

Conference Paper

Barriers in Teaching Science to Students with Special Needs: Exploration From Teachers' Perspectives

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Abstract

Previous research has identified the benefits of science learning to support post-school independence of children with special needs [9]. However, the portion and quality of teaching science to these students is still very limited. This study aimed to explore the barriers faced by teachers in teaching science to children with special needs in both special schools and inclusive school settings. A mixed methods approach was employed to understand the implementation of science learning for children with special needs, especially the support and obstacles faced by teachers and students with special needs. Data were collected through structured interviews and observations of science learning. Interviews and observations were conducted in 11 special classes and 9 inclusive classes when teaching science to reveal the didactic method used by the teacher and the student responses. Guided interviews were conducted with teachers (n = 20, 15 female and 5 male) to understand the teaching process and obstacles experienced. The results of the interviews and observations were validated through a focus group discussion, which was attended by 7 participants. The quality of textbooks with adjustments for students with special needs was found to be the major challenge for teachers as they explained that they have limited time to adjust the content themselves. It was also identified that there is a need for teachers to shift their mindset, as they focus on students' learning problems as teaching barriers. This study calls for professional development for teachers, with a focus on mindset, teaching strategies and accommodation in science subjects, which would enable teachers to support students with special needs in special and inclusive classrooms.

Keywords: science teaching, students with special needs, barriers in teaching

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1. Introduction

Inclusion practices in developing countries (e.g., India, Bangladesh, Indonesia, Cambodia, India) is mandated and implemented as a top down policy [1, 2] that still require more support to implement government policies [3] especially to integrate local wisdom and values that align with inclusion [1].

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As students with special needs enroll in regular classrooms, teachers competencies require to be supported because its success of inclusive practices depends on teachers' knowledge and skills [4] in the area of learning assessment, differentiated instruction, classroom management and collaboration skills [5]. However, practicing teachers reported inadequacy of their formal training and feel less prepared to teach students with special needs in general in developed countries [6, 7]. In developing countries, a literature review conducted by Sharma and colleagues (2013) [1] revealed more challenges than developed countries in terms of the adequacy of teacher preparation program which provide limited content about inclusive education and limited role model. Inadequacy of teaching trainings also found in specific subject (e.g., science education [8]) that calls more studies to explore and filling the empirical gap.

The need to increase teacher competence to teach students with special needs related to government policies requirements and the demand for supporting diverse learners at schools. Current Indonesian government regulation (PP) number 13 of 2020 mandated all school levels from elementary school to post-secondary schools to provide learning accommodation for students with special needs. Following the regulation, the enrollment number of students with special needs in inclusive schools continues to increase year by year in Indonesia and 49% of its population is targeted to enroll in public schools by 2024 (Ministry of Education and Culture, 2019).

In Indonesia, all students, including students with special needs, are required to study 6 fields of study, one of which is science from elementary to junior high school and the choice of science pathway at high school level. Current regulations mandated schools and teachers to provide adequate accommodation for students with special needs in regular schools (PP no 13 of 2020). In another word, students with special needs will have science instructions from special education teachers and subject or classroom teachers. Furthermore, both special and regular teachers require to collaborate to provide adequate learning adjustment.

Teachers' unpreparedness in general to teach children with special needs experienced by special teachers, especially in mastering teaching materials and regular teachers in adjusting the content and deliver the instruction [9]. This is a challenge to provide adequate teacher preparation programs and teacher training that answer the needs of teaching competencies for the diversity of students. Villanueva and colleagues (2012) [9] state that problems regarding the preparation of compartmentalized teacher candidates are the cause of less teacher readiness. Prospective science teachers study science materials and teaching strategies intensively but rarely discuss how teaching strategies are appropriate for students with special needs. On the other hand,

prospective teachers specifically study a variety of teaching strategies for students with special needs but do not delve into teaching materials, especially in the fields of study at the junior high school and high school levels. Therefore, many science teachers are not ready to teach children with special needs and special teachers are also not ready to teach science.

The preparation of special teacher candidates in Indonesia has included subject matter including science [10], however, this has only been done in the last 10 years. Therefore, it can be ensured that special teachers who teach in special schools who graduate before the last 10 years do not receive material in their field of study, including teaching science. On the other hand, teaching science is stated to bring benefits related to the independence of children with special needs [9, 11]. The need for didactic mastery of teaching science methodology for children with special needs is also supported by previous scholars [12, 13] which underline science is a suitable field of study to be taught in various classes including all types of disabilities in public schools. Therefore, support for increasing teachers in the field of science studies and special teachers related to special methodical didactics teaching science for children with special needs and collaborative teaching abilities is needed [14].

Previous studies on teaching science to children with special needs in the last 5 years in developed countries provide recommendations for teaching practices in regards to curriculum, instruction, and assessment. Lynch, S., Taymans, J, Watson. W, Ochsendort, R, Pyke, C., Szesze, M., (2007) [15] investigated the impact of highly qualified curriculum based on criterion according to Project 2061 Instructional Analysis and revealed the effectiveness of the curriculum for both students with and without special needs. Even though this study did not report type of disabilities, but they recommend some criteria of science curriculum include taking account students ideas, engaging students with relevant phenomena, developing and using scientific ideas, promoting students thinking about phenomena, experiences, and knowledge. The instruction techniques that effective for students with special needs also has been explored. Structured inquiry based teaching is suggested by previous studies [13, 16, 17], with additional support (peer support and explicit instructions). Peer support will enable teachers to improve all students participation in heterogenous class so the content-area learning can be enhanced [16]. Some of teaching accommodations in teaching science are suggested which include reteach vocabulary with explicit instruction, use manipulatives, modelling the concept, record the explanation, small group instruction, and multisensory teaching [16, 17]. Specifically for students with visually impairment, the

use of assistive technology and multi modalities of learning (kinesthetic and tactual) are helpful in students' understanding of science concepts [19].

In Indonesia, previous studies revealed teaching practices in science which focused on text book [18], lecturing and practice are the most teaching strategies [20]. Both practices hinder students with disabilities in learning science. Challenges of teaching science in Indonesia has been explored by Ediyanto and colleagues (2020) [19, 34] from general perspectives (e.g., curriculum changes, diverse needs of students, and teaching competence in inclusive classroom). This paper does not focused on empirical facts and mainly based on authors perspectives so that it cannot be generalized about teachers challenges and constraints that need to be supported. Therefore, this research focuses on tracing the barriers to teaching science from the teachers perspectives in inclusive schools and special schools. This study aims to understand the problems faced by teachers in teaching science of students with special needs so that efforts to improve the quality of science learning can be identified.

2. Science Education for Students with Special Needs

Three benefits of teaching science for children with special needs were stated by Scruggs and Mastropieri (2007) [21]. For students with sensory and physical impairments it can enable them to develop compensatory abilities, for example: observing, manipulating, and classifying phenomena. Students with intellectual disabilities benefit from increased knowledge of the world in general, as well as the development of scientific process skills (e.g. observing, classifying, predicting, inferring) and applying these skills to their own experiences. Additional benefits of teaching science are also described by Scruggs, Mastropieri, and Boon (1998) [22]. The first benefit, namely: broadening the experience, especially for students who have limited experiences. For example, children with visual impairments will have a tendency to have minimal mobility if they are not introduced to explore their surroundings. Teaching science provides more opportunities for these students to understand their environment with various sensory functions. The second benefit is: science teaching includes skills and knowledge that are important for adult preparation. For example, students with mental retardation have a vulnerability to unpleasant actions. Through science learning, they can learn about self-safety so that they can act more swiftly when someone wants to do something bad. The third benefit is that science learning can develop problem solving and reasoning skills through scientific activities. Another benefit is that science learning is easier to involve the participation of students with various special needs in public schools because the teaching uses

a lot of practice. The various benefits of learning science above actually have many challenges in learning.

Various challenges regarding science teaching have been researched in developed and developing countries whose results are not much different from the situation in developing countries, namely leading to teaching science that is predominantly using textbooks and poor teacher readiness. Science teaching in both developed and developing countries is still dominated by the use of textbooks and lectures [18, 21, 23]. Scruggs and Mastropieri (2007) [21] emphasize the negative impact of content-driven models when teaching is focused on textbooks in regards to less focus on inquiry and extensive reading which hinder many students with disabilities who have reading problems.

Teaching science has many benefits for children with special needs, however it has many challenges in terms of teacher readiness and availability of textbooks [9]. Teachers' insufficient readiness to teach science to children with special needs is due to the fact that very little time is spent teaching science, especially for theory and practical skills related to special education. In addition, a separate teacher preparation program makes many science teachers unprepared to work with students with special needs and special teachers unprepared to teach science. The second challenge is the existence of text books and science practicum books that are not accessible for students with special needs. The chances for the success of science in students with special needs are very less, especially those who have difficulty reading texts or writing to demonstrate an understanding of science. Barriers to children with diverse special needs demand flexibility in teaching teachers in science.

The main thing that supports teaching science for children with special needs is revealed, namely the relationship between academic material and daily life [11]. The results of previous review by Spooner, Browder, Jimenez, dan DiBiase (2011) [24] shows that effective teaching for children with special needs includes: the use of systematic instruction (for example: task analysis, giving prompts and systematic feedback), this approach is also effective for children with moderate to severe specificity. Brooke and Solomon (2001) [25] stated that direct activities in discovery settings are beneficial for children with intellectual disabilities. Teaching with various approaches such as systematic instruction and graphic organizer is also found to be effective based on research by Knight, Spooner, Browder, Smith & Wood (2013) [26]. Inquiry teaching has various impacts: it is ineffective [27] and effective with peer-mediated embedded instruction [28]. These mixed results warrant further research.

Based on the literature review above, there are some similarities in the obstacles in science learning that are found in developed countries and in Indonesia. Although several science teaching strategies have been found that have proven effective in developed countries, however, empirical research is needed to further clarify the problems faced by teachers and students with special needs in Indonesia. This is an effort to trace evidence-based learning strategies to be applied.

3. Material & Methodology

3.1. Data

In the preliminary study, the population in this study were teachers in inclusive schools and special schools in Yogyakarta, Indonesia. Table 1 shows the demographic data regarding the subjects of this study who taught science to students with special needs. The determination of the research subjects was carried out with a purpose (purposive sampling) with the consideration of adequate support from the education office to explore best practices in teaching science in Yogyakarta. The subjects of this interview consisted of class teachers and subject teachers, students with mild disabilities. In the second phase, the Focus Group Discussion (FGD) was conducted with 7 teachers who provide consent to join the FGD for 2 days which was conducted online. At the end of the FGD, a video call was made to confirm the results of the FGD.

TABLE 1: Demographic data of participants

No	Item	N	%
1.	Gender		
	a. male	5	25
	b. female	15	75
2.	Type of school		
	a. Special School	9	45
	b. Inclusive School	11	55
3.	Education Background		
	a. Undergrad-Special Ed major	9	40
	b. Undergrad- Education major	11	55
	c. Undergrad-Non teaching major	-	-
TOTAL		20	100

3.2. Method

The approach used in this research is a mixed method study approach. Combining quantitative and qualitative data is carried out to improve the meaning of research results through triangulation [29]. In addition, research with a mixed approach is also carried out to complement each other, increase validity through triangulation, and provide different perspectives on complex phenomena [37].

A sequential explanatory design method was selected in this study to understand the teachers' barriers in teaching science for students with special needs. This design includes two stages of quantitative and qualitative research [35] to understand the pattern of barriers that increase teachers and students in science learning. This design was chosen because in order to explore general patterns of barriers to learning science through surveys and then to explore more deeply through focus group discussion.

The survey data was collected through structured interviews which intended to explore the various barriers experienced by teachers in inclusive and special schools in teaching science. The results of this structured interviews are grouped and presented in percentage form to see general patterns regarding obstacles to teaching science. The grouping of survey results was developed from the results of the literature review on research related to teaching science in Indonesia. Open questions are given to anticipate factors that are not included in the question. The results of these preliminary observations were analyzed using descriptive statistics to see the general trend of teachers obstacles in teaching science for students with special needs. This result determined the in-depth search in the FGDs. The FGDs were conducted with teachers to confirm findings from preliminary observations related to obstacles encountered in science learning. The FGDs were transcribed verbatim and each transcription was carried out after the researcher conducted the interview for further coding analysis. Researchers analyzed qualitative data by develop coded, generated categories and themes [36]. Documentation in the form of lesson plans for science learning became material for data triangulation.

4. Results and Discussion

4.1. Results

Initial observations and interviews conducted in 20 schools, found that children with special needs in 1 class ranged from 1-10 children with abilities equipped with 2-4

children in the class. Most of the obstacles in teaching science based on teacher's narrative lead to the limited number of media, limited time for teaching science and the scope of science material that is too broad. A visualization of the results of this initial interview can be seen in Figure 1.

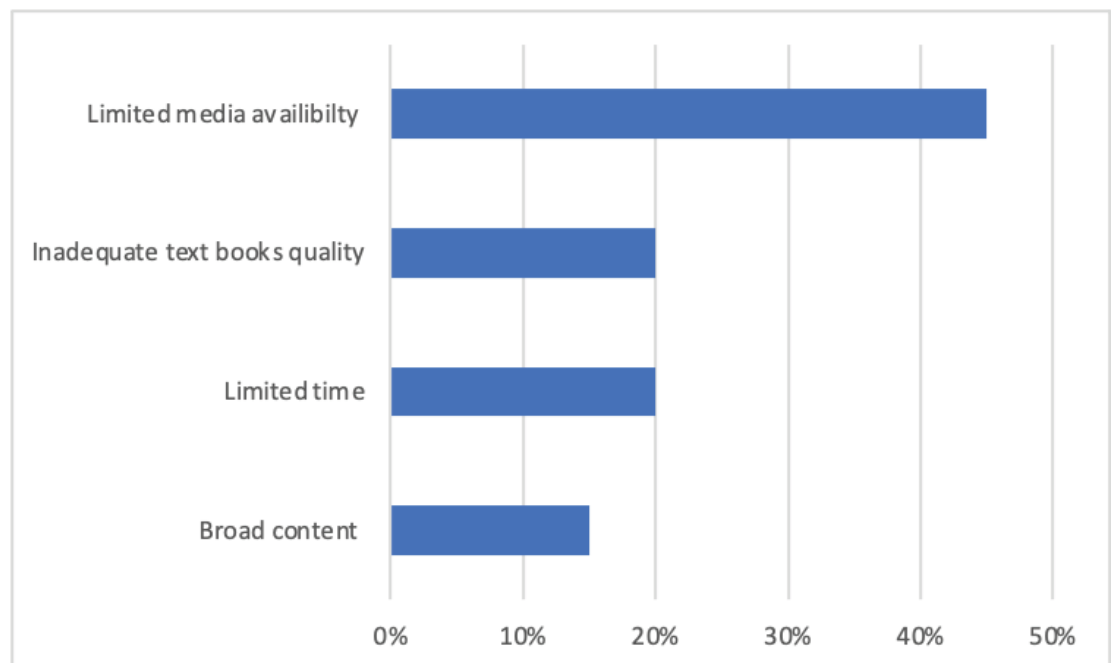


Figure 1: Obstacle in teaching science for students with special needs

In terms of student conditions, respondents reported that children's cognitive limitations were the biggest obstacle in learning science because children found it difficult to understand abstract things. In general, the constraints from the student's side can be seen in Figure 2.

The obstacles mentioned above were still found even though the teachers in this study stated they had used direct practice methods in science learning as set out in Figure 3.

The teachers in this study also stated that the learning resources of students had used real objects around them besides using textbooks and worksheets as shown in Figure 4.

The performance evaluation that had been carried out by the teachers in this study included multiple choice ($N = 85\%$), description questions ($N = 80\%$), and performance tests ($N = 65\%$).

The obstacle mentioned above arose because almost 60% of the participants stated that they did not receive adequate preparation when taking teacher education, while 40% of the other teachers stated that they had received science preparation for ABK

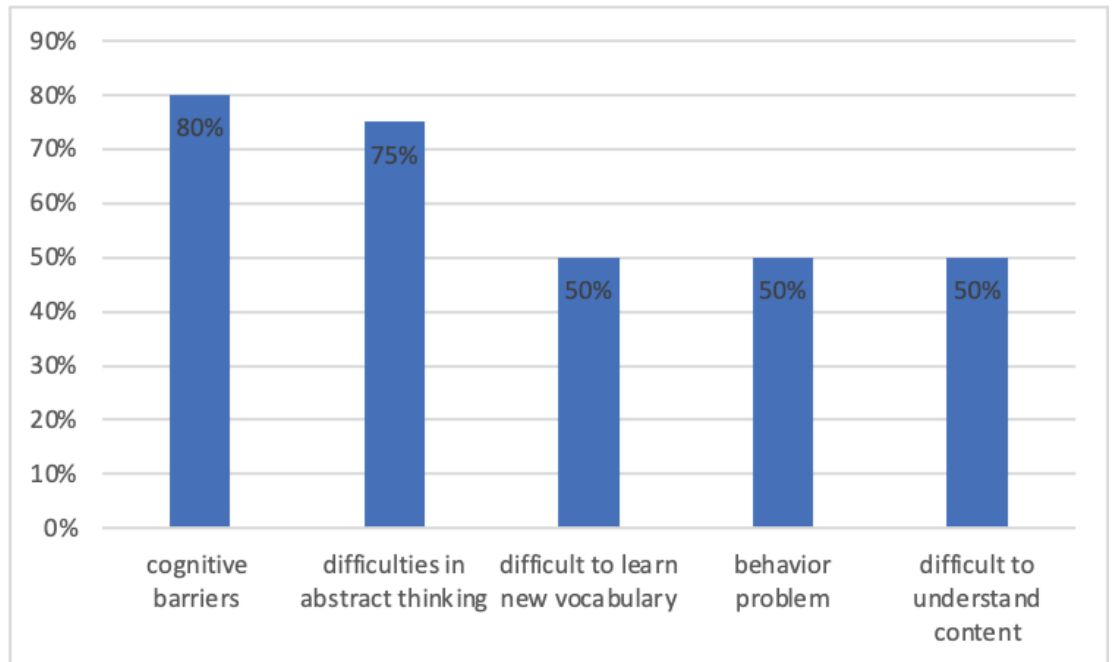


Figure 2: Teaching science barriers in terms of students' condition

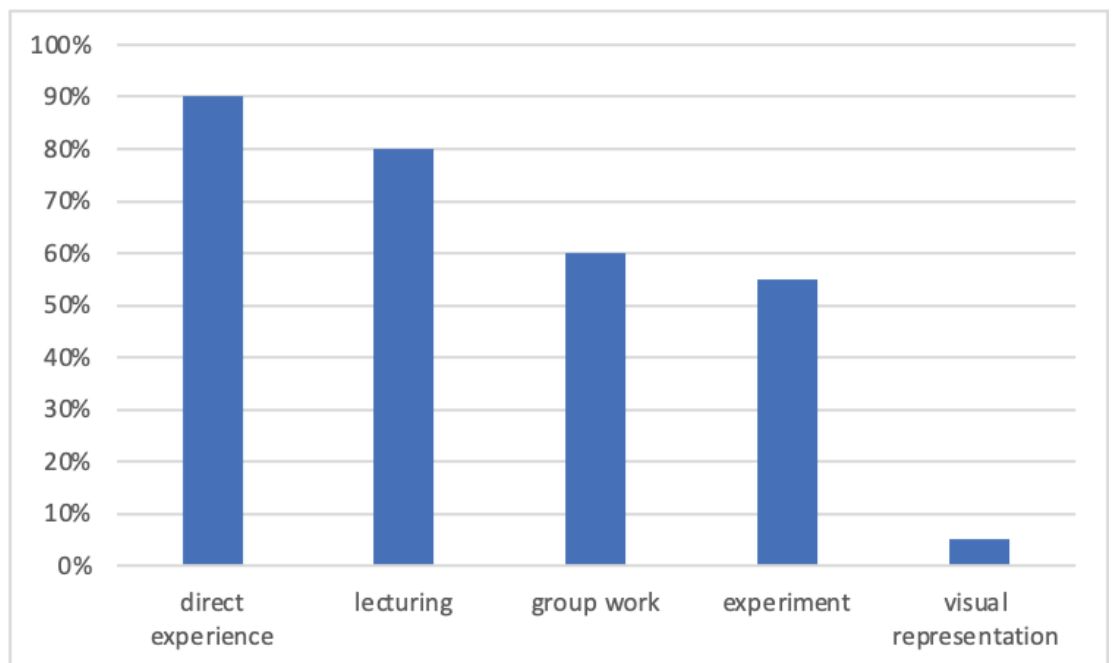


Figure 3: Teaching strategies in science for students with special needs

when taking prospective teacher education. In addition, the majority of teachers ($N = 70\%$) in this study also stated that they did not receive specific training on teaching science for children with special needs, while the rest said they received training during their teaching career.

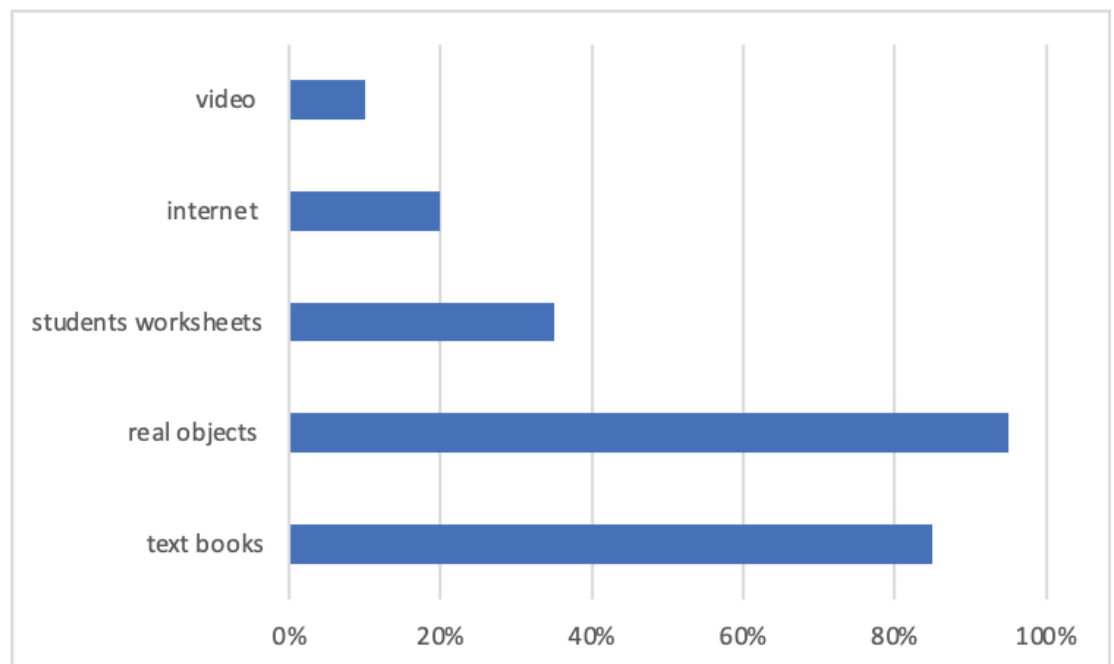


Figure 4: Learning resources used by teachers in teaching science for students with special needs

The conditions found above were traced during the FGD, which was attended by 7 participants who teach in inclusive and special schools. In this FGD, facts were found regarding the support and needs of teachers for strengthening science learning in inclusive schools. The support obtained by teachers in inclusive schools related to science learning for children with special needs in the city of Yogyakarta includes:

1. The existence of Special Assistance Teachers (GPK) in schools. FGDs participants stated that the existence of GPK supports learning in general, not only learning science because there are teachers who support children with special needs when they struggle in learning.
2. Provision of Educational Tools (ET)/ Games by schools. The existence of this ET was stated by one of the FGDs participants related to school policies in the provision of infrastructure related to learning themes in each class. However, the number of APE in schools is not sufficient to be used by students in a class, so they have to take turns. In other schools, the use of ET was not always available, so some teachers stated that they missed the activity to do science experiments. The use of everyday easy-to-find tools for science experiments helps children with special needs to be active in science learning. One of the teachers stated the following:

“ET is provided by schools according to the theme, the number is limited so it cannot be used for all children. Specialization of children affects the flexibility provided by the teacher,” (FGD, #Teacher 1, August 2020).

Other participants chose to use this media in demonstrations based on the risks that might occur, including the trial using fire.

“Learning through concrete media is very necessary, especially for children with special needs so that learning can be successful. Therefore, we often take children out of the classroom to do research / observations. At certain times we use media in the form of a model if it is not available in the school environment. Meanwhile, for high-risk materials (using fire, sharp objects, chemicals), we use demonstration methods to minimize accidents,” (FGD, #teacher 2, August 2020).

Based on the information above, the use of concrete media helps children with special needs to be actively involved in science learning. This experiment can be carried out regardless of the presence or absence of media or ET in schools because teachers describe the use of tools and materials that are easily found everyday around the school and home.

3. Universal Design for Learning (UDL) training organized by the Special Education Division in collaboration with universities.

Several inclusive teachers in the FGDs forum stated that they received UDL training so that they made learning innovations, one of which was often taking students outside the classroom to learn. Teachers' statements that support this are as follows:

“The application of UDL supports children's learning, the use of media [which I use is] more varied. (FGD, #Teacher 1, August 2020).

Programs from agencies and schools that support teacher competence in teaching in general in this study also have a direct impact on science learning. Although not specifically intended for a particular field of study (e.g., science subject), the principles of learning in UDL were found to be sufficient to assist teachers in adjusting their learning. The school policy for the allocation of Indonesian government funds which supports the provision of learning infrastructure also helps teachers to be able to access the media needed for learning. However, teacher creativity to overcome obstacles in science learning when the diversity of students in one class demands that modification of learning is still needed.

The supports that teachers need in science learning for children with special needs in both inclusive and regular schools leads to a supplement to the flexibility of science learning. The supplement includes material modification and evaluation of learning that

can be used by teachers. Some teachers stated that making these modifications was takes time but necessary caused by:

1. The existence of textbooks is currently not in accordance with the conditions of diversity and student learning needs so that modification is absolutely necessary.

Almost all FGD participants stated that the existence of limited media and unmodified textbooks for ABK. Therefore, we need examples of media modification and the availability of supplements that support the modification of science learning for children with special needs in inclusive schools and special schools.

This need is related to the diverse abilities of students in both inclusive and special schools. The diversity of students' abilities in this class requires teachers to make modifications to teaching material and in learning evaluation. The teachers' accounts on which these findings are based include:

“At certain times we use media in the form of a model, if the school environment is not available. Meanwhile, for high-risk materials (using fire, sharp objects, chemicals), we use demonstration methods to minimize accidents. Because the textbook was not suitable, I modified it by taking material from various sources including the internet (videos and pictures) and deaf student books that fit the material (because there were lots of pictures and simple explanations). (FGD, #teacher 4, August 2020).

In addition to the diversity of students' abilities in the classroom and disability conditions that require modification, the teacher also stated other obstacles, including limited time.

The diversity of students' abilities, especially cognitive barriers that make it difficult for students to remember, causes teachers to repeat material frequently and requires modification in the delivery of material in class.

“When learning to use media directly, children understand more quickly. However, the ability to memorize is very low. So, when learning science today with the help of concrete media students will understand, but if asked to answer questions about the material that has been studied the next day the students have forgotten. Examples of media that I use in observing changes in the form of objects are using a stove, water, pot, camphor, and refrigerator.” (FGD, #Teacher 4, August 2020).

2. Time is limited for making modifications because teachers also do administrative tasks that they need to fulfill.

“But another obstacle is, in modifying it takes a lot of time. Meanwhile, there are also many administrative obligations.” (FGD, #Teacher 5, August 2020).

3. The assessment carried out by the teacher is sometimes not in accordance with the fulfillment of the necessary modification needs. This implies the need for teacher assessment skills to determine student’s current abilities in order to develop appropriate learning objectives. The teacher’s statements related to this included:

“My students are in the same condition, with intellectual disabilities with different abilities. Because the textbook was not suitable, I modified it by taking material from various sources including the internet (videos and pictures) and books with lots of pictures and simple explanations. But another obstacle is that modifying takes a lot of time. Meanwhile, there are also many administrative obligations. The results of assessments carried out to modify the material sometimes become inappropriate for one reason or another.” (FGD, #Teacher 3, August 2020).

In an inclusive school, one of the FGD participants stated that although his teaching was able to engage students with the use of concrete objects and their [students with special needs] engagement in class could almost be found in science learning, at the time of evaluation of learning teachers still had difficulty in making modifications. Several other teachers said that they had simplified questions for children with special needs but were still unsure about the appropriateness of the evaluation modifications they had made.

Several important points highlighted by the FGD participants point to the need for supplementary modification of science material for children with special needs, namely:

1. Preceded by the stage of assessing the child’s current abilities

In the teacher’s explanation above, it is implied that there is a need to increase the ability to assess children’s current abilities that require more improvement. Teachers’ ability to assess students’ abilities will later underlie the selection of suitable modifications for children with special needs.

2. Integrate the use of experiments closely with everyday life. One of the FGD participants gave an example as follows:

“The case is like what I did. For example, material about the use of sunlight in life. Learning is not only in the classroom with an explanation of the function of the sun for life (it is abstract) which is difficult for students

to understand. Therefore, I take my students outside the classroom to wash and dry clothes (incidentally at our school there are clothes as tools for self-development). From here the children will find it easier to understand the material being taught.” FGD, # teacher 2, August 2020).

3. Learning modifications offered to anticipate the diversity of abilities of children with special needs in one class. Therefore, it can be given activity stages that the teacher can choose based on the results of the initial abilities. The stages of this material are also associated with the evaluation stages that can be adjusted to the child’s abilities. Teachers’ statements that support this include:

“There is a difference between the materials for the crew members during the evaluation, for example: being asked to tell the process of animal breeding, only in order. Lowering the difficulty level, and rendering of pictures. Student participation is active in class and they just need guidance. An example of an adaptation that is done is writing down the answer, the child spells out the letters when answering. Quiz questions made by yourself, matchmaking, rewriting, drawing, counting objects.” (FGD, # teacher 2, August 2020).

In general, the obstacles faced by teachers in inclusive schools and special schools are related to how to assess the learning needs of students with special needs that must be met because of their disabilities. The need to modify learning is currently supported by teacher training and the existence of ET in schools but it is not sufficient. The existence of material supplements and learning evaluations for children with special needs is needed for teachers so that they are able to provide services without neglecting the fulfillment of other students’ learning needs.

4.2. Discussion

This study found similar barriers faced by participants in teaching science in inclusive schools and special schools, namely around the diversity of children’s learning needs that require modification, especially textbook modification. Most of the participants ($N = 16$, 80%) in this study revealed that science teaching was delivered in the form of lectures and obstacles in the text book that were not accommodating for children with special needs ($N = 17$, 85%). This finding is in line with previous studies [9, 18] which found that most teachers teach science by lectures and rely a lot on textbooks. Children with special needs with reading disabilities and have a limited attention span will have difficulty following the teacher’s explanation. Teachers’ understanding of the

various learning needs and various teaching strategies are important to know in order to provide appropriate modifications [21].

The diversity of learning needs that was most commonly found in this study were cognitive barriers that made it difficult for children to remember the facts that were learned. The impact of this is that the child becomes difficult to do the same learning evaluation with other friends and requires modification. Their learning activeness was found to run well when the teachers provided concrete media and used direct experiments that could be done. However, cognitive barriers is students condition that require support and adjustment from teachers. The attributional theory [30] help to understand this situation. Internal factors relate to different actions because when an individual perceives events or other people's actions differently, then the perceptions lead to different actions. For teachers who perceive their failures are due to controllable causes (e.g., low effort), they might work harder to achieve success because they can control future actions. However, when teachers believe that their teaching failures are the result of an uncontrollable cause (e.g., students low cognitive ability, tasks difficulties, bad luck), then this leads to less motivation. Furthermore, shifting teacher mindset to see the problems is more about inadequacy of learning rather than blame students conditions is required.

The support currently received by teachers is closely related to programs organized by the local educational agency, which include training programs and placement of special teachers in inclusive schools. Although the training held by the educational agency is general in nature (for example: UDL-based learning training), this has resulted in changes in teachers in the use of various methods in delivering learning, increasing student participation, and in evaluating learning. This finding is in line with the findings of previous studies [31] which provides flexibility in the form of video games and additional reading material for children with specific learning difficulties. Marino and colleagues (2014) [31] found that there was an increase in the active participation of students with special needs but the use of UDL was not significant enough to increase the learning achievement of students with special needs. It can be understood that UDL gives students flexibility to be involved in learning but specifically does not yet fully answer the specific learning needs they need [32]. The existence of special education teachers in inclusive schools helps teachers to determine the learning needs of students with special needs and helps classroom teachers in the modification of learning as needed. In this situation special education teachers have the competence to teach children with special needs so that they can become a suitable team for classroom teachers. Villanueva et al. (2012) [9] also stated that the readiness of these special teachers

was low when teaching subject areas because they were not equipped to master in-depth material while classroom teachers lacked mastery of teaching strategies for children with special needs. Therefore, the presence of special education teachers in inclusive schools can be a teaching team for classroom teachers and mutually integrate knowledge in teaching materials and teaching strategies for children with special needs.

In addition, the school programs also helps teachers, especially in terms of providing ET. However, in quantity, the amount of APE is not sufficient for all students to use and not all schools allocate the use of funds for providing ET based on the themes in the curriculum. Therefore, the need for support for science learning for children with special needs was successfully collected in this study leading to the need for supplementary modified material intended for children with special needs. This supplement includes assessment of children's abilities, tiered material stages and tiered evaluation from simple to complex. The scope of this assessment is in line with the suggestions given by Bancroft (2002) [33] which include: a) assessment of children's abilities (memory skills, reasoning skills, mobility, student communication methods, children's abilities in science and language lessons, and interest in learning presentation.), b) activities in accordance with these abilities, c) appropriate context (age, children's interests, and familiarity), d) opportunities to optimize the use of multisensory, e) design learning models that are close to the real world, f) structure of discussions and questions direct, g) strategies that support language needs (for example: use of pictures, word cards, simple letters, and short sentences), h) support for numeracy needs (measurement scale with pictures, use of non-standardized measurements, data visualization), and i) flexibility over necessary changes.

5. Conclusion

The obstacle faced by teachers in inclusive schools and special schools in learning science for children with special needs is the availability of reading books that are not accommodating to the learning needs of students with special needs. In addition to this, the currently available support, such as training and media availability, is deemed inadequate to meet the learning needs of students with special needs in the classroom. Most of the participants have already made modifications, but the teachers are not sure about the suitability of these modifications. The limited time needed to design and prepare material modification and evaluation for teachers implies the need to develop science teaching material supplements for children with special needs as well as increase teacher competence through training. Some of the findings above provide

directions for practical suggestions and further exploration for further research. The existence of special education teachers in inclusive schools is the first step in providing learning based on children's needs, however, there are still many inclusive schools in other areas in Indonesia that do not have support from special education teachers. This situation creates burden for either classroom teachers and subject teachers to handle students with special needs with less support. Future research can also be focused on development of curriculum adjustment for science learning support for special needs especially to serve those who have learning barriers in inclusive and special educational settings.

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