



Article

Challenges and Opportunities of Implementing Differentiated Instruction amid the COVID-19 Pandemic: Insights from a Qualitative Exploration

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Abstract: Differentiated instruction (DI) has been introduced as a viable approach for accommodating the diverse learning needs of students in the same classroom. Despite the significant advantages attributed to this approach, it can still be a challenge for teachers to incorporate DI into practice. This study examined the lived experiences and perceptions of teachers regarding the influence of the COVID-19 pandemic on their differentiation practices. Purposive sampling was used, and 40 in-service primary and secondary school teachers in Hong Kong were recruited. Hybrid thematic analysis was implemented to examine data from the semi-structured interviews carried out in both face-to-face and online formats. Drawing on the five-dimensional model of differentiation as a conceptual framework, the findings were organized into five thematic areas: (1) teaching arrangements, (2) learning environment, (3) teaching methods, (4) support materials, and (5) assessment. The perceptions of teachers, both positive and negative, regarding the impact of the pandemic on DI were categorized into sub-themes. The results indicated that while the pandemic brought about considerable obstacles for educators in practicing DI, it also opened up opportunities for new approaches to meeting the diverse needs of students.



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1. Introduction

The COVID-19 pandemic has posed an unprecedented global challenge to all aspects of our lives, including the field of education. In this time of crisis, schools in many countries were forced to close, and students' learning was disrupted [1]. Even though traditional in-person classrooms could not take place in schools, the doors to learning and teaching were not really closed.

Amid the global pandemic, teachers across the world needed to adapt quickly in response to the pressing need to continue the delivery of education and keep students engaged in learning [2]. Instead of face-to-face instruction, online distance learning became an alternative way for students to attend school. However, the rapid transition to emergency remote classrooms without proper training left teachers with no time for careful preparation and planning. In addition, to look after the different needs of students despite the pandemic, alternative ways of reaching students and advancing their learning were needed immediately. One of the common challenges was the integration of technology in a remote and hybrid learning environment [3]. Most of the technological pedagogical knowledge of teachers was gained in pre-service education and professional development after graduation [4], and teachers had to upgrade their digital literacy skills so that they could play a primary role in encouraging learners to embrace technological literacy during



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the pandemic. Furthermore, poor interaction between teachers and students in a remote or hybrid environment can be a challenge for teachers, which further complicates the implementation of differentiated instruction (DI) [5]. Due to the lack of face-to-face contact, extra work is required from teachers to increase students' motivation to learn during the online learning process [6]. In addition, in order to implement differentiation in remote teaching, teachers have to make even greater efforts to address students' individual academic and social-emotional needs in the virtual learning environment. However, it can be difficult for teachers to assess individual needs and provide tailored instruction for students remotely [7]. Therefore, teachers are required to constantly reflect on their instruction while integrating differentiation and online assessment methods in their daily teaching during the pandemic [8].

Overall, the COVID-19 pandemic caused a significant shift in education, as teachers with traditional teaching approaches moved into a distance learning space. In response to the need to maintain the continuity of students' learning, teachers were involved in the exploration of new pedagogical practices to support remote learning. The literature has suggested that, while implementing DI during the pandemic could be challenging, it was nonetheless possible with the use of technological tools and a variety of instructional strategies. Noting that research on implementing DI virtually is limited, this study sought to explore teachers' experiences as they attempted to cater for learner diversity, focusing on the challenges and opportunities they faced during the coronavirus outbreak.

2. Literature Review

2.1. Differentiated Instruction (DI)

Catering for the growing learner diversity in the same classroom has long been a challenge for many teachers. DI is a teaching approach that involves tailoring instruction to meet the diverse learning needs of individual students. In response to students' readiness, interests and learning profiles, teachers can implement differentiated teaching by modifying the four curriculum components: content, process, product, and environment [9]. With the aim of maximizing the capacities of each student, DI is a proactive approach that enables students to develop their potential by providing them with appropriate scaffolding, supported by a variety of instructional strategies and materials that address their needs [10,11].

A number of studies investigate teachers' practices of differentiation in two aspects: which teaching practices and techniques do teachers use and what do they differentiate [12,13]. Teachers may provide students with content that has been modified for them, offer different options for the learning process, use different assessment tools, or modify the learning environment to meet the needs of students [14]. Additionally, teachers may give some students more time for learning or, on the other hand, encourage high achievers to learn more quickly [15]. In terms of the process, teachers could tailor instruction throughout the lesson or pre-teach to meet the needs of the students [16]. To differentiate instruction for the entire class, it is common practice to split the teaching content into manageable blocks or units. The teacher provides all students with the same instructions for each unit [15], and then is informed via a formative assessment of which students have achieved the required level of mastery. Students that fall short of the expected standard are given further instruction or individual practice [15]. However, the learning objectives do not change even though each student's learning paths are unique. It is notable that formative assessment and DI go hand in hand, as high-quality differentiation is based on ongoing assessment and adaptive strategies to meet students' needs [13,17,18]. Teachers could also use flexible groups, which is a mix of heterogeneous and homogeneous groupings, to structure their instruction in response to students' need.

The previous literature has indicated the advantages of implementing DI in educational settings. Studies have shown that DI leads to increased levels of student engagement and learning motivation, as reported by Johnsen [19] and McAdamis [20]. DI can also lead to improvements in students' problem-solving skills, decision-making abilities, and

overall cognitive development [10,14]. Additionally, DI has been found to elevate learner confidence [12,21] and improve overall and subject-specific academic results such as reading fluency and comprehension [22] and mathematics achievement [23,24]. The majority of earlier studies has focused primarily on how DI practices affect students' academic achievement. The potential impact of DI on students' socio-emotional outcomes, such as students' motivation and attitudes in differentiated settings, has received very little attention [15]. The effects of students' perceived DI on their wellbeing, social inclusion, and academic self-concept were examined in a study by Pozas et al. [25]. The findings showed that these outcomes were positively associated with how students viewed their teachers' DI practices. However, further research is required to illustrate how DI practices affect students' socio-emotional outcomes.

Despite the documented benefits, the literature has mixed findings about teachers' reported usage of DI in their regular classroom. Smit and Humpert [26] discovered that primary and secondary school teachers used DI occasionally, primarily via varying learning objectives and assignments. The uncommon use of DI by secondary school teachers was discovered by Pozas et al. [27], which also noted that teachers at high-track schools tend to use DI strategies less frequently. While Adebayo and Shumba [28] showed the frequent use of a variety of classroom strategies, primary school teachers in Prast et al. [18] study reported a moderate to high range of progress monitoring and instructional adjustments. Although differentiation is thought to offer all students the best learning chances available, teachers remain hesitant to implement differentiation in their classrooms due to the presence of various obstacles [29]. Previous studies have revealed that teachers do not feel capable of delivering DI due to a lack of foundational knowledge regarding the approach [30–32] or a disconnection between understanding and the actual classroom application [33]. Another common concern involves classroom management [34,35]. Teachers can be hesitant to carry out DI strategies, such as grouping practices, especially in a large class. Many teachers consider that grouping practices pose classroom management challenges, as grouping practices often involve multiple learning activities occurring simultaneously, which leads to increased demands on the teacher's time and attention [9,36]. In addition, teachers may resist adopting DI due to concerns about increased workload [13], as the planning and implementation can be time-consuming, particularly in terms of lesson preparation and assessment [8].

2.2. Conceptual Framework of Differentiated Practices

Although several models have been developed to guide the implementation of differentiation, teachers still find it challenging to put DI into practice, and a clear gap exists between theory and practice [37]. To facilitate the implementation of DI, the research-informed five-dimensional (5D) model of differentiation, which draws on constructivism, the zone of proximal development (ZPD), the theory of multiple intelligences and motivation theory, was designed by Roiha and Polso [9] to provide a more practical, tangible and pervasive framework. The model proposes that differentiation can be approached through the following five dimensions: (1) teaching arrangements, (2) learning environments, (3) teaching methods, (4) support materials, and (5) assessment.

Some of the dimensions of the 5D model correspond to the components of Tomlinson's [38] model, such as learning environment and teaching methods, but in an expanded way. The model provides five ways of integrating differentiation into teaching, with an emphasis on both macro- and micro-level practices. Macro-level practices are associated with the responsibility of the entire school community, and they are usually planned and designed in advance [39]. By contrast, micro-level practices are related to adaptive teaching, which is more spontaneous and responsive to students' learning needs [9,39].

Teaching arrangements, which form a macro-level differentiation in the model, refer to the organization of teaching and learning experiences by teachers, such as the grouping of students and co-teaching. Another macro-level consideration, learning environment, refers to where learning takes place, as well as the learning atmosphere. In micro-level

teaching, teaching methods refer to the use of varied teaching strategies based on students' profiles, while support materials are the various learning tools or materials that aim to facilitate students' learning. Assessment, one of the most essential micro-level components of DI, refers to the methods employed to monitor students' learning progress and adjust the instruction accordingly [39].

The 5D model of differentiation provides a clear and easy-to-use framework for understanding the essence of DI; therefore, it was used in the current study as a guiding framework for understanding teachers' experiences of practicing DI during the pandemic.

2.3. Implementing Differentiated Instruction during the Pandemic

Due to the increased demands and limited resources during COVID-19, most educators encountered challenges in moving instruction to emergency remote teaching [5,40]. This may have made it more challenging to offer equal learning opportunities for students with diverse learning needs and styles [41]. Few studies have explored the implementation of DI during the COVID-19 pandemic. A study by Satyarini et al. [6] revealed that DI was not fully implemented by teachers during the COVID-19 pandemic, and one of the obstacles faced by teachers may have been a lack of technology proficiency. The immediate need for emergency remote teaching forced teachers to adapt themselves to new technologies and novel modes of teaching and learning, involving content preparation and assessment methods within a medium that may have been previously unknown or unfamiliar to them [42,43]. While there was uncertainty regarding how long the distance learning would last, the abrupt transition from conventional in-person instruction to a blend of hybrid and distance learning produced significant emotional uncertainty and stress among educators [7,43].

Another common challenge faced by teachers in remote teaching was associated with students' participation in a virtual setting [6]. The learning process during the pandemic, which was conducted in a virtual or blended mode, was different from the learning process usually carried out in offline classroom-centric education. Remote instruction prevented face-to-face interaction in the classroom, students exhibited poor concentration, and teachers found it hard to maintain students' motivation and engagement in learning, especially if teachers conducted one-size-fits-all teaching for all students [44]. In terms of the implementation of DI, extra work was required to make students focus during lessons, and teachers had to come up with various learning materials catering to students' diverse needs. However, teachers stated that they lacked time for lesson planning, and group activities in distance learning were therefore very limited [45]. Although online teaching and emergency remote instruction conducted during a crisis are similar in that they both involve delivering instruction through technology, they are distinct in terms of their purposes, planning, and levels of preparation. Online teaching is a deliberate approach that requires careful planning to deliver instruction through a digital platform. By contrast, an emergency remote class is just a temporary shift from face-to-face instruction due to an unexpected crisis or event, with a focus on maintaining continuity of learning and minimizing the disruption to students' education; thus, students' diverse needs may not be taken into consideration when designing the teaching content [46].

Many teachers considered online learning to be less effective than learning face-to-face, as learning face-to-face can facilitate socialization between teachers and students, and teachers can observe students' performance more directly [45]. However, prior research [47,48] demonstrates that information and communications technology (ICT) applications can support student-centred learning and have positive effects on student achievement. More research is required to investigate how ICT can be used in DI as an adaptive tool and not so much as an add-on to conventional teaching [47,49].

Given that limited research has been conducted on how teachers handled learner diversity during the COVID-19, this paper adds to the body of knowledge by examining how teachers catered for different needs of students during the pandemic, focusing on their challenges, coping strategies, professional learning, and professional growth.

3. Method

3.1. Study Context

The COVID-19 pandemic caused substantial disruptions to the Hong Kong education system, which required adjustments to maintain the safety and continuity of education. The pandemic outbreak in Hong Kong led to periodic school closings as these measures changed frequently as the situation changed. To stop the spread of the virus, all schools in Hong Kong were temporarily closed earlier in the epidemic for around four months. To ensure that students' education continued throughout that time, the government later launched remote learning initiatives. This made it difficult for some schools to deploy online learning quickly. Depending on the setup and arrangements of the schools, teachers were forced to adopt a variety of online platforms and technologies to remotely deliver lessons and assignments either at home or school. As the pandemic situation stabilized, schools gradually began to reopen and the government introduced blended learning approaches that allowed students to return to school every day with half a day of face-to-face learning and half a day of online learning.

3.2. Aims of Study

The present study set out to explore teachers' perceptions and experiences of implementing DI during the COVID-19 pandemic. The investigation was guided by the following research questions:

1. How did teachers interpret their experience of implementing DI during the COVID-19 pandemic?
2. What challenges and opportunities did teachers identify for differentiation during the pandemic?

3.3. Research Design

The current study, which forms part of a larger study, set out to explore teachers' lived experiences of implementing DI during the COVID-19 pandemic. A total of 40 in-service teachers (22 primary and 18 secondary school teachers; 11 male and 29 female) from 11 schools (six primary and five secondary schools), who had previously participated in a university-school partnership program on DI in Hong Kong, were recruited using purposive sampling. The teaching experience of the sample ranged from 1–30 years ($M = 11.63$; $SD = 8.31$), and the teachers were from different school sectors and subject disciplines (Table 1).

Table 1. Demographic information for the participants.

		Primary School (n = 22)		Secondary School (n = 18)		Total (n = 40)	
		n	%	n	%	n	%
Gender	Male	4	18.2	7	38.9	11	27.5
	Female	18	81.8	11	61.1	29	72.5
Teaching experience (year)	0–3	2	9.1	4	22.2	6	15.0
	4–7	8	36.4	2	11.1	10	25.0
	8–15	5	22.7	5	27.8	10	25.0
	16–23	4	18.2	5	27.8	9	22.5
	24–30	3	13.6	2	11.1	5	12.5
Role	Teacher	9	40.9	8	44.5	17	42.5
	Vice subject panel head	2	9.1	2	11.1	4	10.0
	Subject panel head	6	27.3	6	33.3	12	30.0
	SEN coordinator	2	9.1	0	0	2	5.0
	Primary school curriculum leader	2	9.1	NA	/	2	5.0
	Prefect of studies	NA	/	2	11.1	2	5.0
	Vice principal	1	4.5	0	0	1	2.5

3.4. Data Collection

The participants were interviewed by the same researchers (i.e., first and last author) via Zoom or face-to-face interviews. We conducted 11 focus groups (one for each school) and 10 individual interviews, each lasting approximately 60 to 100 min. Data were collected through semi-structured interviews guided by a standardized interview protocol (Appendix A). The participants were invited to respond freely to a series of open-ended questions, and follow-up questions were used to encourage them to explain and elaborate their answers. Demographic data were collected, including gender, year of teaching, position, and subject of teaching. Ethics approval was obtained from the Survey and Behavioral Research Committee of the Chinese University of Hong Kong, and participants were informed about the purpose and confidentiality of the research.

3.5. Analysis Methods

All interviews were audio-recorded and transcribed in traditional Chinese. The transcriptions were anonymized, checked, and edited against the audio recording by the research team. Data were analyzed using the six-step reflexive thematic analysis [50], focusing on the participants' perceived challenges and opportunities in catering for learner diversity during COVID-19. A hybrid analytic approach [51] was adopted, which constitutes a combination of inductive and deductive thematic analysis. First, the first and second author read and reread the transcripts and familiarized themselves with the set of data. Second, we individually selected and generated codes deductively aligned with the 5D model of differentiation [9] with the codes grouped into five themes: teaching arrangements, learning environment, teaching methods, support materials and assessment. Third, we reread the data and cross-checked our initial codes organized under the five dimensions of the 5D model of differentiation to explore common perspectives, categories, and patterns, using inductive coding. Fourth, the data were analyzed iteratively using existing theoretical lenses, and the similarities and differences between the codes were reviewed and discussed among team members to derive sub-themes of the predetermined themes. Fifth, the essence of each theme and sub-theme was co-discussed and placed into a broader overall story about the data. Sixth, once we had agreed on code labels and definitions, the findings were summarized (Table 2), and sample quotes that best illustrated each code were selected from the data.

Table 2. Themes, sub-themes, and codes derived from the analysis.

Themes				Sub-Themes	Codes			
					Positive (+)/ Coping Strategies		Negative (–)/ Obstacles	
Macro-level practices	1.	Teaching arrangements	1.1	Collaboration time among teachers	•	learning community	•	less regular meetings
					•	collaboration time	•	respond to new policies
			1.2	Instruction time	•	professional conversations		
					•	try new teaching ideas		
					•	remedial instruction	•	widen students’ heterogeneity
					•	learning loss		
1.3	Grouping practice	•	more manageable for group discussion	•	not feasible for conventional grouping			
		•	facilitate student interaction with digital tools	•	not able to group students effectively			
						•	face to face interaction as irreplaceable	

Table 2. Cont.

Themes		Sub-Themes		Codes	
				Positive (+)/ Coping Strategies	Negative (–)/ Obstacles
Micro-level practices	2. Learning environment	2.1 Physical environment	/		<ul style="list-style-type: none"> • hard to get students engaged • easily distracted at home • lower learning outcomes
		2.2 Psychosocial environment		<ul style="list-style-type: none"> • positive learning atmosphere • equal opportunities for students • more attention to low achieving students • new classroom routines • maintain students' interest 	
	3. Teaching methods	3.1 Teaching content		<ul style="list-style-type: none"> • greater autonomy in adjusting teaching content 	<ul style="list-style-type: none"> • competing demands between curriculum and students' needs
		3.2 Teaching strategies		<ul style="list-style-type: none"> • more aware of students' needs and difficulties • prioritize teaching focuses • adjustable learning pace • tiered questioning strategies 	
	4. Support materials	4.1 Use of instructional computer technology (ICT)		<ul style="list-style-type: none"> • try different online learning tools • improve online teaching skills • integrate technology in own style of teaching • previous knowledge about online instruction 	<ul style="list-style-type: none"> • hesitant to move online • low proficiency in using online tools
		4.2 Design of learning materials		<ul style="list-style-type: none"> • individualized instruction • modifying learning materials • extended resources 	<ul style="list-style-type: none"> • extra workload
	5. Assessment	5.1 Assessment format		<ul style="list-style-type: none"> • formative assessment 	<ul style="list-style-type: none"> • hard to conduct summative assessment
				<ul style="list-style-type: none"> • release from summative assessment • students' self-assessment • diversify assessment method 	

Table 2. Cont.

Themes	Sub-Themes	Codes	
		Positive (+)/ Coping Strategies	Negative (–)/ Obstacles
5.2	Learning outputs	<ul style="list-style-type: none"> multiple ways to demonstrate learning outcomes students' sense of accomplishment 	/
5.3	Communication with parents	<ul style="list-style-type: none"> maintain connection with parents appreciate students' progress 	/

4. Findings

This section reports on the qualitative findings from the primary and secondary teachers in Hong Kong about their experiences of implementing DI during the COVID-19 pandemic. Based on the analysis of the interview data, the participants' perceptions of the challenges and opportunities with respect to catering for learner diversity amid the pandemic are discussed based on the five dimensions of the 5D model of differentiation framework [46]. Sample quotes from the participants were translated into English and will be presented in English only. To provide more context for the quotes, we provide the school sector and teachers' years of experience after each quote in the following sections.

4.1. Theme 1: Teaching Arrangements

4.1.1. Collaboration Time among Teachers

Collaboration among teachers is regarded as a key factor not only in the implementation of differentiation practices, but also in the planning and evaluation of these practices [25,47]. While educators transitioned from traditional face-to-face instruction to online platforms for remote teaching, many challenges arose that required structural changes in the curriculum and additional resources to provide equitable and appropriate remote learning for all students. While schools adjusted in accordance with their social distancing arrangements, policymakers and school leaders needed to make rapid decisions regarding the curriculum and syllabi that teachers had to adapt to the new reality.

Some of the participants, particularly those experienced teachers in a managerial position in school, pointed out that they used to have regular meetings with the team for lesson co-construction and exchange of teaching materials. However, during the pandemic, more time was devoted to responding to the changing policies from the government:

(–) Under the situation of COVID-19, we have had very limited meetings . . . while most of the discussions among colleagues have revolved around responding to the pandemic. . . as a result, the actual time remaining to do routine work has been relatively reduced. (P0201 (Subject ID: P = Participant; the first two digits = school code (e.g., 02 = school no. 2); the last two digits = teacher's code in that particular school (e.g., 01 = the first participant from that school)); Secondary; 20 years)

An interesting and unexpected phenomenon emerged during the pandemic whereby the entire teaching staff became a larger learning community group. During the pandemic, teachers had much less time during which they were responsible for students, yet there was more teaming and collaboration time among teachers than ever before (P0103; Primary; 19 years). Many teachers, used to working on their own, were engaged in professional conversations and planning regarding the direction of their work and actions. The teachers

found themselves doing something they had rarely done before, simply because online learning made it accessible and effortless:

(+) The “new normal” teaching environment actually brought us many possibilities. . . tasks that were previously found difficult to do can proceed more smoothly. . . surprisingly, we have gained a positive outcome from these changes. (P0105; Primary; 24 years)

4.1.2. Instruction Time

Due to the school closure and half-day online teaching, there was a significant reduction in instruction time. Consequently, adhering to the established curriculum timeline became impossible, resulting in a substantial learning loss for students. The heterogeneity of students was expected to broaden owing to various contributing factors, such as student drive, familial backing and resource availability. Remedial instruction became an alternative way to assist those struggling students to catch up with their peers:

(+) It will take a lot of time to catch up with their progress. . . I understand this is also part of differentiated instruction. . . which is not limited to the learning materials but also needs to take care of those falling behind (P0704; Secondary; 30 years)

Furthermore, following the onset of the pandemic and the subsequent return to in-person instruction, extended instruction was arranged to help those students who had suffered academic setbacks:

(+) [We] must arrange make-up lessons. . . because after the online classes, everyone knows that the [students'] grades will definitely drop. (P0605; Primary; 9 years)

(+) Since the resumption of classes, students have been struggling to catch up on the teaching schedule. . . which was merely the minimum requirement. All of us are suffering, both the students and the teachers. . . students will not move forward unless we push. . . leaving us with no choice. (P0501; Secondary; 18 years)

4.1.3. Grouping Practice

Several participants acknowledged the significant impact, in both positive and negative ways, of the pandemic on the practice of grouping which is a vital strategy within the context of DI. Some of the teachers mentioned that the conventional practice of grouping was hard to implement in blended learning:

(+) Back in the days before the pandemic, a common practice for grouping students was based on their seating. . . with a focus on heterogeneous grouping. . . pairing up more capable students with those who are less capable. (P0901; Secondary; 7 years)

This teacher also mentioned that the pandemic had disrupted his plan to implement effective grouping of students for meaningful learning experiences in blended learning:

(−) We were making attempts a few years ago, but with the pandemic, we can rarely group students as effectively as we used to. In the past, we may have paired students in groups of two, four, or even six. However, the best we can do now is to have only two students per group [when using electronic learning tools in face-to-face instruction]. (P0901; Secondary; 7 years)

Conversely, a number of teachers noted that digital tools and applications were able to address the absence of face-to-face interaction between teachers and students as well as among students themselves during the period of distance education:

(+) Online classes during the pandemic have made certain learning approaches more attainable. . . for example, group discussion. . . which is required by school. . .

has become more manageable with the online methods we are using this year. (P1102; Primary; 4 years)

The participants appreciated the opportunity to try out alternative approaches and diverse forms of teaching to engage their students. Nonetheless, most of the teachers considered that these interactions could not replace the conventional mode of in-person teaching. One of the participants said as follows:

(±) Online teaching is actually a great means of interaction. . . although it cannot entirely replace face-to-face discussion since it is very momentary. . . yet it makes up for some of the shortcomings. Thanks to the pandemic. . . we have been given the opportunity to explore electronic tools. . . which are advantageous. (P1001; Primary; 9 years)

4.2. Theme 2: Learning Environment

4.2.1. Physical Environment

Amid the ongoing global pandemic, there was a prolonged period where teaching was delivered via online platforms instead of the traditional in-person modality. Since all learning was conducted online, students' engagement was a hindering factor [52]. Teachers observed that learning from home had decreased students' motivation. In addition, it was difficult for students to maintain engagement and establish meaningful connections with teachers and fellow students within the online learning environment:

(−) Getting students to pay full attention was extremely challenging, as I had limited control over them while they were at home. . . I found managing this issue in a virtual environment to be extremely challenging. (P0201; Secondary; 20 years)

The participants also articulated several unfavorable consequences that emerged in the contexts without in-person contact. These included lower learning outcomes and difficulties in sustaining concentration of students:

(−) This year's students have been greatly impacted by the pandemic. . . resulting in a decline in their academic performance. . . decreased levels of concentration, and difficulties in focusing. . . or rather. . . an inability to focus at all. (P1101; Primary; 4 years)

4.2.2. Psychosocial Environment

There is a growing awareness that the social and emotional experiences of students have a significant impact on their learning outcomes [53]. The onset of the pandemic required teachers to devote more efforts to addressing the social and emotional needs of learners. Consequently, it was crucial for educators to acquire the necessary skills to incorporate the psychosocial considerations into their instruction to optimize the effectiveness of student learning. One of the teachers stated the following:

(+) We cannot simply rely on traditional teaching methods and must instead apply diverse strategies in online teaching. . . such as methods to encourage student participation and engagement. . . [in order to] create a positive learning atmosphere. . . and provide equal opportunities for students to answer questions. I believe this is a challenging task, but we are all making efforts to overcome it. (P0805; Primary; 20 years)

At the time when social distancing measures were implemented, students needed personal contact, a feeling of belongingness and the opportunity to share the difficulties they were going through [15]. Students were engaged not only in self-paced works but also in collaborative learning activities through the effective use of online tools. Teachers engaged students in a remote learning environment by using a "living bulletin board", inviting all students to post questions, respond to questions, or offer support to each other. Therefore, social barriers could be eliminated, and the engagement of students could be

increased. One teacher noted that those previously considered as low achieving students were found to become more enthusiastic about learning, which was an unexpected outcome of online teaching:

(+) COVID-19 has been a good trial. . . [all] students have received more attention and opportunities to participate in the class. . . for those who are less capable or less confident. . . their feeling of helplessness—saying “I will not learn anything anyway; it is pointless to study so hard”—has gradually reduced, and their sense of achievement has increased. Moreover, I believe their perception of the class and their learning experience have improved. (P0304; Secondary; 10 years)

There has been a longstanding concern regarding the challenge of classroom management in implementing DI [34,35]. One teacher provided insights into her experiences in managing a differentiated classroom during the pandemic and the shift toward remote education. Her approach entailed the implementation of specific and well-defined expectations, routines, and procedures to guide whole class participation:

(+) In our online classes, the students were required to use hand gestures to indicate their answers to the questions. . . this method is relatively easy for students to follow. . . it also allows the teacher to get an accurate understanding of students’ learning progress. . . and before the class starts, we highlight some rules and regulations to help students behave and focus in order to maintain classroom order. (P0605; Primary; 9 years)

Ultimately, returning to the fundamental principles, the crucial element for a successful lesson resides in its capacity to maintain students’ understanding and engagement in the learning process. This is consistent with the following statement by one of the teachers:

(+) The teaching schedule has been really rushed in the pandemic situation. We can hardly implement differentiation in every subject and every topic. . . I think this [DI] is important and deserves to be carried out. . . but if we are to continue such efforts, I will consider how to maintain students’ interest to keep them attending my class. . . this is my primary concern. (P0501; Secondary; 18 years)

4.3. Theme 3: Teaching Methods

4.3.1. Teaching Content

Regarding the micro-level implementation of differentiation, the respondents employed various differentiated strategies in the virtual mode of instruction amid the pandemic outbreak. Numerous teachers noted that due to the constrained instructional time, they were obliged to choose and modify educational content and materials accordingly. One of the respondents said the following:

(+) The conventional pedagogical approach is a more comprehensive and thorough education. However, in virtual classrooms, diverse strategies are required to capture students’ attention, or [it was necessary to] select key concepts of the learning content, so the students were able to acquire knowledge despite the constraints of the virtual environment. (P0902; Secondary; 5 years)

Teachers were granted a greater degree of autonomy regarding curricular adjustments (P0605; Primary; 9 years). In particular, they could simplify or reduce the learning content to ensure students’ learning [52]. However, they were confronted with the significant pressure to strike a delicate balance between the diverse demands, benefits, and constraints that came along with this responsibility. One teacher stated as follows:

(−) Since our lesson time was very limited, we were challenged to weigh the options between teachings in an exam-oriented or a comprehensive manner. . . there are many competing demands regarding this issue. (P0805; Primary; 20 years)

4.3.2. Teaching Strategies

The initial phase of emergency remote learning in response to the crisis situation, characterized by a predominately reactive stance, gradually underwent a shift toward a more deliberate approach to online learning and teaching, which focused more on the learning needs of students. Teachers dedicated extensive efforts to this task, persistently working to amend and refine their pedagogical techniques:

(+) Due to the pandemic, half of our class time was spent online. . . so we have implemented DI in a more focused manner. This involves targeting the learning needs of individual students. . . [to] really concentrate on their difficulties. . . and help them to better understand the learning content during online teaching. (P0605; Primary; 9 years)

In light of the students' needs, teachers designed teaching plans that prioritized certain instructional approach based on their understanding of their students:

(+) Some adjustments have been made in the teaching design. . . perhaps some of them emphasizing discussion-based [learning]. . . while the others may be a more thought-based approach. . . we cannot do all the things well in online teaching. . . so it is necessary to streamline and focus more on the characteristics of our students. (P0902; Secondary; 5 years)

Amid the unprecedented circumstances of online instruction during the pandemic, it became apparent that rigorously adhering to the academic syllabus was an unfeasible task. In a classroom free from the burden of a strict teaching schedule, teachers were given the opportunity to adjust the teaching pace so that it better catered to the needs of their students:

(+) I will deliberately slow down the pace of instructional delivery. . . to ensure that the students understand the subject matter. (P0102; Primary; 18 years)

Several teachers reported that they implemented questioning strategies more frequently as a means to facilitate the learning progress of students, with varying levels of readiness and progress (P1001; Primary; 9 years). In addition, some of the teachers developed guiding questions in a tiered fashion to accommodate learners with varying needs:

(+) We used to design two to three questions in each lesson with different levels of difficulty. . . to facilitate the thinking of students. . . and discussion with their peers. (P0902; Secondary; 5 years)

4.4. Theme 4: Support Materials

4.4.1. Use of Instructional Computer Technology (ICT)

All the participants reported their experiences of using ICT for online instruction amid the ongoing pandemic. Teachers were exposed to cutting-edge technological resources that allowed them to step out of their comfort zones and involve learners in interactive and collaborative learning tasks:

(+) Because of the pandemic, I have the chance to try out different online learning tools. . . so yes. . . I have indeed experienced some benefits from it. (P1001; Primary; 9 years)

Many teachers continued improving their online teaching skills throughout the pandemic. They continued seeking professional help in order to enhance their techno-pedagogical proficiency, and they tried to make use of diverse teaching tools:

(+) I think the pandemic may have been helpful for us, because in the past, it did not occur to us to consider electronic methods for teaching. . . though we have encountered many setbacks along the way. . . such as issues with developing electronic learning materials. . . and students encountering technical problems, such as difficulty accessing lesson materials. . . these issues arise from time to time and are inevitable. (P0805; Primary; 20 years)

Following the initial period of online instruction, teachers came to the realization that this hybrid approach would likely persist for a long period of time. This insight prompted all the teachers, including those who initially hesitated and deferred their decision, to move their instruction online:

(+) Our teaching team is relatively traditional, with some senior teachers who may not be as proficient in conducting online classes. . . their level of acceptance towards online classes may not be as favorable. . . however. . . in my opinion. . . some of the features are optional; the students can still raise their hands in the class. . . and differentiated instruction is still achievable. (P0401; Primary; 13 years)

The incorporation of technology into instructional practices was observed by one teacher as a supplementary strategy that could enhance the instruction of teachers:

(+) I did not consider it [using ICT] time-consuming, so I just gave it a try. . . I feel that I have still kept my personal teaching experience and style. . . I did not abandon my personal style just to adapt to the online instruction. . . that would not be good. (P0401; Primary; 13 years)

Several teachers reported that their previous exposure to virtual instruction, experience access to online instructional materials, and supportive colleagues facilitated a faster and smoother transition to online teaching:

(+) Our school began using the online tools. . . about four years ago, so we already have a foundation in place. . . therefore, during the pandemic, we simply expanded our use of the online teaching and learning tools. (P0605; Primary; 9 years)

(+) My colleague is proficient in using technology. . . thanks to his proficiency, we were able to overcome obstacles this year. . . and were able to utilize online meeting software to teach. (P1101; Primary; 4 years)

4.4.2. Design of Learning Materials

As a replacement for conventional group discussion practice, one teacher shared his attempt to turn the teaching into a set of organized, well-structured notes. This method guided students step-by-step through the development of critical thinking abilities:

(+) During the pandemic, we were unable to conduct group discussions, so we shifted the focus to note-taking and had students take the lead. The content taught in class is categorized by different levels of difficulty. . . and we would encourage the students to work independently. . . I demonstrate working on a small part first. . . and students complete the remaining parts following my demonstration. . . meanwhile, I observe and identify students who may have trouble understanding the concept. . . and provide a few more prompts to help them to keep up. (P0902; Secondary; 5 years)

With the rapid and ever-changing policies in respond to the pandemic situation, it was vital to prepare for teaching in distance, blended, and in-person mode. The transition to online teaching resulted in a substantial increase in responsibilities, involving much work on the planning and redesigning of learning materials for students:

(−) When preparing for classes, the content is constantly changing, and there is no fixed formula to follow. With the pandemic coming, in addition to the transition of teaching mode from in-person to online. . . our class material such as worksheets, also required corresponding adjustments. . . which was extra work to be done. (P0703; Secondary; 17 years)

Given the constrained instructional time, additional educational resources were provided to students, allowing them to exercise their autonomy in selecting learning materials that matched their interests and learning progress:

(+) Due to limited lesson time, I can barely cover anymore content. . . so I need to adjust the approach based on the progress. . . I prefer to upload several reference materials to the online learning platform, with answer keys provided for simpler questions. . . advanced students can challenge themselves with more difficult questions without answers provided. (P0501; Secondary; 18 years)

4.5. Theme 5: Assessment

4.5.1. Assessment Format

During the pandemic, it was more difficult for teachers to obtain adequate knowledge about all students' learning [52]. Therefore, to ensure the achievement of meaningful learning outcomes, teachers who used to utilize traditional paper-and-pencil tests were forced to explore alternative modes of assessment. Several teachers noted that they had better understanding of their students' learning through formative assessments using ICT:

(+) We used an online platform to collect student exercises and homework. . . also, we used an online application this year to receive timely feedback after class. . . and assess students' understanding of key concepts and difficult points. . . this enables us to concentrate on monitoring students' learning outcomes, identifying students who may be struggling. . . and providing suitable tasks and practices for them. (P0605; Primary; 9 years)

(+) Through online classes. . . I can identify whether students have grasped the ideas. . . even if I cannot see the students' expressions, their immediate responses provide an indication of their level of understanding. . . for instance, if some of them fail to react. . . or answer questions [online tasks] incorrectly. . . I am aware that they have not yet fully understood, and I will have to spend more time explaining about that. (P1001; Primary; 9 years)

One participant noted that the online pedagogy had alleviated the burden of conducting summative assessment in schools, which has long been a significant hindrance to the implementation of DI:

(+) Many tasks may not be conducted in the same way. . . therefore, the school will not be pushing so hard [for examinations] this year. . . some assessments may be taken remotely at home. . . with the results serving as a reference. . . rather than being recorded officially in academic transcripts. (P1103; Primary; 6 years)

Furthermore, the use of online applications could facilitate students' self-assessment in the learning process:

(+) Online tools and software offer students the opportunity to self-evaluate their own competencies. (P1103; Primary; 6 years)

Teachers recognized that the current atypical situation called for more tailored and adaptable strategies to perform assessment. The assessment could include novel and diverse techniques by utilizing technological resources:

(+) I used to think video-watching was a waste of time. . . as students may not understand the purpose even after watching. . . however, I have come to appreciate video-watching as an assessment strategy. . . I now prefer to segment videos into small parts and pause when playing. . . prompting students with questions between the gaps. (P0401; Primary; 13 years)

4.5.2. Learning Outputs

The introduction of online teaching provided students with multiple outlets to display their learning outcomes. With a mutual agreement on the ways to showcase their learning outcomes, students were found to exhibit greater diligence and effort than before:

(+) We have allowed students to submit assignments in audio format. . . [and] also provided them with the opportunity to participate in radio drama production,

which enables them to present their ability to utilize online tools in multiple ways. . . this brings us back to what we previously discussed. . . if students derive a sense of accomplishment in a particular area, they are more likely to develop an interest in your subject, regardless of how much knowledge they acquire. . . at the very least, this approach helps prevent disinterest and resistance toward the subject. . . for students who have been struggling academically, I consider this a positive outcome. (P0901; Secondary; 7 years)

4.5.3. Communication with Parents

Teachers highlighted the importance of maintaining a connection with families throughout the pandemic, placing an emphasis on communicating the social–emotional well-being of students in conjunction with their academic progress. One teacher said as follows:

(+) I have created a Google Site to upload student assignments, including homework, artwork, designs, and more. . . due to the pandemic, it has become difficult to share students' work at school. . . however, I believe the online platform provides a permanent and easily accessible space to showcase their achievements. . . these works can be easily shared with parents. . . I want to encourage parents to recognize their children's progress and abilities. . . not merely focusing on exam results. . . even if a student does not perform well on an exam, it is important to acknowledge their progress. . . I hope to convey this message to all. (P0201; Secondary; 20 years)

5. Discussion

The aim of this study was to investigate the perceptions and lived experiences of educators regarding the implementation of DI amid the COVID-19 pandemic. We conceptualized teachers' experiences using the 5D model of differentiation as a conceptual framework. The 5D model, as a research-informed guiding framework, provides five critical perspectives from which we can examine how DI is carried out during the pandemic outbreak. By utilizing the framework, the current study bridges the gap between theory and practice and provides insights into future DI implementation and evaluation from a theoretical perspective. Based on the findings, the following discussion is organized around three key emerging issues.

5.1. Innovative Approaches to Cater for Learner Diversity

Consistent with previous research, the teachers perceived the pandemic as worsening the academic gap between students [54,55]. Therefore, to make learning more conducive to students, educators around the globe attempted innovative ways to provide effective virtual instruction. The digital educational innovation that has occurred in educational technology over the past few decades proved to be immensely useful during the pandemic. Amid the pandemic, the ways in which teachers engaged with, interacted with, and assessed students changed following the shift to a virtual learning environment. Teachers developed and employed multiple strategies alongside diverse online tools and applications to engage students with technology-assisted instruction and to provide extended materials to support learning.

Despite numerous efforts to introduce the integration of technology into teaching and learning processes during the past two decades, a considerable number of educators were ill-equipped and lacked the necessary knowledge and skills to integrate ICT into their instruction. While some teachers remain hopeful of a resumption to pre-pandemic normal conditions, it is crucial to acknowledge that the transformative change is profound and lasting [40]. As Jantjies [56] has argued, the COVID-19 pandemic has conclusively demonstrated that technology is "no longer a luxury" (p.2) but an indispensable component of the modern educational process. Therefore, implementing online instruction should not be viewed as a quick fix to replace the interaction in a traditional, face-to-face classroom setting. As previous study found that computer technology can be useful in differentiation [47], the

profound online teaching experiment carried out amid the COVID-19 pandemic offered new possibilities and insights regarding what works in effective education and how to respond to students' different learning needs [57]. As online learning is now commonplace, more changes in educational practices might be expected after the pandemic [40]. To promote the adoption of innovative pedagogical approaches, there is a strong need for more advanced professional development and training in technology for in-service teachers in the post-pandemic times [40].

5.2. Rethinking the Essence of Differentiated Instruction

While learning in the time of COVID-19 has been challenging for students and teachers, the moment of disruption created the opportunity to rethink what is effective in DI. One of the key shifts brought by the pandemic in education was the move away from high-stakes assessment to a more balanced and performance-based assessment of students which makes it closer to the ideal learning environment for differentiation. For example, a Chinese language teacher (P0901) used radio drama production instead of conventional pen-and-paper format to evaluate students' integrated language abilities, including organization and presentation skills. A science teacher (P0401) used timestamped questions in video clips to facilitate students' learning and monitor their learning progress. During the pandemic, school schedules suddenly became tighter yet flexible and adaptable. In one way, the competing agendas and limited instruction time compelled teachers to make decisions about what core knowledge and skills were essential to teach that is cumulative and content-specific in order to support students in building solid knowledge foundations. Teachers also granted more autonomy in adjusting the curriculum and subject content, providing students with more choices regarding their learning. By embracing the opportunities presented by the pandemic, teachers were exposed to diverse way of teaching and could continue to provide effective and inclusive instruction to their students, even in the face of unprecedented challenges.

Teachers are currently attempting to ensure that all students are able to catch up on the learning outcomes that should be achieved under normal conditions [52], and interaction seems to be one of the essential ways of minimizing lost learning during online learning from home. The pandemic has highlighted the importance of DI in meeting the needs of all students. The participants' descriptions of many of the practices in each dimension seem to be general strategies aimed at the whole class. However, the findings of the present study show that the teachers' practices were also related to group and individual level differentiation, especially for low achievers and those who had previously received less attention in the traditional classroom setting. By using technology to support DI, such as online tools and online platforms, personalized learning experiences can be provided based on individual student needs [58]. Moreover, during the pandemic, teachers conducted ongoing formative assessment more frequently to monitor student progress and adjust instruction accordingly, which can help ensure students receive appropriate support and challenge [38]. As Darling-Hammond [59] posited, assessment is an inherent element of teaching and learning. Educators are required to come up with appropriate assessment strategies that align with their instructional practices. Through the use of computer-based learning during the pandemic, differentiated assessment was able to be conducted in various formats, using technology to showcase the learning progress and outcomes of students. In this way, teachers can create a safe learning environment so that, even though learning is limited by time, students can get a taste of independence, self-correction and new responsibilities for their own learning, which can in turn increase the spirit of learning in all students [41].

5.3. Professional Learning and Partnership

The pandemic highlighted the importance of and need for continued, on-going professional development to support effective teaching. Teachers may need to rethink traditional teaching approaches and seek out professional development opportunities to effectively

meet the diverse needs of students in the new normal environment. Regarding teachers' much-needed in-service professional development, teacher professional development programs in the post-COVID-19 era should consider how they are preparing teachers to enter the ever-changing field of education. In particular, teachers should be equipped with the knowledge, tools, and resilience that will help them cope effectively with future educational challenges similar to those faced during the COVID-19 pandemic. In addition, it is important that we approach teacher professional development by providing teachers with learning opportunities that are embedded in the classroom context and constructed through experience, practice and reflection [36,60].

The growing partnership between educators is one of the positive results of the coronavirus era. Consistent with Kirshner's [42] findings, the teachers gained a stronger sense of teamwork while connecting to learn the nuances of teaching online. While the lack of face-to-face interaction and limited access to resources could complicate the implementation of DI in a remote or hybrid learning environment, the use of technology and collaboration among educators helped overcome these challenges. More advanced planning was required to conduct lessons in the virtual format, the teachers learned how important partnerships were in the process [42]. They could share ideas, resources, and strategies for DI through collaboration [25], which helped reduce the workload associated with lesson planning and assessment. As teacher collaboration is identified as one of the most important features of school culture in terms of fostering learning about teaching, enhancing the effectiveness of teaching, and promoting teacher [61]; thus, strong collaborative ties are the backbone of healthy organizations and institutions.

This study has several limitations that should be acknowledged. First, the current study aimed to capture a range of responses regardless of participants' school sector, teaching experience, and position. Future study could strive for better group representation for a more thorough analysis. In addition, the sample of teachers had been participants in a DI intervention program; thus, they may have had more knowledge and skills for implementing differentiation. They may also have had more interest in and motivation regarding this subject. Future studies could investigate the long-term impact of the pandemic on teachers' strategies for catering for learner diversity, which would add to our understanding of the sustainability of the newly developed differentiation strategies following the return to normal schooling. In addition, future study could explore how teachers perceive differentiation, particularly in the context of Hong Kong. As one of the participants mentioned, "we can hardly implement differentiation in every subject and every topic" (P0501). This caught our attention in an attempt to understand teachers' conception of DI in future study.

6. Conclusions

In conclusion, the implementation of DI during the pandemic posed significant challenges, yet the teachers also appreciated how it provided them with educational opportunities to explore new approaches to meet the diverse needs of students. At the beginning of the pandemic, the teachers were unprepared and felt as if they had been thrown into the new online learning environment. As one participant said, "the pandemic has shaken many of our core educational beliefs and led teachers to experience setbacks in their original educational concepts and methods (E0806; Primary; 20)". However, teachers were resilient and adaptable, demonstrating a commitment to reach and engage all students through online virtual platforms despite the need to quickly connect with students and switch to unfamiliar teaching methods [43]. The utilization of technological tools, such as online learning platforms and digital assessment, provided the teachers with valuable information about students' academic progress and created opportunities for individualized instruction. Additionally, the pandemic created an opportunity for educators to align and share effective strategies for integrating DI into virtual and blended teaching environments. Although teachers have experienced a particularly uncertain time in their professional lives and work, the COVID-19 pandemic has enhanced the capacity of educators to learn and grow throughout their professional trajectories [59]. This highlights the critical role of

self-efficacy in a teacher's ability to teach in all formats and environments [7]. As a result, many of the coping mechanisms developed by teachers during the pandemic are expected to shape teachers' approaches to teaching and enhance their transformative skills in the years to come [52].

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Appendix A

Table A1. Interview protocol.

Perceptions and experiences of DI implementation
1. What did you think of using DI during the pandemic?
2. Can you tell us about your experience using DI during the pandemic?
Process of DI implementation
3. What has been achieved /changed?
4. To what extent do you feel satisfied about this change?
5. What challenges did you encounter?
6. What possible solutions (resources or strategies) did you manage such difficulties encounters?
Reflections over the process of DI practices
7. What have you learnt during the process?
8. If you are going to make a change, what will you do? Why?
9. What are the important elements in making DI possible in classrooms and schools during the COVID-19 pandemic?

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