JPPIPA 10(5) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Creating Accessible Chemistry Content for Students with Disabilities: Findings from Schools Providing Inclusive Education in Indonesia

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Received: December 29, 2023
Revised: February 28, 2024
Accepted: May 25, 2024
Published: May 31, 2024

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DOI: 10.29303/jppipa.v10i5.6755

Abstract: The trend of students with disabilities attending secondary schools providing inclusive education in Indonesia is rising. This trend requires teachers as a key person to offer learning that suits the needs and abilities of each student, including those with disabilities. This research portrays how chemistry teachers provided alternative modes of representation as one of the principles of Universal Design for Learning (UDL). Three teacher participants from three schools providing inclusive education (SPIE) in the Special Province of Yogyakarta were recruited purposively and agreed to be interviewed on how they varied the chemistry content format. A descriptive method was used and directed content analysis was applied to analyze the data. The findings demonstrated that chemistry learning content were created more accessible for students with disabilities. Three chemistry teacher participants demonstrated that they implemented the principle of Multiple Means of Representation of UDL in a simple manner. The participants created learning objectives without modifying them to suit the student's abilities. Learning content was offered in various ways and delivered with some strategies. Chemistry teacher participants demonstrated how they provided various assessments to gain students with disabilities opportunities to show their understanding.

Keywords: Chemistry learning; Inclusive education; Multiple means of representation; Student with disabilities

Introduction

Inclusive education in Indonesia is defined as an educational service system that welcomes students with disabilities to learn together with the same age peers in the same regular school and ensures rights and opportunities for learning without discrimination (Gusti, 2021; Kamil et al., 2023; Khairuddin, 2020). The inclusive education program is mandated by law as well as national and local regulations (Mayya et al., 2019; Sahib et al., 2022; Saputra, 2016). Schools that welcome students with disabilities are designated as a school providing inclusive education (SPIE), and these schools are established through statutory regulations. The Department of Education of the Special Province of Yogyakarta recorded that the number of students with disabilities attending SPIE at the secondary school level has increased yearly. These data indicate that SPIE is necessary to provide equal opportunities for students with disabilities to learn appropriately and meet the student's needs. Teachers in SPIE can collaborate with colleagues, special education teachers, paraprofessionals, and parents because teaching students with disabilities is challenging, especially for chemistry (Amatullah, 2022; Darma & Rusyidi, 2015; Juvonen et al., 2019).

Chemistry is learned by students in years 10 to 12 (secondary school), and this is an elective subject. Learning chemistry is essential because this subject is a fundamental science close to students' lives and can

How to Cite:
Wulayalin, K. A., & Suprihatiningrum, J. (2024). Creating Accessible Chemistry Content for Students with Disabilities: Findings from Schools Providing Inclusive Education in Indonesia. *Jurnal Penelitian Pendidikan IPA*, *10*(5), 2199–2210. https://doi.org/10.29303/jppipa.v10i5.6755

improve students' thinking abilities (Kamolovna, 2022; Priliyanti et al., 2021). Chemistry also involves understanding abstract concepts, reaction equations, and calculations, which are challenging for students with disabilities (Ristiyanti, 2020; Sausan et al., 2020). Musengimana et al. (2021) and Surya et al. (2021) highlighted that the difficulty students learning chemistry caused by: learning that less engaged students; low motivation, lack of interest, and negative views towards chemistry; and the way teachers presented materials are limited and they cannot associated the content with daily life.

To increase the accessibility of information and content, teachers can refer to a framework, namely Universal Design for Learning (UDL). UDL helps teachers design content/materials that are accessible and can improve students' learning experiences regardless of each individual's learning abilities to create a classroom environment that respects and values others (Al-Azawei et al., 2016; Barteaux, 2014). UDL has three principles i.e., multiple means of representation, action and expression, and engagement (Almumen, 2020; Kennette & Wilson, 2019; Rao & Meo, 2016; Rearick et al., 2021). UDL can overcome student differences by designing a more flexible curriculum because sometimes an inflexible curriculum can become an unintentional obstacle to learning (Al-Azawei et al., 2017). Plan learning using UDL combines implementation and systematic revision, which involves teaching and reflecting on what works and needs to be revised to reduce further obstacles. This process is carried out iteratively, allowing teachers to explore ways to support student diversity in the classroom (Evmenova, 2021).

Teachers can implement Multiple Means of Representation (MMR) to support students' diversity in how they access information and chemistry content. MMR is re-exposing concepts obtained in various formats to improve students' achievement with different learning styles, such as pictures, words, graphs, and diagrams (Irwandani, 2014; Matthews et al., 2022). MMR refers to the way chemistry teachers: present lesson material in various formats, for example, by utilizing text-based learning, video, and other media; mark important information in learning using text, graphics, and diagrams; create a syllabus for learning; offer simple navigation, consistent use of the learning management system; and provide timely feedback (Boothe et al., 2018). MMR can create a bridge from something abstract to concrete because learning activities can provide experiences, materials, and interactions that make them involved in learning through flexible information delivery methods according to student's abilities and needs (Gauvreau et al., 2019; Kelly et al., 2022).

Previous research has limitations in exploring how chemistry teachers represent chemistry content. As a result, information regarding accessible chemistry content, especially for students with disabilities, is limited. Most research focuses on learning strategies or classroom management for students with disabilities (Oktavianti et al., 2020; Pawlak & Groß, 2021; Polirstok, 2015). For example, Pawlak et al. (2021) highlighted that chemistry subjects are closely related to experimental activities; therefore, the teacher needs to manage the class and set several rules and their consequences to ensure the safety of each student. Moreover, teachers need consistency in responding to student behavior in inclusive classes and encouraging students to be responsible for everything they do (Polirstok, 2015). Implementing inclusive classroom management benefits teachers in achieving designed learning objectives by adjusting the abilities of each student (Oktavianti et al., 2020), while a variety of teaching strategies creates a more enjoyable class atmosphere.

Therefore, this research aims to provide information about alternative ways for chemistry teachers to present content that is accessible to students with disabilities. When students with disabilities can access information and content in an equal manner with their peers without disabilities, it will improve students with disabilities learning experiences by paying attention to the learning abilities of each individual. In addition, the results of this study are expected to provide recommendation for teachers and principals in SPIE on how they can provide better inclusive atmosphere and culture, as well as in the classrooms. The MMR of UDL can be utilized to create a more inclusive chemistry learning that applicable to determine learning objectives, teaching materials, learning strategies, and assessment approaches.

Method

A descriptive qualitative design, which describes the who, what, and where of events or experiences from a subjective perspective (Doyle et al., 2020) is applied in this research. Three chemistry teacher participants were recruited purposively, with the criteria of teachers who had taught students with disabilities for over three years. Three chemistry teachers, Rina, Silvi, and Anis, agreed and consented to participate in this research. Before the data were collected, participants were informed about the purpose of the study, and their participation was anonymous, voluntary, and confidential.

Data were collected through structured interviews to gather information about the chemistry learning process that involved students with disabilities. The

questions given to participants have been prepared according to the sequence, making it easier for researchers to compare and detect patterns from the responses given (Mwita, 2022). Interviews were conducted for approximately 60 minutes for each participant, and it was recorded. The interview data were analyzed using the content analysis method. The analysis is used to interpret interview results in depth using decontextualization, recontextualization, categorization, and compilation (Figure 1) (Bengtsson, 2016). There are three approaches to content analysis: conventional, targeted, and combined; and this research applied a targeted content analysis approach because the theory and coding sources for the subsequent analysis stage are derived from theory or relevant research findings regarding MMR.

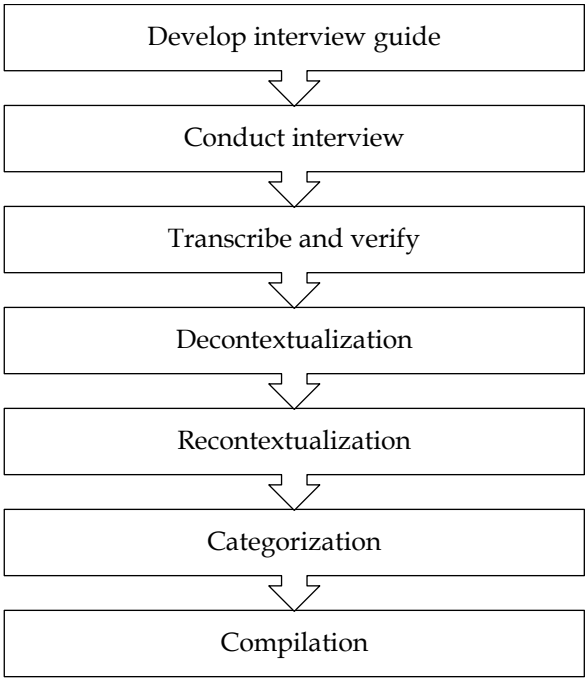

Figure 1. Data collection procedure

Result and Discussion

The MMR principles have been implemented in each participant's school in a simple way, providing more accessible information and chemistry content for students with disabilities. The interview processes are shown in Figure 2.

Chemistry teacher participants applied curriculum adaptation, in which they did not modify the learning objectives but offered various ways to achieve them. According to the ACCESS project, Colorado State University (Collins, 2023), the principle of MMR can be seen in four aspects of learning such as the way teachers design learning objectives and indicators, deliver teaching materials to students in various media, organize material and building student knowledge, as well as preparing assessments to measure the development of knowledge of students with disabilities.

Figure 2. Interview process

Designing Learning Objectives

The findings show that all teacher participants admitted to making objectives clear and specific. Based on the interviews, Rina, Silvi, and Anis designed clear and specific learning objectives by considering the cognitive, psychomotor, and affective domains. There are no differences in learning objectives between the students with disabilities and their peers. For example, in Anis's classroom lab activities, all students were required to do acid-base reactions, but for a student with physical disabilities, Anis offered virtual lab work. Anis mentioned that she tried to provide all students similar opportunities to do lab work, even though students with disabilities participated in less work, such as differentiating litmus papers, and then continued working in a group with their peers. Anis explained:

> "*During the lab work, the student with disabilities was offered a virtual lab. Our school provides two types of lab work. When the students do lab work, the student with disabilities is provided a virtual lab and maximizes the group activities to discuss their work. For example, the student with disabilities observes the changes in litmus paper. Even though the student with disabilities has limitations to do the lab activities, the objectives for them remain the same as their peers*".

These findings indicate that teachers place high expectations for students with disabilities and provide alternative ways for them to access learning. Learning objectives are the first thing teachers must design because learning objectives can direct teachers to create student success in following the learning process (Budiastuti et al., 2021). Referring to Revised Bloom's Taxonomy, learning objectives can be classified into three domains, cognitive, psychomotor, and affective, which determine students' ability to learn from the

results of learning activities (Magdalena et al., 2020).

Learning oriented towards the revised Bloom's Taxonomy can be adapted to student characteristics and designed and utilized through active learning theory. The active learning theory applied in this revised Bloom's taxonomy-oriented learning includes student-centered learning, goal-based learning, orientation towards discovering new things in learning, independent learning, use of varied media and learning resources, involvement of all parts of the body and the five senses in learning, and involving social interactions (Sudirtha et al., 2022). Sudirtha et al. (2022) further shows that the implementation of Bloom's taxonomy revision-oriented learning has a positive impact on students' metacognitive abilities, where students can learn actively, reflect on their abilities, and be confident and honest about their knowledge. Bloom's Taxonomy can be used as a learning tool to help in designing learning objectives because it can control cognitive development and help increase students' metacognitive awareness where increasing students' metacognitive awareness can lead students to deeper and more meaningful learning (West, 2023).

Three teacher participants grouped learning objectives into essential and non-essential, especially for students with disabilities. Based on the interview, all teacher participants asserted that they reduced non-essential learning objectives for students with disabilities. Anis mentioned that she has considered the conditions and needs of students with disabilities while still providing essential and non-essential learning objectives. On the other hand, Silvi stated that if she did not have adequate time to teach some topics, she would skip non-essential objectives. In implementing learning, teachers admit to reducing non-essential learning objectives and focusing more on essential objectives. This reduction allows students to focus on basic competencies such as literacy or numeracy (Syam et al., 2023). Teachers and students are not too burdened by the demands of completing all learning outcomes (Wiguna & Tristaningrat, 2022).

The interviews showed that Rina and Anis had implemented the SMART (Specific, Measurable, Achievable, Relevant, Timely) and ABCD (Audience, Behavior, Condition, and Degree) strategies in designing learning objectives. However, Silvi chose to use the ABCD strategy. These two strategies are popular to be used in Indonesia. The SMART strategy explains the learning objectives' elements (Chatterjee & Corral, 2017). The SMART strategy can be written using specific guidelines by describing the learning objectives in detail, using a transparent measurement system such as when and how much of the learning objectives have been achieved, establishing whether the objectives are achievable, appropriate and relevant to real life, and can be completed within the specified target time (Rusyandi & Rachmawati, 2017). The ABCD strategy, on the other hand, is an essential element that, in its preparation, does not have to be arranged in ABCD order but must contain all of these elements (Arapah, 2017). These elements are students who listen to the teacher's teaching, student behavior, conditions and situations created to achieve a learning goal, and the level of student mastery of the learning material that has been provided (Syahputra, 2022). The ABCD strategy is used to assess measurability, conditions, and goal criteria (Yamanaka & Wu, 2014).

Teaching Materials

The findings show that all teacher participants provided students with various teaching material formats. The following are several formats of teaching materials given to students to support the teaching and learning process. Teachers provide learning materials for students with disabilities in various formats. In summary, the format used by teachers in delivering learning material in the three schools studied is presented in Table 1.

Table 1. Teaching Material Formats Offered for Students

Teaching material format	Rina	Silvi	Anis
Text	√	√	√
Picture	√	√	√
Audio	-	-	-
Videos	√	√	√
Models	√	√	√

Based on the interviews, teachers usually present material in text, images, videos, and models, such as atomic models in 3D form. Rina mentioned:

> *"Students with disabilities can use all learning formats the same as other students. If the student experiences a lag in recording the learning material, the teacher provides relief by taking notes using notes on a cellphone."*

For the Deaf student, Anis provided learning formats other than audio because they cannot hear through their sense of hearing. Anis explained:

> *"Maybe using the audio format in chemistry learning is not important. Because chemistry is usually more suitable for videos where images appear and can be repeated, audio formats will be needed in music arts and English subjects."*

Teaching materials is anything that can be used to stimulate the learning process and convey messages to students so that effective learning can be created (Frasnyaigu et al., 2023). Suitable teaching materials are teaching materials that can support students' abilities in understanding and communicating science (Asikin &

Yulita, 2019). The teaching materials can be combined with learning strategies and models according to the students' needs. The process of developing teaching materials can be adapted to existing learning objectives (Fatimah et al., 2023). Teachers can present it in text form, for example, PowerPoint, student worksheets, images, atomic models, molecular models, and even videos according to students' needs. According to Anis, if there is a lack of understanding of the material, the Deaf student will watch it repeatedly until they understand the material being presented. Thus, the presentation of various formats of learning material teachers provide helps students understand complex chemistry learning material.

Students' disabilities will impact the process of receiving the material the teacher provides. Therefore, teachers must adapt to the conditions and needs of their students by presenting material in various teaching formats, both visually and verbally, so that the material can be readily digested by students with disabilities (Pino & Mortari, 2014). The use of video is closely related to visualization in the form of images. The video format can provide advantages for Deaf students because they can rely on other senses, especially sight (Khasawneh, 2023). However, there are still various considerations in providing teaching materials in video format to Deaf students, including time speed, selection of material and image objects, font selection, colors for narrative text, and following the content of the learning material so that it can help students to gain a good understanding. in terms of theory and practice (Kurnia et al., 2019). The learning style of Deaf students is usually visual and kinesthetic, so apart from videos, teachers use graphics, posters, pictures, and writing to protect their hearing disabilities (Sabiq & Sukirno, 2020).

Teaching Methods

Findings show that teacher participants use several options to build students' knowledge when compiling materials. The following is a description of the ways teachers build knowledge of students with disabilities. Teachers have an essential role in the classroom's teaching and learning process. Chemistry teachers must be able to develop a complete learning design so that abstract chemistry learning concepts can be conveyed to students because learning conception is essential in student learning behavior, especially at higher education levels (Priyambodo & Wulaningrum, 2017).

Linking New Concepts to Prior Knowledge

The three teachers linked new concepts to students' prior knowledge based on the interview. Linking previous concepts with new concepts to be studied positively affects student engagement in class and can reduce students' cognitive load (Dong et al., 2020). The learning process occurs because there is a combination of new skills and knowledge into the skills and knowledge that students already have so that students can build and discover their knowledge (Stehle & Peters-Burton, 2019).

Associating knowledge with new concepts can form a memory integration process, forming a consistent knowledge schema for students (van Kesteren et al., 2018). A simple example that can be applied is giving instructions to read, where reading is an interactive process when the reader is involved with the text while connecting and utilizing previous knowledge. By utilizing previous knowledge, readers can discover new facts and essential concepts (Mafarja et al., 2023).

Highlighting Essential Concepts and Explaining How They Relate to the Objectives

The results of the interview analysis show that the teacher admits that she always underlines essential concepts and explains their relationship to the learning objectives that students will achieve. Delivering learning material to students by underlining important concepts and linking them to learning objectives is very important. Science learning, including chemistry, considers in-depth scientific literacy regarding concepts, theories, principles, scientific processes, and their complex relationships. Therefore, it is necessary to break it down into essential parts or concepts (system thinking) so that students can receive the material easily (Hrin et al., 2017). Underlining important concepts is done to make it easier for students to achieve learning goals and provide an overview of the subject matter provided in the teaching and learning process at that time.

Beginning Each Lesson by Presenting an Outline of the Material to be Discussed and Ends Each Session with a Summary of the Essential Points

The interview shows that the teacher started learning by conveying the material and sub-material to be studied. At the beginning of the lesson, the teacher takes students to look at events in everyday life or currently trending topics. Rina mentioned: "We take our students to reflect their daily lives, more directly into application. For example, incidents or use of substances in the environment. So, when events are trending, we discuss them together." Then, at the end of the lesson, the teacher invited students to conclude the learning material that had been presented. For students, especially Deaf students, the material is concluded in writing or can be combined. Rina asserted: "Speech-impaired students are sometimes also asked to convey learning conclusions using writing."

The role of the teacher in providing an outline of the material discussed at the beginning of learning is crucial to prepare students to start learning and provide a complete picture of the subject topics to be learned. Thus, an approach is formed that will lead the teacher to know what students need (Wulandari & Setiawan, 2023). Then, the role of the teacher in ending learning is no less critical as a conclusion to the learning that took place that day, thereby helping students to build new knowledge that has just been obtained.

Explaining Important Concepts Both Written and Verbally

The three teacher participants admitted that they always explained essential concepts in their interviews in writing and orally. However, presenting material is always a challenge for them. The teacher can choose to explain orally, in writing, or both. When a teacher faces a class containing diverse students, the teacher must have an effective way so that all students can understand the concept's explanation. The interview results show that the teacher always explains essential concepts in writing using a blackboard and orally with discussion. For Deaf students, if the oral and written explanation of a concept is not well understood, then the student will be helped by a peer. The teacher also admitted to assisting Deaf students and using lip language to communicate with them.

Creating an Active and Participatory Teaching and Learning Process

The interviews show that all teachers continually make learning active because, in the Independent Curriculum, the teacher is considered a facilitator and gives students more space to build their knowledge. Teachers also admitted in the interview that they created participatory learning. For example, Rina mentioned that when students ask questions, other students give answers or opinions. After that, she would add to the answers given or provide feedback. Rina explained her experience when she applied the Jigsaw Learning Model to create an active and participatory class. Rina said:

> *"The Jigsaw learning model is simple and can form collaboration in groups. In addition, student participation in the lab work is high. When the work took place, the students were very enthusiastic. Students with disabilities were also active and still involved in lab activities. Other students will help students with disabilities if they have difficulties."*

The modern teacher's role in the classroom is as a facilitator, where the teacher provides more opportunities for students in the learning process and facilitates students to learn optimally by using various methods, strategies, resources, and learning media (Purnama, 2018). Building active and participatory learning will teach students more about their needs (Gessiou, 2022). However, in creating a participatory classroom atmosphere, for example, in group work, students tend to be more relaxed; this will undoubtedly hinder the process of achieving learning goals, so teachers need to design special steps to reduce this risk (Ciobanu, 2018).

Using a Student-Centered Learning Approach to Teaching

The interviews showed that the three teachers stated that they always adopted a student-centered learning approach, so students also had a role in learning in the classroom. In the student-centered learning approach, students can build their knowledge to obtain in-depth learning, thereby improving the quality of students (Saputro, 2018). Through student-centered learning, students gain knowledge by actively participating in learning. Student-centered learning requires good interaction between students and teachers, so the role of teachers should be considered (Krishnan, 2015). The teacher acts as a facilitator who will direct and guide students to remain on the right path in solving difficulties (Latif et al., 2020). Student-centered learning can increase students' understanding in acquiring knowledge, critical thinking skills, and learning motivation (Dong et al., 2019). In addition, student-centered learning can provide opportunities for students to improve analytical skills, problem-solving skills, skills in understanding learning in-depth, and self-directed learning (Ameliana, 2017; Ardi et al., 2021).

Relating Learning Material to Examples or Applications in Everyday Life

According to the interview results, the teacher always used relevant examples in explaining chemical material; for example, in thermodynamics material, the teacher connects endothermic and exothermic processes with events that occur in real life. Anis explained:

> *"For example, when discussing thermodynamics, students must be able to measure temperature and differentiate between exothermic and endothermic. So, I will usually lead and provoke students to see events around them, and then the students themselves will actively learn to understand these events."*

Problems often occur in learning process are conceptual errors or misconceptions because chemistry contains a complex and abstract material. These misconceptions cause students facing difficulty in constructing new concepts during learning (Ardi et al., 2021). Using events that occur in real life in the learning process can motivate students' learning levels because it is easier for students to remember the concepts presented, and these concepts will be more meaningful (Rutumalessy et al., 2023). Students can process new information or knowledge so that it makes sense to them (Alfian, 2019). Linking learning to events in the

surrounding environment is one innovation towards learning that cares for the environment. It also helps students think critically and creatively in solving potential problems (problem-solving skills) (Santoso et al., 2022; Wahyuni et al., 2020). Moreover, it is very helpful in describing chemical concepts that are abstract.

Another strategy teachers use in compiling learning materials is differentiated learning, sorting and selecting materials that suit each student's abilities. The learning objectives are the same in this case, but the ways to achieve them differ. When students with disabilities do not understand the teacher's explanation of the material, students with disabilities are welcome to ask questions or discuss with other friends. The main focus in implementing differentiated learning is to emphasize teacher activity as implementers of the learning process who can analyze the conditions and needs of students in the school (Faiz et al., 2022). Teachers can consider several aspects in implementing differentiated learning: students' interests, level of readiness, and learning styles (Wahyuningsari et al., 2022).

Assessment Method

The findings show that teacher participants use accurate assessment methods to measure students' knowledge development. The following are ways teachers can design research methods to measure the development of students' knowledge.

Developing Direct Objectives Assessments, Even Before Designing Learning Content

Based on the results of interviews, teachers always develop an assessment of the objectives, even before designing learning materials. The development of assessment tools can be done without designing learning materials as long as they are adapted to the learning objectives (Gürler & Baykara, 2015).

Using Alternative Assessments (in Addition to Traditional Quizzes and Exams)

The results of the interviews show that teachers are considering creating alternative assessments for students with disabilities, such as oral and project assessments. Alternative assessments are assessments teachers give instead of traditional quizzes and exams. Types of alternative assessments can be portfolio assessments (such as project reports and presentations), journals (such as reading activity responses, study notes, and study strategy notes), and self-assessment and peer assessment (Evenddy, 2017). Alternative assessments provide a means of assessing student skills that cannot be assessed directly with traditional tests. Alternative assessments can also help teachers find the proper assessments to implement in the classroom and determine what students need (Alokozay et al., 2020).

Providing Instructions on How to Complete Assignments and Assessments, Both Orally and in Writing

The interview results show that the teacher always provided instructions for the tasks orally and in writing. For example, if there is a question about filling in a table, the teacher explains verbally or in writing how to fill in the table. Rina explained: "For example, I give you a table, then I direct you on how to fill in the table. So, for example, to find molarity, I will give directions on what steps you need to look for to find molarity using some cycle."

Good instruction is basic in teaching practice because instruction determines whether students can grasp the meaning of what they are supposed to do (Sowell, 2017). There needs to be more than just providing written instructions. Teachers need to add verbal instructions but use short and unambiguous terms so that students understand the instructions given (el Kemma, 2019).

Setting Clear Expectations/Goals and Feedback

The interview results show that the teacher provided clear goals and feedback by emphasizing that the material to be studied was essential. Apart from that, teachers also always provide feedback on the assignments carried out by students. The teacher provides feedback depending on the student's discipline in submitting assignments. So, the grades of students who submit assignments on time will differ from those who submit assignments beyond the specified time limit. Teachers have an essential role in providing clear goals and feedback to students. The teacher must provide a stimulus with the expected response to get students' responses or feedback because the students' responses will depend on the stimulus offered (Sukarso et al., 2022). Feedback can be used as a guide to build the student's capacity as a learner and identify areas that need improvement (Obilor, 2019).

Creating an Assessment Rubric to Ensure the Objectivity of the Assessment

The interview results show that teachers always use assessment rubrics to ensure the objectivity of assessments for students. Apart from ensuring the objectivity of assessment, creating rubrics can be intended as a teacher's hope for students in providing evaluative criteria in the assessment (Chowdhury, 2019). Rubrics can also be used as an effective reflection tool about the ongoing learning process (Rini & Purnawarman, 2019).

In general, Rina stated that students with disabilities deserve to study at their school because this high school provides adequate learning facilities and infrastructure, a friendly environment, and teachers who regularly carry out inclusive education training.

Trained teachers with the ability to organize strategies, methods, and supporting materials, as well as adequate knowledge and skills, are essential in supporting the education of children with disabilities (Istiyati et al., 2023). Unfortunately, Rina stated that they were not ready to accept students with visual impairments due to the lack of facilities at the school. In line with Rina's statements, Anis admitted that students with disabilities deserved to study at their school because the environment was amicable and supportive. However, physical building accessibility is still lacking. Anis's School does not yet have an elevator to the 2nd floor, so students with disabilities can only use the facilities on the 1st floor. The three teacher participants agreed that the biggest obstacle and challenge for a teacher in dealing with classes with diverse students is not to discriminate between disabled students and other students. The lack of accompanying teachers for students with disabilities and the inability of teachers to respond to questions from disabled students who tend to be highly curious are also challenges in themselves.

Conclusion

Chemistry teacher participants have implemented aspects of MMR to enhance opportunities for students with disabilities to learn and increase their participation. Participants designed learning objectives that are mostly clear, specific, measurable, and achievable. The teaching materials are developed in various formats according to the needs and learning styles of students with disabilities so that students can more easily access them. The teaching methods participants use can build students' knowledge and skills in varied ways, so each student can gain their understanding. Assessment methods are created to accurately measure the progress of students' knowledge and skills, although the methods need to be varied to increase the way students with disabilities demonstrate their knowledge and skills.

Acknowledgments
Thank you to the Institute for Research and Community Service (LPPM) and the Department of Chemistry Education UIN Sunan Kalijaga Yogyakarta for funding assistance to complete this article.

Author Contributions
Conceptualization, J. S.; methodology, K. A. W.; riset instrument, J. S.; data retrieval, K. A. W.; data curation, K. A. W.; writing—original draft preparation, K. A. W.; writing—review and editing, J. S..: visualization, J. S. and K. A. W.. All authors have read and agreed to the published version of the manuscript.

Funding
This research was funded by Institute for Research and Community Service (LPPM) and the APC was funded by Department of Chemistry Education UIN Sunan Kalijaga Yogyakarta.

Conflicts of Interest
The authors declare no conflict of interest.

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