding of the phenomenon within its natural context, particularly when there is a gap between the phenomenon and its surroundings (Hasiara, 2018; Yin, 2011). As Creswell and David (2018) point out, phenomenological research is a qualitative strategy intended to explore and understand the experiences of individuals or groups related to certain phenomena. Through this multi-site research, researchers can understand phenomena related to technology-based DI practices from various perspectives to find common patterns and propositions from existing sites within Islamic primary school settings in East Java.

Participants

This study was conducted at five IPS with a minimum education index of 0.7 based on the data of education indexed in East Java in 2024 (Central Bureau of Statistics, 2024). The sample size was determined based on the recommendations of Braun and Clarke (2021), which suggest careful consideration in determining sample size prior to data saturation. Two Islamic schools in an urban area and three Islamic schools in a rural area were purposively selected based on the criteria of 'good' grade accreditation and a preliminary interview in schools that have implemented DI through IC. The researcher, who acts as facilitator of IC implementation in East Java, has identified the schools that meet the criteria. At the five targeted IPS, the principals received an information sheet via email to seek their consent to participate. Regarding research ethics, the participants were asked to read, complete, and sign an informed consent form to ensure that they voluntarily agreed to participate in this study. They also deserved the right to withdraw their participation from the study at any time without any consequences. All participant data were anonymized and treated confidentially. In the email, the principals were informed to choose a teacher for the first grade and fourth grade. The selected teachers should have met the criteria: (1) aged between 25 and 45 years old, (2) have a minimum educational background of a bachelor's in education, (3) have experienced in applying DI for at least 3 years, and (4) have attended pedagogic learning training at least once. Primary data sources were obtained from in-depth interviews with 10 teachers and 5 principals from the five schools. Table 1 illustrates the demographics of the participants in this study.

School numbers 1–2 are from urban Islamic elementary schools; school numbers 3–5 are from Islamic elementary schools in rural areas that have implemented DI in East java. Table 1 shows the demographic profile of the participants. Of the fifteen participants, 60% were female, 40% were male, and no one (0.0%) chose not to provide their gender. The participants were coded as T (Teacher) and P (Principal) to ensure confidential and anonymization. Islamic primary schools in the urban areas were represented with A and B, meanwhile C, D, and E for Islamic elementary schools in rural areas. The interview results were transcribed into English, assisted by the DeepL free version. This research was undertaken following ethical approval from the research committee of Universitas Negeri Malang (Contract Number: No.23.2.1/UN32.14.2.8/LT/2024).

Data collection technique

Data collection involved in-depth interviews, documentation-DI lesson plan, and Focus Group Discussions (FGDs). The interviews with participants from each IPS were conducted separately via Zoom, in two sessions per participant, with each session lasting 30–45 minutes on average. The interviews consisted of 14 core questions and additional questions to help clarify related topics. These 14 questions were organised from five topic areas. Eight questions were tied to research questions related to the enactment of DI according to Ann Tomlinson's concept and six questions were related to the challenges that hindered the implementation of technology-enhanced DI in IPS. The outline of the interview is in Table 2.

To gain valuable insights based on participants' real experiences in implementing DI and identifying the challenges of the technology absence in DI practices, the questions were developed from the five domains of inclusive teaching practice of DI, they are: (1) collaboration and team work, (2) instructional practice, (3) organizational practice, (4) social emotional and behavioural practices, and (5) progress

Table 1. Demographic characteristics of the participant.

School	Participant code	Position	Age	Gender	Educational background	Teaching experienced	Related training
A	T1	Teacher grade 1	28	F	Bachelor's in education	6 years	Curriculum
A	T2	Teacher grade 4	30	F	Bachelor's in Islamic Primary Teacher Education (IPTE)	8 years	Curriculum
A	P1	Principal	26	F	Bachelor's in Islamic Education (IE)	5 years	Curriculum
B	T3	Teacher grade 1	25	F	Bachelor's in IPTE	5 years	Curriculum
B	T4	Teacher grade 4	29	M	Bachelor's in IE	8 years	Curriculum
B	P2	Principal	36	F	Bachelor's in IPTE	10 years	Curriculum
C	T5	Teacher grade 1	41	F	Bachelor's in IE	15 years	Curriculum
C	T6	Teacher grade 4	35	F	Bachelor's in IPTE	10 years	Curriculum
C	P3	Principal	43	M	Bachelor's in IE	16 years	Curriculum
D	T7	Teacher grade 1	30	F	Bachelor's in IPTE	8 years	Curriculum
D	T8	Teacher grade 4	32	F	Bachelor's in IPTE	8 years	Curriculum
D	P4	Principal	35	M	Bachelor's in Islamic school management	11 years	Curriculum
E	T9	Teacher grade 1	28	F	Bachelor's in IPTE	5 years	Curriculum
E	T10	Teacher grade 4	30	F	Bachelor's in IPTE	6 years	Curriculum
E	P5	Principal	36	M	Bachelor's in IPTE	12 years	Curriculum

T: Teacher; P: Principals.

Table 2. The interview guideline questions.

No	Aspect	Indicators	Elicitation questions
1	Collaboration and team work	Building work cooperatively with other professionals and stakeholder	1. What are the Institutional supports to succeed DI? 2. What problems do you face in enhancing technology-based learning within DI practices?
2	Instructional practice	Providing students with insight into the learning path to follow	1. What does meaningful differentiation look like in a real classroom? 2. How do you address the different needs, readiness, interest, and abilities of your students? 3. How do you adapt your teaching methods and materials to create a more inclusive learning environment? 4. What are the technological problems in addressing instructional practice?
3	Organizational practice	Arranging the setting suit to the needs of all students	1. What strategies have you used to create accessible learning materials and activities? 2. What are the obstacles in utilizing information technology in organizational practice?
4	Social emotional and behavioural practice	Building positive classroom climate and ensure that all students get equally occasion to engage into learning process.	1. What strategies do you use to encourage a positive classroom environment where all students feel valued and included. 2. What challenges do you face in creating an inclusive and engaging learning environment that respects diversity?
5	Determining progress	Assessing and monitor students' performance and achievement	1. How do you offer flexible assessments by allowing students to demonstrate their knowledge in various ways 2. How do you use assessment data to inform your teaching and create a more inclusive learning environment? 3. What factors that hindered the process of monitoring students' learning progress? 4. What are the challenging of using information technology as assessment tools?

determination (Lindner & Schwab, 2020). Meanwhile, the FGDs session lasted approximately 60 minutes. At the five targeted schools, the total number of teachers involved in DI practice was counted, included ten teachers. Of the 10 teachers, 6 agreed to participate at FGDs, while the remaining four teachers declined due to heavy workloads at their schools. Thus, the participants comprised five principals, 6 teachers, and 2 experts in the field of curriculum design and educational technology, bringing the total sample size to 13 participants for the focus groups.

Data analyses technique

All the data from the interview sessions were audio recorded to recheck for bias or errors. For data analysis, we employed pattern coding and meaning-making strategies according to Miles and Huberman's

Table 3. Process of generating code families (theme).

Codes	Grouping codes	Code families	Frequency of code families (%)
1. Challenges with class size	11. Lack of professional skills	Human resources limitations	6.81%
2. Challenges in identifying needs	12. Technology-illiterate teacher		
3. Vary students' characteristics	1. Challenges with class size	Large class size	28.40%
4. Challenges in adjusting time	2. Challenges in identifying needs		
5. Challenges in designing assessments	3. Vary students' characteristics		
6. Constraints in accessing technology	10. Difficulty in providing flexible grouping		
7. Difficulties in monitoring learning progress	4. Challenges in adjusting time	Bias students' learning progress	10.22%
8. Insight-poor data	7. Difficulties in monitoring learning progress		
9. Difficulty in determining appropriate learning	8. Insight-poor data		
10. Difficulty in providing flexible grouping	5. Challenges in designing assessments	Tiered assessment and learning	13.63%
11. Lack of professional skills	9. Difficulty in determining appropriate learning		
12. Technology-illiterate teacher	20. Unstructured learning		
13. Inadequate infrastructure	21. Uncontrolled learning		
14. Incorporate with psychologist	6. Constraints in accessing technology	Technology for DI	22.72%
15. Incorporate all stakeholders	7. Difficulty in assessing technology		
16. Incorporate with parents	23. Insufficient technological support		
17. Internet connection problems	17. Internet connection problems		
18. Lack of instruction	18. Lack of instruction		
19. Lack of professional training	13. Inadequate infrastructure	Institutional supports	18.18%
20. Unstructured learning	19. Lack of professional training		
21. Uncontrolled learning	14. Incorporate with psychologist		
22. 22.Insufficient technological support	15. Incorporate all stakeholders		
	16. Incorporate with parents		

concept (Miles et al., 2014). The whole process of analysis was carried out using Atlas.ti 9. The data analysis through Atlas.ti took four steps: (1) data organization, (2) code creation, (3) coding, and (4) relationships and interpretation findings (Chapman et al., 2017). The analysis process started by organizing the data to create codes. Coding can begin once all primary documents are uploaded. Then, we started coding by reading text and creating an open code, for example, 'Large class size'. The next step was creating code families for organization and helping develop the structures and themes. Finally, the transcript was analysed using content analyses to determine the number of times particular codes appeared and co-occurrences to identify themes and make interpretations. The process of determining themes using Atlas.ti 9 is in Table 3.

The data validity technique in this study used triangulation and a member check to ensure the trustworthiness of the findings. The triangulation techniques in this study were source triangulation (teachers, principals, and educational supervisor), technique triangulation (interview and documentation), and time triangulation (comparing and cross-checking data found with different approaches and times). The other key stakeholders who can counterbalance potential institutional bias is Educational Supervisor (ES). Data from ES is a comment and suggestion stated on the DI lesson plan as a check against the DI implementation. In the final stage, conclusions were drawn, and member checking was conducted by confirming the data with informants.

Findings

The enactment of DI as an inclusive teaching practice in Islamic primary schools

Differentiated learning practices in the IPS have been implemented since 2022. Various policies related to the implementation of DI have also existed through Ministry of Religious Affairs Decree Number 347, Year 2022, and Ministry of Religious Affairs Decree Number 450, Year 2024, related to the implementation of IC at Islamic schools. Nevertheless, the results of this study show that DI practices still vary, especially due to technological support factors, underscoring a critical shortfall that DI practice is largely symbolic rather than substantive. The enactment of DI practice in this study related to collaboration and team work shows that the school needs to underscore the incorporate of stakeholders.

Based on the interview results, navigating the support system through collaboration and team work was limited. One principal stated,

> At the beginning of the school year, the school always conducts an initial assessment to compile a student profile. The results of the mapping are given to each classroom teacher to be used as a reference in designing learning. However, due to time constraints, the mapping conducted by the school is limited only to students' academic abilities. To support this initial assessment activity, schools need to involve psychologists related to learning preferences assessment and the assistance of school administrators

(P3). This situation captures a fact that the school needs to underscore effective collaboration among key stakeholders to ensure that each student receives the necessary academic and personal growth support. Another principal reported that teachers also needed to incorporate all stakeholders to support technology enhancement (P5). Regarding the instructional practice, most teachers in an urban area tried to incorporate technology into learning. For example, school A has often utilized various learning resources, such as videos and using Microsoft 365 platform for asynchronous learning, notably during the Covid-19 pandemic. Meanwhile, the use of technology for assessing students' learning progress is limited, as all the sample teachers reported that they have not been able to utilized technology to conduct assessments and identify students' learning progress.

A qualitative analysis of the data from document observation results revealed that all teachers prepared a lesson plan with DI, however, some of them saw it as 'fake differentiation'. One teacher we interviewed uses the term 'fake differentiation' to describe teaching practices that 'seem like DI (T6), but only at the surface level. The teacher designs DI, but fails to offer all students access to equitable DI. Based on the DI lesson plans, it is found that the teacher designed a differentiated learning based on the information of students' learning profiles in the introduction. However, the teacher does not give students choices, board or tiered instruction that suits the pre-assessment. An instructional plan explains how to cater to students' learning needs through the differentiating process, yet it still falls short in capturing the differentiated contents and products. The formula of formative assessment was not stated explicitly, and there was no elaboration of technology used for the learning process. Teachers developed a similar assessment for all the students. Based on the ES notes, the DI lesson plan at school A shows that the pre-assessments' results have not correlated to a meaningful learning experience. Assessment and the learning design is separable, moreover in differentiating content and product. The ES suggests the teacher to use varied resources to differentiated content and giving multiple modes of assessment.

Teachers implemented DI by organizing students to work in groups. Teachers faced difficulty in engaging an effective grouping because of large class sizes with more than 30 students. Consequently, the inclusivity promised in DI learning remains largely symbolic, rather than being fully realised in practice. Teachers faced difficulties assembling flexible grouping in students' zones that diverged. As one teacher in school E (T5) revealed, she tried grouping with various patterns. First, the teacher formed homogeneous groups of students. Through this grouping model, the teacher found that much of the teacher's time was consumed in assisting the middle and low ability groups. Meanwhile, students with high ability categories received less attention because they were more independent. Nevertheless, after the lesson, the teacher felt guilty for ignoring the high-ability students, which means that the teacher has not provided balanced services for each child with each of their strengths. Finally, the teacher tried heterogeneous grouping by implementing peer coaching. Through this grouping, the middle and low ability students tended to just mimic and agree with their friends' ideas, so that the teacher felt that these children had not actually learned anything. Finally, the teacher tried grouping based on close friendship. In this situation, the students' communication was more interactive and the group dynamics worked well. The teacher said, 'I think this is the most successful grouping model. Students are motivated to complete their assignments and help each other to get out of class on time' (T5). Another teacher said that the group model that is often used is the homogeneous model with the consideration that it is easier for the teacher to provide assistance and assignments to students.

Regarding to the implementation of DI, almost teachers do not follow up the results of assessment for learning. The research finding shows that eight out of ten teachers never give feedback on what areas students need to be improved, as it is stated by one teacher (T8),

> Some of the most time-consuming in implementing DI is that teachers need a long time to prepare pre-assessment, map the students' academic competencies, and use assessment as feedback for better learning. Whereas, teachers should build a positive classroom climate and ensure that all students get an equal opportunity to engage in the learning process.

Challenges of DI implementation in Islamic primary schools

The development of DI-based learning in IPS faces significant challenges due to issues related to the readiness of human resources. The obstacles experienced by teachers are the lack of training and mentoring in managing DI learning, leading to further complications in implementing the principles of DI. Teachers also face difficulties in utilising technology in learning. Many teachers stated that they were unprepared to conduct pre-assessment, making it difficult to address students' learning needs. Additionally, identifying and classifying the students' learning needs for large class settings are further exacerbated, that make DI practice become more difficult.

Another obstacle is the lack of adequate experience among teachers, particularly in dealing with tiered assignments and teaching-learning process. Teachers often spend long time conducting assessments because the absence of a system that supports the process of identifying and classifying students' learning needs. A teacher from an Islamic primary school in an urban area stated,

> Even though I have conducted pre-assessments, I am not sure that the results of these assessments really help me determine the appropriate learning for students. Likewise, when I conduct formative assessments, I do not have a complete data describing students' learning progress, thus I am unsure that the learning intervention has progressed well (T1).

Some teachers said that they faced difficulties in preparing different assessments for all subject contents, 'It is very difficult to make different assessments for each learning objective. Six out of ten teachers reported that it was difficult to prepare multiple modes of assessment. There are so many learning goals and students are diverse, thus, administering and scoring assessments are time consuming' (T2).

The complexity of data analyses can leave teachers with insight-poor data. As a result, the students are at risk of receiving inappropriate educational intervention. As one of the teachers said, 'When I conduct formative assessments, I do not have complete data describing students' learning progress so I am not sure that the learning improvements have helped students learn at their own pace' (T3). The principal reinforced this fact: 'Based on the results of supervision, teachers still have difficulty in identifying students' needs, difficulty in applying formative assessments, and differentiating learning. I think the teachers believe that they have implemented differentiated instruction, nonetheless, teachers should be more professional' (P1).

The analysis of FGDs' results revealed that one of the main factors hindered the practice of DI is challenges in adjusting time management because of teachers' over-extended schedules and difficulty in designing and implementing assessment effectively. One teacher (T2) states that, 'I often get stuffed of teaching time because I am a classroom teacher. This situation makes me lack of reflecting teaching practice. Furthermore, designing and collecting data assessment is not easy'. Another participant confirms that designing and implementing assessment appropriately is time consuming, particularly, if the teacher teaches in a large class size. This condition happens to teacher in the rural area because almost the class consist of 30 students and more. T4 says, 'Preparing and implementing assessment to capture students' learning readiness could not completed effectively. This situation impact to teachers' ability to modify instruction effectively'. Based on the FGDs, the theme 'tiered assessment and learning' has emerged as one of the key themes in this research.

Another condition that occurs in the classroom is that when the teacher focuses on the middle and low groups, the teacher gives more challenging tasks to students with high abilities. However, in certain schools, there are still groups of students who have finished working earlier than their friends. This is because students learn and work at different speeds, while the teacher gives the same time allocation to the same assignment. As a result, high-ability students who can complete activities quickly have to wait, while low-ability students will rush and leave certain activities unfinished. These findings highlight the various problems that arise related to the practice of DI in IPS.

Another problem that arises in the practice of DI in the IPS in this study is inadequate teaching and learning resources. The practice of modifying tasks, such as lowering the difficulty level, needs advanced resources. The lack of adequate learning resources limits students' ability to adapt to learning tasks. Figure 1 illustrates the main barriers faced by teachers in implementing DI in IPS.

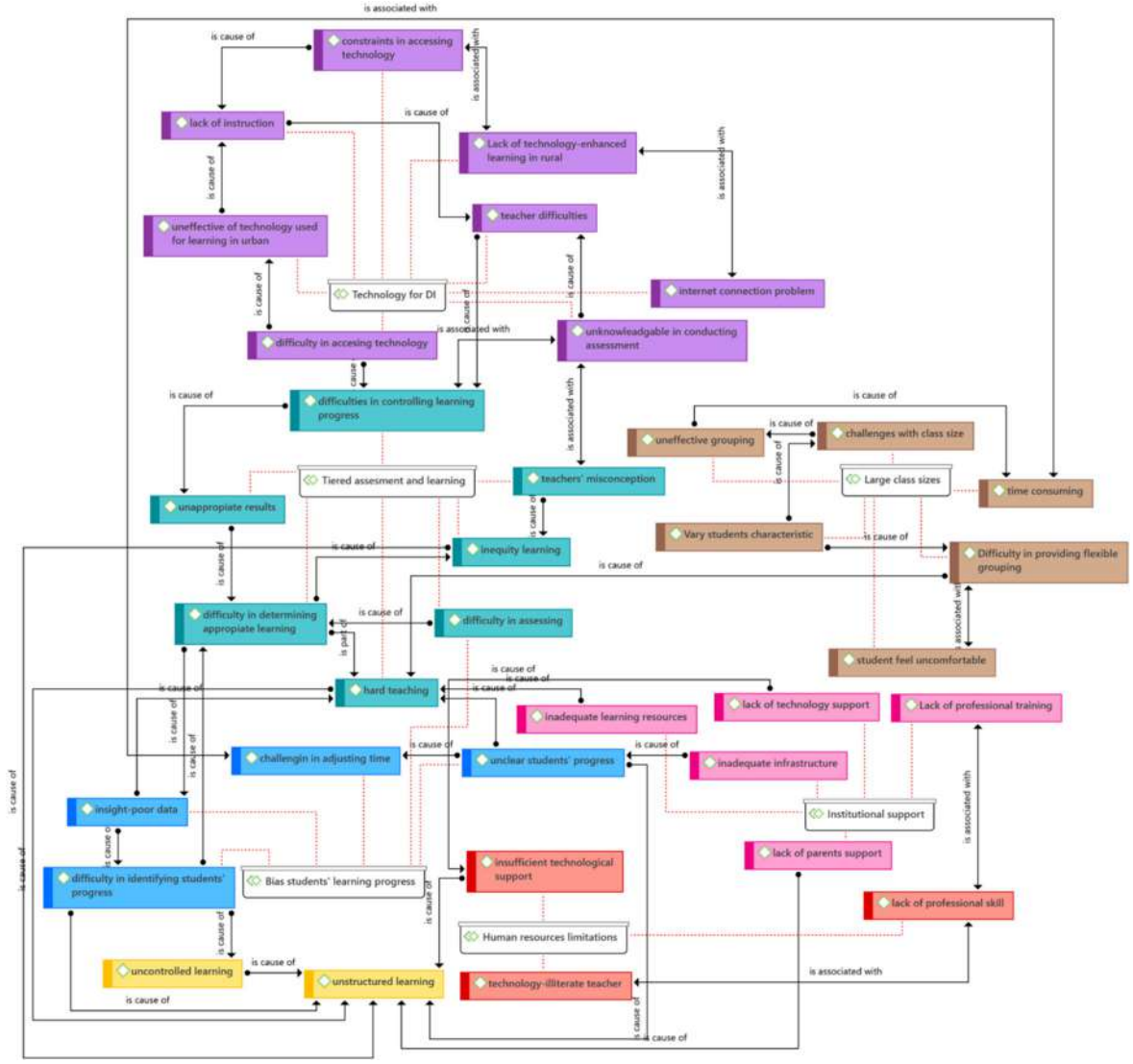

Figure 1. The network view of challenges in implementing DI within Islamic primary school.

On Figure 1, It seems that the barriers identified include the readiness of human resources, teachers' difficulties in identifying students' learning needs, inadequate institutional support, large class sizes, challenges in tiering learning with assessment, and inadequate teaching and learning resources.

The results of this study reveal a significant gap in the provision of technology for learning. Among the five Islamic education institutions that implement DI, only two institutions have begun to utilize technology in learning. However, the use of technology is limited and has not helped teachers implement effective and structured DI learning. For example, school A has often utilized various learning resources such as PPT, videos, and utilized Microsoft 365 platform for asynchronous learning. However, teachers have not been able to utilize technology to conduct assessments and identify students' learning progress. The findings from this study are crucial in understanding DI practices that utilize technology in Islamic education institutions. The study identified two types of schools, they are: Islamic primary schools in urban areas with easier access to technology and Islamic primary schools in rural areas with limited resources and access to technology. Table 4 below outlines the gaps of technology-enhanced DI in the IPS setting.

Islamic primary schools in urban areas, with educational institutions located in the educational institution in the centre of the city, adequate internet network access, and the availability of software platforms such as Microsoft 365, face challenges related to teacher professionalism in utilising technology for learning. Besides, all the learning is implemented synchronously, which limits students' access to available learning materials on digital platforms. This suggests that an adequate educational technology

Table 4. The gaps of technology-enhanced DI practices within islamic primary schools.

Theme	Rural schools	Urban schools
Human resources limitations	Online learning platforms such as Microsoft 365 and Google Classroom are available but have not been fully utilized by teachers.	Various learning platforms are not yet available to support students' learning. Moreover, most teachers are technology illiterate, therefore, they still need to learn a great deal about utilizing ICT-based media to support learning.
Large class-size	Large class sizes with an average 15–25 students. The students' diverse backgrounds, lead to further complications in providing appropriate interventions.	Large class sizes with more than 30 students. Teachers face difficulty in engaging an effective grouping which students may learn based on common interests, academic balance, learning preferences, and they can get along together in grouping.
Bias students' learning progress	Teachers have conducted pre-assessments and formative assessments but they face difficulties in identifying students' abilities to determine appropriate learning interventions for the next steps.	Teachers face challenges in adjusting the time for assessment and identifying students' learning progress. It may result in rich-data but insight poor data for learning.
Tiered assessment and learning	Teachers face difficulties in tailoring to students' needs that cause inequity in DI practice.	Teachers get difficulties in tailoring students' need that cause inequity in DI practice.
Inadequate teaching and learning resources	There are adequate teaching and learning resources, but teachers need to increase their capacity in integrating the resources to address students' needs.	Lack of teaching resources including teaching aids, visual aids, adaptive technologies, and a slower internet connection that could hinder students' learning. Inaccessible school facilities and infrastructures.
Lack of institutional support	Lack of professional training.	Lack of internet connectivity, slow internet speeds, and the absence of essential technology devices.

should be supported by sufficient professional skills. One of the school principals stated, 'Numerous teachers face difficulties in utilising technology for learning because of a lack of information and technology skills. Even though, the institution provides high-speed connection and learning software application, it is useless' (P2). Another principal stated that teachers faced difficulties in applying technology-based assessment, 'Based on the supervision, teachers get confused in arranging and identifying students' learning progress. It takes time and they are not able to utilize technology to make it easier' (P1). Two of the principals stated that the factor that hindered teachers in utilizing technology for designing multiple modes of assessment is a lack of skills.

Meanwhile, Islamic primary schools in rural areas, which have also been implementing DI since the implementation of the IC in Indonesia, are constrained by inadequate resources, such as the unavailability of various learning platforms, limited internet network access, and limited teachers' ability to utilize technology. One participant remarked, 'Some teachers in our school who are over 40 years old have limited mastery of technology, so it is still difficult to utilize various ICT-based learning resources and conduct assessments using applications' (P3). Even though the teachers have joined curriculum training, they stated that the training material was less focused on integrating technology for DI. The topic mainly covers how to design an institutional curriculum, designing DI, and designing a modul for the *projek pelajar Pancasila* (Pancasila student project). Teachers in the urban area may have accessible learning resources. On the other hand, teachers in a rural area may lack of instructional learning resources, as stated, 'For the urban city, it may be very effective to utilize technology in learning. However, in a rural area, we are often constrained by the internet connection because the school is in the remote area. Moreover, the students are also unfamiliar with the online-assessment features, which may difficult to implement'. Another principal stated that teachers faced constraints in accessing technology, curriculum support, and a lack of professional development. Three of five principals reported that they needed a supporting system to tackle this problem (P3, P4, P5).

Discussion

DI as an inclusive teaching practice with the absence of technology

The implementation of DI in Indonesia plays a strategic role in improving the quality of education by addressing the students' needs, moreover, in a situation that Indonesia has been characterized as a

multi-cultural country. Unfortunately, these research findings show that the implementation of DI faces challenges in the absence of technology, that leads to inadequate inclusive learning. This research is coherent with the previous research that the integration of technology in education, including the implementation of DI in Indonesia, is still at an early stage (Nurjanah et al., 2024).

One study reported that the practice of DI was complex and required a variety of learning resources (Benjamin, 2014). Furthermore, the implementation of DI requires rigid lesson planning and adequate resources (Hikmahwan et al., 2025). Based on the lesson plan document analysis, almost all lesson plans show that the results of pre-assessment are separable from the tier instruction. It is challenging to adjust the assessment results and learning instructions. As it is found in the previous research that the assessment process and scoring the results is time consuming and difficult to implement (Mills et al., 2014). Therefore, using technology to differentiate instruction is pivotal to alleviate some of the burden (Hayati & Ushalli, 2024).

Another aspect of pedagogical foundations of the DI is social emotional and behavioural practices that involve how teachers encourage a positive classroom environment by engaging students' participation and giving constructive feedback and clear instruction (Pozas et al., 2020). This research finding shows that almost teachers have not given constructive feedback for formative assessment. Whereas, at the DI practice, it is pivotal to improve the quality of learning. The teacher's attitudes during teaching and learning take a pivotal role in their inclusive instructional practice. During the learning process, assessment for learning, also known as formative assessment, is necessary to act upon the feedback to modify better teaching and learning (Van der Kleij et al., 2015). Another research depicts that formative assessments are designed to align with an expected learning progression (Y. Yin et al., 2014). Formative assessment enhances more interactive lessons (Westbroek et al., 2020). A formative assessment is a powerful way to enhance students' achievement because it alerts students to check and see where they are. At the end of the lesson, students check their achievement of learning goals through a summative test (Hamm & Adams, 2013). Therefore, DI practice should refer to the assessment as a key to determining teaching and learning activities.

The development of DI in this research is based on a constructivist learning theory, which explains how humans construct knowledge through their interactions with the world around them. Therefore, students' participation, interaction, collaboration, and engagement are the main foundations of the constructivist learning theory (Eppard & Rochdi, 2017). Research on constructivist pedagogy has underscored the transformative pedagogy for fostering students' potentials.

Challenges of DI implementation in Islamic primary schools

This study illuminates how the absence of technology hinders the true practice of DI in Islamic primary school settings. The shortage of technology used remains an obstacle for teachers and students in DI practice in the classroom. One of the greatest challenges of DI is that it requires up-to-date information on students' readiness to engage students in the teaching and learning process based on their learning needs. Whereas, students learn best when they are engaged on their learning pathway (El-Sabagh, 2021; Jiang & Peng, 2023). The integration of educational technology can provide systematic feedback to address an appropriate learning intervention (Förster et al., 2018; Wright et al., 2018). It is much easier for teachers to find resources that support students' learning needs at the right level. Advances in technology-enhanced DI help teachers tackle the DI-work problem and automate some of the most time-consuming tasks in the assessment process. The utilization of technology-enhanced DI offers various benefits and challenges for students and teachers. The findings showing that teachers' difficulty in implementing technology-enhanced DI is a challenge in the digital era learning are the foundational driver, and technology can be a great accelerator.

The integration of technology into DI, offers a personalized instruction for students, assesses students' progress, and creates engaging learning experiences (Lee et al., 2019; Nkomo et al., 2021). As emphasized by Krishan and Al-Rsa'i (2023), the technology use increases students' motivation by providing learning resources. The use of diverse learning resources is one form of content differentiation, allowing students to experience varied learning approaches. Therefore, creating technology-enabled and personalized learning environments that focuses on students' learning is pivotal.

This study also highlights the effectiveness of DI within Islamic primary school settings that depends on institutional support which provides adequate infrastructure and professional human resources. Teachers'

ability in implementing effective classroom management, differentiating methods of teaching, content, and evaluation through technology-use has attracted students' attention and helped students learn at their own pace (Krishan & Al-Rsa'i, 2023). In contrasts, the lack of professional training in teaching and learning among teachers further complicates the practice of high-qualified DI. This study highlights that a lack of specialised training related to technology-enhanced learning impact to teachers' capability in utilizing technology for learning. Therefore, institutional support should emphasize a professional development that contextually relevant to empower educators in implementing technology within DI practices.

Another challenge that arises is the human resources readiness, especially teachers over forty years old. The application of new educational technology remains an obstacle for educators and students at the Islamic primary schools because they are not familiar with the use of technology for learning. In this situation, technology adaptation is needed to optimize the teaching and learning (Haleem et al., 2022). Furthermore, the large student-to-teacher ratios observed among Islamic primary schools hinder the capacity of educators to manage the class well. One published research highlighted that large class sizes enacted specific ways in teaching strategies than larger classes because it restricted teachers' ability to modify instruction effectively (M. C. Wright et al., 2019). In this situation, technology plays a pivotal role in promoting inclusive instruction. Effective instruction promotes inclusivity, considering how various students can engage with ideas differently based on their background and culture.

Moreover, technology may accelerate the DI teaching and learning process. For example, grouping students to meet the various learning needs becomes a lot of work. Through educational technology, teachers can recommend groups of students in similar zones for a proportion of the time. The evaluation process is also more structured by engaging all students in a dynamic teaching and learning process (Deunk et al., 2018; Smale-Jacobse et al., 2019). These results reveal that investment in educational technology infrastructures is an important step to transform pedagogical approach.

In contrast, the absence of technology-enhanced learning can hinder the effectiveness of any interventions of transformative pedagogy and reduce the overall quality of DI practice. Educational technology integration provides an environment for students to encourages personalized learning (Schmid et al., 2022). With constructivist as a pedagogical basis, technology used constructively as pedagogical tools to give students opportunity to learn on their pathway (Abedi, 2024). To provide students' learning pathway, a successful DI should be practiced as one of the effective teaching strategy. According to Ann Tomlinson, DI instead of identifying students' profile to define a set instructional path that cater to students' learning needs (Tomlinson & Imbeau, 2010). DI is a continues cycle evaluating needs, planning, and delivering instruction by differentiating content, process, and product around those needs, and re-evaluating progress to start the cycle over again (Tomlinson, 2014). While teachers must be engaged in this process, utilizing technology to differentiate instruction can hinder the challenge of DI practices, especially when it comes into large size class and problems in saving time. When DI accommodates students' learning needs, students' outcome was improved (Hendel, 2022).

In contrast, one study published that decreasing of students' cognitive load could be an important issue for mobile learning as one of the technology-based learning. The utilizing of mobile learning placed students in a more complex learning situation that potentially reduce students' concentration in learning (Chu, 2014). This previous finding also shows another challenging issue to propose an appropriate technology-enhanced learning. From this case, it can be underscored that the function of technology to improve an effective learning and support an active learning environment could not be separated from the instructional practice, deals with how teachers facilitate teaching and learning process. Technology plays a pivotal role in transforming education by providing self-paced learning experiences and encouraging education to be accessible in remote areas. The existence of technology within DI practice addresses flexibility and facilitates limited access learning in a rural area. Therefore, it is pivotal to create inclusive learning environments through technology-enhanced DI.

Conclusion

This research reveals significant deficiencies in teachers' proficiency in the urban area that impact their ability to integrate technology into DI effectively. Meanwhile, inadequate learning resources and

technological support from institutions in rural areas become significant challenges. This situation hinders the technology integration into DI practice within IPS in Indonesia. To truly embody the principles of DI, there must be a supporting system that provides adaptive learning to cater to students' learning needs. The adaptation of technology-enhanced learning in diverse learning situations is inevitable for building inclusive learning.

However, it is important to acknowledge certain limitations in order to contextualize the findings and to inform future research. Firstly, the purposive number of participants, comprising only Islamic schools represented urban and rural areas, is not meant to generalize this conclusion to a bigger context of regular schools in Indonesia. Future research should capture a broader range of technology-enhanced learning in DI practices in any situation to identify the richer complexity of DI practice and how the supporting system tackles the problems. Secondly, the data collection methods have not gathered data from a classroom observation. Therefore, further research can use broader context and gather data using different research methods, such as classroom observation and surveys to deepen the contextual insights.

Additionally, this study focused on assessing technology used in the DI practice, utilizing data from experienced teachers. Therefore, future research can apply a comparative case study to investigate the technology towards DI among novice teachers and experienced teachers. Further research could also examine teachers' self-efficacy in implementing technology in new pedagogy learning to capture a more complete landscape of technology-enhanced learning.

This research suggests that advances technology tools help teachers tackle the DI-work problem and create an adaptable learning experience. The utilization of technology in urban areas illustrates that the availability of technology should be supported by professional human resources. Meanwhile, schools in rural areas should ensure the availability of technological infrastructure to support learning. This study contributes to existing research that effective teaching in today's classrooms often means differentiating instruction based on student's needs and technology can provide domain maps and potential learning pathways. These insights provide a practical recommendation for Islamic educational institutions in implementing technology-enhanced DI to address the students' learning needs, foster inclusion, and improve student's academic performance. In policy setting, this study provides valuable implications for stakeholders to promote constructive practices in learning by advancing continuous teachers' professional pedagogical skill and distributing technological infrastructure across schools in Indonesia.

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