

MALAYSIAN CHEMISTRY TEACHERS' CHALLENGES TO PRACTICE DIFFERENTIATED INSTRUCTION IN CLASSROOM**Muhamad Furkan Mat Salleh*****Rose Amnah Abd. Rauf****Rohaida Mohd Saat**

Faculty of Education Universiti Malaya

rose_amnah@um.edu.my*Mohamad Hisyam Ismail**Faculty of Education,
Universiti Teknologi MARA**ABSTRACT**

Regardless of students' differences, they should have opportunities to learn in a classroom environment that adequately promotes their interests and scaffolds their progress. Often, research highlights the struggles teachers face in **accommodating learners' needs while ensuring effective lesson delivery at various educational levels**. Although there have been a growing number of studies investigating the use of differentiated instruction in chemistry, there is a scarcity of research focusing on challenges to practice differentiated instruction in chemistry classrooms, especially in the Malaysian context. This study explored **chemistry teachers' challenges to practice differentiated instruction in their classrooms**. The researchers elicited sixteen chemistry teachers' experiences selected through purposive sampling in one-to-one semi-structured interviews. Thematic analysis of the data revealed four major challenges that the teachers face: **catering to students' needs, lesson planning and delivery, support and skill and time constraints in practising differentiation**. Furthermore, it was found that teachers face more challenges on governable factors that could be rectified to help teachers successfully implement differentiated instruction. Finally, the study suggested that chemistry teachers involve in professional development training to enhance their knowledge and skills in differentiated instruction.

Keywords: *Differentiated Instruction, Chemistry Teachers, Challenges in Teaching Chemistry, Teaching and Learning Chemistry*

INTRODUCTION

In recent years, students' diversity and differences have posed a great demand for teachers to be more proactive in crafting lessons tailoring to students' demands and needs (Tomlinson, 2017; Variacion et al., 2021). Over the years, teachers, researchers, and relevant stakeholders have continuously explored the best practices that teachers could embrace in delivering lessons that would benefit students the most. In Malaysia, for instance, the notion of differentiated instruction (DI) has not been made well known until lately (Kaur, 2017). In promoting the 21st-century learning approach, Malaysian Education Blueprint 2013-2025 emphasised the need to **understand t various learners' needs in class for teachers** to create inclusive learning by adopting DI. However, though the approach is not new in the education

field, Malaysian teachers have not widely implemented it due to a lack of exposure and understanding (Kaur, 2017; Ramli & Nurahimah, 2020).

DI is a prominent approach that places learners' needs as an essential factor in determining how learning is designed and implemented in the class. Aldossari (2018) defined DI as a wide-ranging approach for learning and instruction stemming from the notion that teaching strategies need to be **differentiated and adapted to cater to the various students' needs (p.75)**. DI also is a systematic and flexible approach (Tomlinson, 2017) which can be translated into various forms of instructional practices such as flexible and ability grouping activities, tiered lesson, anchored instruction, flipped learning, and authentic assessment (Kaur et al., 2019; Ramli & Nurahimah, 2020). However, adopting the DI approach successfully in classrooms has still become one apparent challenge by many teachers (Cornelius et al., 2018). Taking chemistry as an example, how DI could be operationalised in teaching the subject on top of existing hardships that the teachers experienced? As a subject which deemed complex and abstract (Treagust et al., 2018); teaching the subject requires a theoretical explanation **which illustrated to students through multiple representations' strategies** (Davidowitz et al., 2010; Gilbert, 2006) and validated through a series of practical experience (Okanlawon, 2017) which set out **to deepen students' conceptual understanding and ability to relate to the application of the knowledge within a specific context**. However, such instructional activities demand teachers' skills and agility for effective lesson delivery. Moreover, teaching the subject in a heterogeneous classroom comprises students at different ability levels creating more instructional complexity and difficulties for the teachers (Al-Subaiei, 2017; Okanlawon, 2017). As Nusrat (2017) noted, classroom dynamics and control can be disrupted when more differences exist between students in a classroom.

Furthermore, Bekiryazc (2015) discovered that, due to a more significant number of students with varying competencies, teachers might prefer teaching at the level of moderate ability students. Consequently, more advanced students believe they are not learning much and students with the lowest ability level continue to struggle with the lesson (Chan, 2016). Besides, past studies in DI revealed that teachers faced various challenges such as scarcity of resources, lack of time, larger class size, lack of support, knowledge and training that hinder them from practising DI effectively in class (Aldossari, 2018; Lavania & Nor, 2020; Shareefa et al., 2019). Given such situations, the researchers feel there is a need to embark on uncovering challenges chemistry teachers face to practice DI in their classrooms. Although in recent years, there have been a growing number of studies investigating the use of DI in chemistry (Colegado, 2020; Cornelius et al., 2018; Jawad, 2020; Tyrina, 2021), the studies mostly venturing into the effectiveness and implementation of a specific strategy of DI in the subject at secondary and higher education levels. Moreover, a recent study by Kaur et al. (2019) in the Malaysian context **revealed an apparent gap in teachers' understanding of the purpose of practising DI and its application in the classroom context** justified the need for the researchers to conduct the study.

Therefore, the study intends to explore Malaysian chemistry **teachers' challenges in practising** differentiated instruction in their classrooms. Consequently, the study set out to answer the following research question: What challenges did Malaysian chemistry teachers face to practice differentiated instruction in the **classroom at the secondary school level? The study's outcome will better understand** the hindrances in practising DI among teachers and stakeholders and how it can be confronted for a successful implementation in the chemistry classroom.

METHODOLOGY

Research Design

This study explores the challenges chemistry teachers face to practice differentiated instruction at secondary schools in Malaysia. The researchers employed the qualitative research design as it deemed **appropriate in discovering teachers' challenges within the context of this study** (Merriam, 2009). Besides, qualitative approaches allow researchers to have in-depth comprehension and uncover the **meanings of phenomena attributed to the participants' experiences** (Tracy, 2013).

Participants of the study

The researchers selected sixteen (16) participants for this study via purposive sampling, which comprised six (6) males and ten (10) female teachers. The number of participants is considered sufficient for a qualitative study that used the interview as the data collection method (Baker & Edwards, 2012). The informants selected by the researchers via this strategy were those who have vast experience (more than five years) in teaching chemistry at school. They are also currently serving at different schools all over Malaysia. Moreover, most informants are considered experts in the subject as nine (9) of them are excellent teachers while another five (5) teachers are at the senior level. Therefore, the researchers believe that the informants have an in-depth understanding of the phenomenon under study and would be able to provide extensive insights based on their experiences.

Data Collection Procedure

The researchers used semi-structured interviews to acquire insights into informants' experiences while practising DI. The interviews were conducted individually via the google meet platform during movement control order (MCO) in Malaysia due to the COVID-19 pandemic. Each interview lasted between 80 to 160 minutes. Using the online platform for the qualitative study is deemed appropriate since it is widely adopted by qualitative researchers and provides an alternative for the researchers to proceed with the data collection process, especially during the pandemic (Carter et al., 2021). A set of validated interview protocols was used, and each participant consented to be part of the study prior to the interview.

Data Analysis

Thematic analysis was used to analyse the interview transcriptions. The transcriptions were read several times before proceeding with the open-coding process to help the researchers to immerse and familiarise themselves with the data (Saldaña, 2013). 77 initial codes emerged. Some of these codes were eliminated and merged to form the new codes through the screening and cleaning process. Data triangulation was used and achieved by comparing the analysis of the same data set by two different individuals for consistency. The researchers also used the cross-checking approach, ensuring agreement on the codes assigned to interview passages. All processes, decisions, and modifications throughout the study were meticulously documented as an audit trail. The use of triangulation, cross-checking, and an audit trail ensured the study's trustworthiness (Merriam, 2009; Patton, 2015).

FINDINGS

Challenges in practising differentiated instruction

This category refers to the aspects limiting or hindering chemistry teachers' differentiation practices. Figure 1 below depicts the summary of the research findings. The subsequent sub-headings will discuss the sub-categories further:

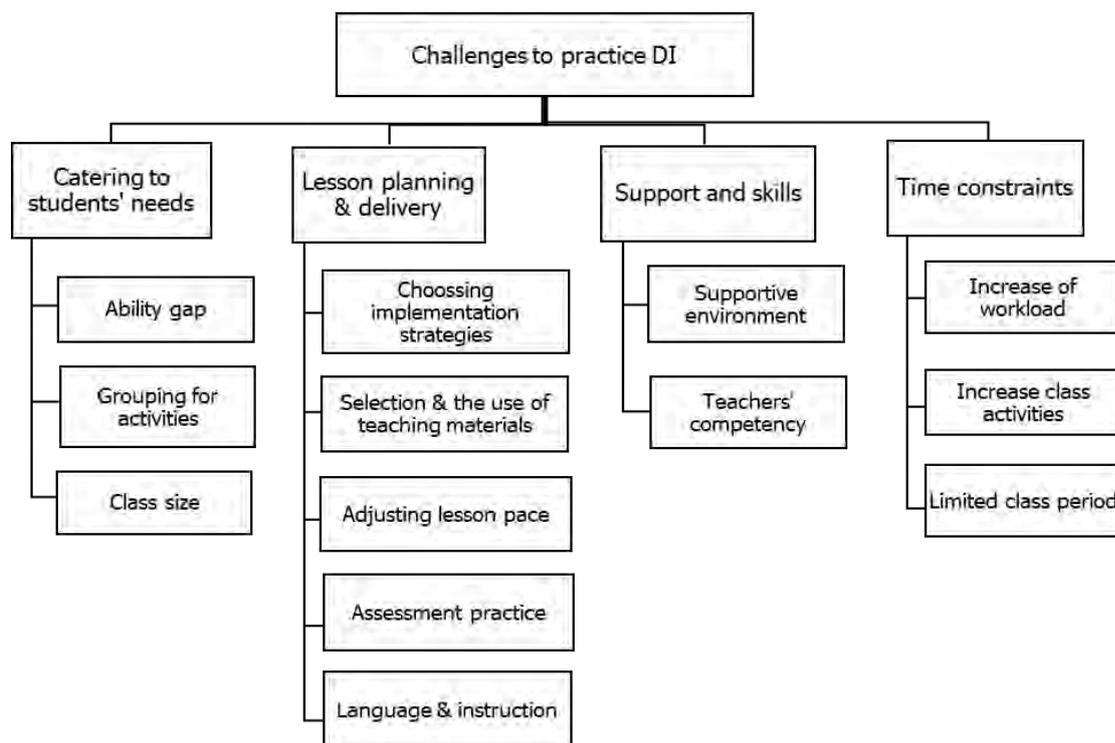


Figure 1. Summary of the Research Findings

Catering to students' needs

The first sub-category of challenges in practising DI is catering to students' needs. The findings revealed that most of them faced a great challenge in catering to students' needs due to the vast ability gap between students in class. The disparity exists in various aspects; Teacher A, for example, used 'students' performance in assessment or exam score' to describe the vast ability differences among students in her class (A, In. 290 - 292), while Teacher P described the wide gap in terms of students' readiness or prior knowledge' among his students (P, In. 121 - 126). The teachers mentioned that the vast gap raised the need to think and provide appropriate approaches specific to these individual students, which is difficult to fulfil all the time. For instance, in the following excerpts by Teacher O and F:

"The bad side here is the weak students in the class will feel that they have been left out. I can't possibly attend to their needs all the time. I can't slow down all the time just to revisit the basic knowledge..." (O, In. 112 - 113)

"I think it was a great challenge for me to have these two groups of students in my class, it was a huge gap, and sometimes I can't fulfil their expectations....." (F, In. 446 - 447)

In addition, some teachers admitted that they struggle to cater to moderate students' needs in class as they tend to focus more on students at the two extreme groups. For example, Teacher H described:

"Supposedly, I need to group my students into three levels of performances, but I rarely do that since I can't focus on moderate students. I'm so used to overseeing how excellent students doing in class while assisting the weak students to complete any tasks provided to them..." (H, In. 167 - 169)

Since the teachers mainly used group activities, the teachers concurred that DI usually utilises flexible grouping. Hence, they tried various grouping strategies to ensure students experience active learning. **However, the teachers were struggled to fulfil students' needs in grouping their students for activities. Moreover, they faced issues like 'preferred group members' among students, students' inferiority, and balancing group members' composition (e.g., ability and gender), which disrupted the lesson's differentiation plan or the flow.**

For instance, Teacher F, K and L mentioned that their students **tend to prefer to 'form group between members who are at the same ability level', especially students who are high and weak achievers in the class (F, In. 488 – 490, K, In. 172 – 175, L, In. 490 – 495).** For high achievers, the reason was more on having a productive group work as they do not assume any hindrances caused by any of the members like poor attitude and commitment towards the activity. While for the low achievers, the informants exposed that they do not prefer to be grouped with high achievers due to their inferiority and uncomfortable feelings. As described by teachers L, H and G:

"Weak students tend to have low self-esteem. They want the teacher to give special attention to them, and they do not want me to group them with the excellent students in the class..." (L, In. 461 – 462)

"..cause when I paired up weak and excellent students together, the weak students tend to feel inferior towards the partner, cause they are not at the same level, it is difficult for the student to accept mentoring by another student" (H, In. 657 – 660)

"In groups comprised of weak and excellent students, I can see the excellent students will more active, while the weak students tend to be quiet and asked fewer questions .."(G, In. 337 – 338)

Even though teachers sometimes accommodated students' requests or responded to emerging circumstances related to students' groups, they mostly adhered to their grouping plan to ensure the activity planned achieved the intended goal. Nonetheless, the teachers admitted that teachers' facilitation and monitoring during group work is crucial to ensure the students play influential roles during the group activity.

Another challenge that teachers face within this sub-category is the class size. In general, the teachers involved in this study teach class comprises between 25 to 40 students. Given the nature of DI, the teachers revealed that the number of students imposed a great challenge for them in teaching the subject. The teachers remarked that the higher number of students increases individual needs and differences that need to be scrutinised to implement DI in class. As mentioned by Teacher K and A for instances:

"In daily schools, we have more or less 40 students in each class, sometimes less., but it was not easy to keep data for each of my students and analyse each of them individually throughout the school years" (K, In. 797 – 798)

"I think it is not simple to understand the needs of each student in the class. I teach 4 chemistry classes, two in each form, 4 and 5. In each class, I have about 30 to 35 students, and in total, I have more than 120 students. So, imagine the struggle to monitor all these students' progress.." (A, In. 334 - 336)

Lesson planning and delivery

The second sub-category reports the teachers' challenges during the planning and implementation of the DI lesson. Teachers emphasised that 'student' is the central aspect that needs to be considered in lesson planning. Based on students' data and personal views, teachers decided on implementing

strategies, activities and materials that would best fit students' preferences and abilities. However, teachers are still battling with the students' acceptance and responses towards what they have implemented in class. As for what Teacher J thought, *'the method she chose workable for a certain type of students, but turned out the opposite'* (J, In. 651 – 657).

Likewise, other teachers reported that certain students showed a lack of interest in certain activities or learning materials that they used to teach particular topics in class. For example, in the case of Teachers E, J and P, the use of video in their classes produced mixed responses and reactions from their students. They claimed some students have difficulty understanding the video content and prefer to have an **actual demonstration in class. Nevertheless, some students showed 'interest' and could quickly** understand the video without much assistance from the teachers (E, In. 612 – 614, P, In. 354 – 361, J, In. 293 – 294). Another example is when weak students prefer to have fun learning in class while excellent students only see the activity as wasting their time. Instead, they prefer doing exercises that would help them score in the examination (D, In. 557 – 565). Conversely, excellent students prefer to have presentations, while weak students tend to feel less keen to participate in such activity (I, In. 657 – 658).

Specifically, for teaching materials, the researchers discovered that most of the chemistry teachers preferred to use modules consisting of a compilation of questions and handouts to approach mixed ability students in their classes. However, they revealed that the use of modules or handouts could be a disadvantage to a specific group of learners depending on the situation. For instance, if the module **or handout did not consider students' ability level or weighted towards a specific ability level (high or low)**. As mentioned by Teacher N:

"If the module is too easy, the excellent students will easily feel bored and less challenging. And if the module is slightly or too difficult, the weak students will feel less motivated as they could not attempt to answer the questions in the module..." (N, In. 235 – 237)

According to the teachers, therefore, they cannot simply use the available materials without thoroughly considering how students responded to the materials. It also means that teachers might use more than one materials for different groups of students at one time if needed. However, some teachers aired their **concern on students' perceptions of receiving different materials during class and the struggle teachers** faced to execute lessons using different materials concurrently. As described by Teacher C and E:

"If we use different materials, the instructional material's difficulty level will be different...But the implementation of it is a bit difficult. Anyway, students will ask "Why do we get easier materials compared to other groups?" (C, In. 432 – 435)

"I think we could use different materials, but we also need to consider how to manage the activity and students during class. Specifically, the implementation aspect like delivering the instruction, monitoring students' work and so on..." (E, In. 399 – 401)

Additionally, in delivering lessons, the researchers found that most teachers faced problems adjusting the lesson pace while embracing the DI. For instance, teachers opted for the moderate delivery pace **to fit a broad spectrum of students' abilities in class** (O, In. 121 – 128). However, depending on circumstances and topics, the teachers might adjust the pace to tailor the lesson to most students in **class. For instance, in Teacher K's case, when she found** that most students did not acquire the concept in a particular lesson, she would slow down and repeat the whole concept to the entire class (K, In. 390 – 393). In response, those who are excellent felt frustrated as they thought they should be investing **the time on something that benefits them other than listening to teachers' explanations**.

In contrast, most of the teachers revealed that they tend to speed up the lesson as they feel obliged to finish the syllabus as scheduled. They claimed that the implementation of DI might affect their pace as

they must explain the content and conduct activities in ways that support students' needs. If the teachers failed to complete the scheduled syllabus, they were afraid that the students will not perform well in the **standardised examination**' (e.g., C, In. 191 - 193). However, they are aware that such implementation will put those weak students at risk to be left out and demotivated. As described by Teacher D and M:

"...I think most of the teachers will use a faster pace when they need to finish the syllabus on time, students will have problems if they learn everything too fast in a short period, but they can always ask later when I discuss samples of questions in class..." (D, In. 300 - 301)

"Though we knew that weak students might be affected, I think it is important to finish the syllabus as planned..." (M, In. 690 - 691)

The next challenge that teachers face is 'assessment practice'. The teachers stated that, in practising DI, continuous assessment is an element that should be implemented on a lesson-to-lesson basis. This is because it provides the teachers with the data that reflect students' readiness to learn the future topics to help teachers prepare DI-based lessons. However, the teachers admitted that the challenge is **maintaining routine and practice assessments that could reflect students' performance**. Also, some of the teachers mentioned that students' abilities might change depending on the topic within the syllabus. They denoted, '*not necessary that the students are weak or excellent for the entire syllabus*' (e.g., D, In. 589 - 591), sometimes their '*ability to understand the topic change, depending on the nature of the topic itself or students' inclination towards the topics*' (M, In. 641 - 645, L, In. 621 - 623). Thus, teachers cannot settle on using few assessments data and differentiate the instruction solely based on the data as the students' abilities change from time to time.

The researcher found that in differentiating the assessment materials, the teachers frequently provided the students with guided and unguided questions for students with low and high ability levels. In contrast, those at the moderate level will have both types of questions in their handout. Additionally, they also used objective, structured and essay type questions to differentiate tasks for the students. However, they found drawbacks in this strategy as students at low and moderate ability levels **experience difficulty scoring in standardised examinations**. The teachers' contended that though they were encouraged to differentiate their instruction in class, the standardised examination for everyone at the end of the school term does not jive to the lesson implementation (A, In. 505 - 513, G, In. 237 - 239).

The last challenge for this sub-category is 'the use of language and instruction' during teaching and learning. Some informants mentioned challenges in the use of language when catering to students' needs in class during lessons. For example, teachers in Dual-Language Programme (DLP) mentioned that the use of English as a medium of instruction could hinder students' understanding. Besides, teachers' fluency and choice of words in the language added up to the problems. Hence, weak students or those who are less proficient in the language frequently demanded teachers to repeat the explanation by using simple words and at a slower pace (e.g., F, In. 226 - 229, I, In. 321 - 324)

In using simple words or terms for differentiation, some teachers also raised an issue on how the process could affect students' conception of specific topics. For instance, when teachers use simple words or analogies to help weaker students to understand a complex process, these students tend to have a superficial understanding of the concept or misconceptions (F, In. 410 - 413). In addition, students tend to provide answers in examinations based on the words used by teachers in class, which sometimes can be non-scientific or overly simplified from the actual concept. Sometimes, the teachers also worried that the explanation they used to help weak students could affect those at the moderate or excellent level as they overheard teachers' explanations during class (C, In. 202 - 205).

Support and Skills

The third sub-category refers to the teachers' challenges concerning support and skills required to practice DI. According to the teachers, they were encouraged to tailor their instruction to students' needs by practising instructional differentiation; however, most of the mechanisms on how DI should be implemented are unclear. In addition, some teachers mentioned that they still lack skills in practising DI (e.g., eliciting students' understanding, conducting multiple assessments, using instruction that is easier to be followed by students) (B, In. 409 – 411, M, In. 357 – 358, H, In. 624 – 629). Teachers also asserted that they need a proper guideline on how they can adjust their instructions to different sets of learners in the class:

"...The problem here is how to approach different students in the class was not clearly informed: it depends on our initiatives, understanding and skills..so we did what we knew about the approach. It would be good if we have some sort of guidelines on the approach..." (D, In. 388 - 393)

Moreover, they admitted that DI is not easy to implement unless the teachers are competent and frequently practice it in class. As such, teacher J thought that teachers need to be provided with an avenue to upgrade their knowledge and skills on DI through Professional Learning Community (PLC) activities at school.

"I think differentiated learning is not that easy to be implemented in the classroom. Unless you are practising it, that means you need a certain level of knowledge to implement it. So for that teachers have to equip themselves with the differentiation learning strategies.....and teachers can use PLC as a platform to learn and practice DI in teaching..." (J, In. 669 – 673)

Additionally, teachers also faced challenges in implementing DI as they lacked support from their working environment. For example, certain teachers asserted that it was difficult to get other chemistry teachers in the same school to commit to learning and practising DI in teaching. As an example, Teacher F remarked that it was 'hard to synergise' with chemistry teachers in her school on this matter as they are more 'exam-oriented' and felt that 'they have enough experience and skills in ensuring students get good results in examination' (F, In. 138 – 142). Aside from that, teachers also felt that they received a lack of support from the administration to employ differentiated instruction in class and find the balance between the administration workloads and energy invested in planning the approach (E, In. 301 - 305).

Time constraints

The last challenge identified from the teachers' responses is time constraint. The constraints were due to 'increase of workload' as teachers mentioned that that 'analysing students individually', 'devising strategies' and 'materials' that could cater to students' needs is time consuming (J, In. 643 – 644, A, In. 370 – 373, C, In. 423 – 425, E, In. 680 – 685). They also asserted that preparing different materials for activity or assessment can be daunting and takes much time and effort. As mentioned by Teacher O:

"In school, time plays an important factor. Sometimes teachers tend to choose an activity or approach that is more convenient...cause DI preparation itself was time-consuming. Imagine if I have to prepare a game and prepare for simulation/demonstration at the same time? It can be very tough for me..." (O, In. 384 - 387)

The participants also mentioned that conducting DI in class usually will require longer implementation time as teachers need to tier their instructions at different levels such as to the whole class, group or even at the individual student's level (e.g., P, In. 66 – 68). Furthermore, the practice also increases class activities and posed the need for extra time as teachers sometimes could wrap up the lesson entirely as they did not have enough time to conduct discussions on the assessment provided to students during

class (*G*, *In.* 312 - 315) and to re-explain concepts as requested by the students (*M*, *In.* 332 -333). Besides, teachers also need to adhere to the scheme of work they have prepared for the subject (*B*, *In.* 234 - 238) and avoid adjusting their lesson plan due to inconsistency between the planned lesson and its' actual implementation. As mentioned by Teacher E:

"Sometimes I have to reduce certain activities that I've planned for the class due to students' responses in class...some of the activities will be re-introduced in the next lesson. Though this is something I wanted to avoid as it disrupts my planning"
(*E*, *In.* 214 – 218)

The teachers also justified that the class period for chemistry is considered limited given the increases in in-class activities. It is because the subject was only allotted four periods, which is equivalent to 2 hours lesson. However, despite varying lesson approaches, activities and assessments as part of the DI approach, teachers are also required to conduct all the experiments within the syllabus, which usually takes much time to be completed. Hence, they need to opt for DI strategies or activities that do not take too much lesson time or else they will have to extend the lesson (*E*, *In.* 690 – 694; *C*, *In.* 205 - 206).

DISCUSSION

In catering to students' needs in DI's implementation, the teachers faced significant challenges due to the ability gap that exists in the class, students' demands and attitudes towards grouping practice and also the due to the class size. DI requires teachers to support the learning process rather than impart information to students, which necessitates giving students autonomy and responsibility for what and how they will perform in the learning process (Roy et al., 2013). However, while facilitating and granting autonomy to students, they may also contribute to the barriers to DI implementation (Aldossari, 2018; de Jager, 2017; Lavania & Nor, 2020). In responding to challenges related to grouping the students in class, Nhan and Nhan (2019) reported that students prefer to choose their group partner(s) rather than having them assigned to them at random by the teacher. Most students, however, wanted to be in groups with colleagues who were at a higher or the same academic level as them.

Additionally, Saleh et al. (2005) concurred that when involved in the class activities, students of similar ability are more likely to complement and build on each other's opinions resulting in more interaction and collaboration within the group setting (Fritsche, 2021). To some extent, this explains the findings on low performing students' inferiority to be placed in the group with high performing students as they feel less comfortable as they are within the same ability level. Regarding the participant's challenges on the high number of students in the classroom, Brühwiler and Blatchford (2011) posited that smaller class sizes most likely lead to higher academic progress, better student knowledge, and classroom practices. In contrast, vast class size will challenge teachers' adaptive teaching competency and ability to sustain the quality of differentiation during the implementation (Aldossari, 2018; Lavania & Nor, 2020; Taylor, 2017) and urged a more significant needs for the teacher to implement DI (Shareefa et al., 2019).

In planning and delivering DI lessons, chemistry teachers in this study faced several challenges like choosing and implementing strategies and learning materials that suit their students' needs and preferences. A study by Bondie et al. (2019) reported that planning for differentiation would be the most demanding part for teachers to practice DI, which might cause them to feel more reluctant to modify instruction in class. Additionally, studies by Nusrat (2017) and Djurayeva (2021) reported similar findings to this study, which asserted that teachers faced problems and challenges in choosing specific strategies and learning materials tailored to their students' needs. Likewise, in a study by Tolsdorf et al. (2018), chemistry teachers experienced problems preparing material that matched more high-performing students. Nusrat (2017) also contended that teachers might face a great challenge on students' reaction towards strategies and materials implemented in the classroom due to students' differences.

Concerning language proficiency and teachers' competence in delivering instruction, Magableh and Abdullah (2020) reported that students at lower ability level tend to have problems concerning the use of language in class. To rectify the issue, teachers usually implemented code-switching and simplified the

language used to meet the level of the students. Likewise, Djurayeva (2021) reported language, instruction and delivery issues as common among teachers in mixed-ability classrooms. Also, the study found that teachers in this study were aware of the need to conduct continuous assessment in practising DI. However, they lack consistency in embracing the continuous assessment as they perceived the practice as a significant challenge in practising DI (Salleh et al., 2017). Similarly, findings of a study by Kaur et al. (2019) on Malaysian in-service teachers' differentiated assessment practice raised issues on **teachers' competency in conducting DI assessment in class**. Nonetheless, Valiandes and Neophytou (2018) argued that **crafting lessons towards an impactful differentiation ultimately lies in teachers' mentality and takes much effort to sustain the practice over time**.

In practising DI, teachers in this study also aired several issues like lack of support from their surroundings, competency, and unclear implementation mechanism of DI. Without sound knowledge, teachers will not be keen to practice DI and invest more in low-preparation DI strategy without really **accommodating the learners' needs** (Maeng & Bell, 2015). Therefore, teachers need a proper guide and some standard reference and replicable strategies to support their needs as they work toward becoming **teachers who can efficiently fulfil students' needs** (Freedberg et al., 2019) and on the same time sustain the practice (Valiandes & Neophytou, 2018). In addition, Roy et al. (2013) pointed out school climate and adequacy of resources are among the aspects that teachers consider to practice DI. Hence, school administration plays a vital role in promoting the culture, collaborative works among teachers and providing sufficient support, encouragement and professional development training for teachers to practice DI in class (Al-Shaboul et al., 2021; Roy et al., 2013). Deprived of support from the school administration will cause teachers to be demotivated and more contested towards the use of DI (Lavania & Nor, 2020; Taylor, 2017)

Another main challenge that the teachers faced was time constraints, particularly due to lesson and materials preparation on top of the need to complete the syllabus, conduct experiments, and prepare students for standardised examinations. For most participants, preparation time is crucial in determining the implementation of DI in their class (de Jager, 2017; Lavania & Nor, 2020). The participants especially brought up issues like constraints on analysing individual students in their class and preparing lessons and materials to implement differentiation. Past studies asserted that teachers mainly claimed that the nature of DI was time-consuming as it requires thorough lesson planning (Magableh & Abdullah, 2020; Shareefa et al., 2019), extra modifications to teaching aids (de Jager, 2017), and a more extended implementation period as compared to other methods (Aldossari, 2018; Shareefa et al., 2019). However, **Lavania and Nor's (2020) discussion on the barriers of DI implementation contended time as a governable factor that could be altered depending on teachers' effort**.

CONCLUSION

In conclusion, despite the challenges, the teachers recognised **the need to cater to students' differences** in their classes and devised strategies to deal with their needs through differentiation approaches. The study found that the challenges faced by the chemistry teachers comprised of both internal and external factors, which majority of it (e.g. skills, knowledge, preparation of lesson and materials, etcetera) are considered as governable and could be overcome through a deep reflection and practical strategy which requires collective efforts from teachers and various stakeholders. In improving the current practice **significantly, teachers' willingness to overcome the challenges and efforts in re-aligning their mentality to assess the worth of implementing DI for the benefit of their students is very much needed and recommended**.

REFERENCES

- Al-Shaboul, Y., Al-Azaizeh, M., & Al-Dosari, N. (2021). Differentiated instruction between application and constraints: Teachers' perspective. *European Journal of Educational Research, 10*(1), 127–143. <https://doi.org/10.12973/EU-JER.10.1.127>

- Al-Subaiei, M. S. (2017). Challenges in Mixed Ability Classes and Strategies Utilized by ELI Teachers to Cope with Them. *English Language Teaching*, 10(6), 182. <https://doi.org/10.5539/elt.v10n6p182>
- Aldossari, A. T. (2018). The Challenges of Using the Differentiated Instruction Strategy: A Case Study in the General Education Stages in Saudi Arabia. *International Education Studies*, 11(4), 74. <https://doi.org/10.5539/ies.v11n4p74>
- Baker, S. E., & Edwards, R. (2012). How many qualitative interviews is enough? *National Centre for Research Methods Review Paper*, 1–42. <https://doi.org/10.1177/1525822X05279903>**
- Bondie, R. S., Dahnke, C., & Zusho, A. (2019). How Does Changing “One-Size-Fits-All” to Differentiated Instruction Affect Teaching? *Review of Research in Education*, 43(1), 336–362. <https://doi.org/10.3102/0091732X18821130>**
- Brühwiler, C., & Blatchford, P. (2011). Effects of class size and adaptive teaching competency on classroom processes and academic outcome. *Learning and Instruction*, 21(1), 95–108. <https://doi.org/10.1016/j.learninstruc.2009.11.004>
- Carter, S. M., Shih, P., Williams, J., Degeling, C., & Mooney-Somers, J. (2021). Conducting Qualitative Research Online: Challenges and Solutions. *Patient*. <https://doi.org/10.1007/s40271-021-00528-w>
- Colegado, J. C. (2020). Think-Tac-Toe Differentiated Instruction Strategy: Enhancing the Academic Performance and Engagement in Chemistry of Grade 8 Students. *International Journal of Multidisciplinary Approach and Studies*, 7(6), 64–77.
- Cornelius, N. A., Francis, E., Obinna, P., & Gabriel, I. (2018). Effectiveness Of Differentiated Instruction And Cooperative Learning On Secondary School Students’ Achievement In Chemistry. *Researchjournal’s Journal of Education*, 6(6), 1–9.
- Davidowitz, B., Chittleborough, G., & Murray, E. (2010). Student-generated submicro diagrams: A useful tool for teaching and learning chemical equations and stoichiometry. *Chemistry Education Research and Practice*, 11(3), 154–164. <https://doi.org/10.1039/c005464j>
- de Jager, T. (2017). Perspectives of teachers on differentiated teaching in multi-cultural South African secondary schools. *Studies in Educational Evaluation*, 53, 115–121. <https://doi.org/10.1016/j.stueduc.2016.08.004>
- Djurayeva, Y. A. (2021). Teaching Mixed-Ability Student in Classroom. *Academic Research in Educational Sciences*, 2(2), 1071–1075. <https://doi.org/10.24411/2181-1385-2021-00301>
- Freedberg, S., Bondie, R., Zusho, A., & Allison, C. (2019). Challenging students with high abilities in inclusive math and science classrooms. *High Ability Studies*, 00(00), 1–18. <https://doi.org/10.1080/13598139.2019.1568185>
- Fritsche, M. (2021). *Homogeneous and heterogeneous ability grouping in the EFL classroom*.
- Gilbert, J. (2006). **On the nature of “context” in chemical education.** *International Journal of Science Education*, 28(9), 957–976. <https://doi.org/10.1080/09500690600702470>
- Jawad, Z. R. (2020). The degree to which chemistry teachers practice differentiated teaching strategy in teaching from their point of view. *Elementary Education Online*, 19(3), 2271–2279. <https://doi.org/110.17051/iikononline.2020.03.735384>
- Kaur, A., Noman, M., & Awang-Hashim, R. (2019). Exploring and evaluating differentiated assessment practices of in-service teachers for components of differentiation. *Teaching Education*, 30(2), 160–176. <https://doi.org/10.1080/10476210.2018.1455084>
- Kaur, M. (2017). To recognise, realise and differentiate the learning needs of students. *Pertanika Journal of Social Sciences and Humanities*, 25(2), 503–510.
- Lavana, M., & Nor, F. B. M. (2020). Barriers in differentiated instruction: A systematic review of the literature. *Journal of Critical Reviews*, 7(6), 293–297. <https://doi.org/10.31838/jcr.07.06.51>
- Maeng, J. L., & Bell, R. L. (2015). Differentiating Science Instruction: Secondary science teachers’ practices. *International Journal of Science Education*, 37(13), 2065–2090. <https://doi.org/10.1080/09500693.2015.1064553>**
- Magableh, I. S. I., & Abdullah, A. (2020). The effectiveness of differentiated instruction by streaming: A preliminary study of current practices in the UAE. *International Journal of Learning, Teaching and Educational Research*, 19(6), 95–110. <https://doi.org/10.26803/ijlter.19.6.6>
- Merriam, S. B. (2009). *Qualitative Research: A Guide to Design and Implementation* (Second Ed). San Francisco: Josey-Bass.

- Nhan, H., & Nhan, T. A. (2019). Different grouping strategies for cooperative learning in english majored seniors and juniors at can tho university, vietnam. *Education Sciences*, 9(1). <https://doi.org/10.3390/educsci9010059>
- Nusrat, D. (2017). Overcoming the Challenges Faced in a Mixed Ability Classroom. *Journal Of Humanities And Social Science*, 22(7), 9–14. <https://doi.org/10.9790/0837-22070160914>
- Okanlawon, A. E. (2017). Teaching Chemistry to Students with Learning Difficulties: Exemplary Adaptive Instructional Practices of Experienced Teachers. *Ife Psychol/A*, 25(2), 262–279. Retrieved from <http://linkinghub.elsevier.com/retrieve/pii/S0167273817305726%0Ahttp://dx.doi.org/10.1038/s41467-017-01772-1%0Ahttp://www.ing.unitn.it/~luttero/laboratoriomateriali/RietveldRefinements.pdf%0Ahttp://www.intechopen.com/books/spectroscopic-analyses-developme>
- Patton, M. Q. (2015). *Qualitative Research & Evaluation Methods* (4th Editio). California: Sage Publications, Inc.
- Ramli, R., & Nurahimah, M. Y. (2020). Self-efficacy and differentiated instruction: A study among Malaysian school teachers. *Universal Journal of Educational Research*, 8(4), 1252–1260. <https://doi.org/10.13189/ujer.2020.080416>
- Roy, A., Guay, F., & Valois, P. (2013). Teaching to address diverse learning needs: Development and validation of a Differentiated Instruction Scale. *International Journal of Inclusive Education*, 17(11), 1186–1204. <https://doi.org/10.1080/13603116.2012.743604>
- Saldaña, J. (2013). *The Coding Manual for Qualitative Researchers* (Second Edi). Retrieved from www.sagepublications.com
- Saleh, M., Lazonder, A., & De Jong, T. (2005). Effects of within-class ability grouping on social interaction, achievement, and motivation. *Instructional Science*, 33(2), 105–119. <https://doi.org/10.1007/s11251-004-6405-z>
- Salleh, M. F. M., Ismail, M. H., Wahab, N. A. A. A., & Abdullah, N. (2017). The Malaysian science teachers' readiness and the effectiveness of professional development course for the implementation of 'Pentaksiran Tingkatan 3.' *Advanced Science Letters*, 23(4), 3263–3267. <https://doi.org/10.1166/asl.2017.7733>
- Shareefa, M., Moosa, V., Zin, R. M., Abdullah, N. Z. M., & Jawawi, R. (2019). Teachers' perceptions on differentiated instruction: Do experience, qualification and challenges matter? *International Journal of Learning, Teaching and Educational Research*, 18(8), 214–226. <https://doi.org/10.26803/ijlter.18.8.13>
- Taylor, S. (2017). Contested Knowledge: A Critical Review of the Concept of Differentiation in Teaching and Learning. *Warwick Journal of Education - Transforming Teaching*, 1, 55–68.
- Tomlinson, C. A. (2017). *Differentiate Instruction in Academically Diverse Classrooms* (3rd Editio).
- Tracy, S. J. (2013). *Qualitative Research Methods: Collecting Evidence, Crafting Analysis, Communicating Impact* (1st Editio). West Sussex: Blacwell Publishing.
- Treagust, D., Nieswandt, M., & Duit, R. (2018). Sources of students difficulties in learning Chemistry. *Educación Química*, 11(2), 228. <https://doi.org/10.22201/fq.18708404e.2000.2.66458>
- Tyrina, A. (2021). *Investigating the Attitudes, Beliefs and Practices of High School Chemistry Teachers Regarding the Differentiation of Instruction* (University of Maine). Retrieved from <https://digitalcommons.library.umaine.edu/etd/3406>
- Valiandes, S., & Neophytou, L. (2018). Teachers' professional development for differentiated instruction in mixed-ability classrooms: investigating the impact of a development program on teachers' professional learning and on students' achievement. *Teacher Development*, 22(1), 123–138. <https://doi.org/10.1080/13664530.2017.1338196>
- Variacion, D. A., Salic-Hairulla, M., & Bagaloyos, J. (2021). Development of differentiated activities in teaching science: Educators' evaluation and self-reflection on differentiation and flexible learning. *Journal of Physics: Conference Series*, 1835(1). <https://doi.org/10.1088/1742-6596/1835/1/012091>