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The Development of Integrated Science Process Skills among Primary Pupils Based on Classroom Assessment

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Abstract
The focus in science education for primary schools are scientific skills and thinking skills as the primary source of knowledge acquisition of science through inquiry approach. The Science Process Skills (SPS) are part of scientific skills that are needed to find answers to problems or making decisions systematically. Nevertheless, it has been found that the SPS achievement of primary school pupils remains unsatisfactory. Thus, this study focuses on the development of pupils' integrated SPS via the implementation of a science curriculum in elementary school based on classroom assessment. Data were gathered from six teachers and twelve fifth-grade pupils selected purposively. The findings show four themes related to the development of pupils for integrated SPS; (1) pupils understanding towards six integrated Skills, (2) problems in mastering integrated SPS, (3) pupil's effort to understand SPS and, (4) pupils ask friends to explain the SPS. As a conclusion, most of the pupils are not able to master the integrated SPS based on their responds and sharing session during the interview.
Keywords: *Science process skills, classroom assessment, primary science curriculum*

Introduction

Science education is critical for society's futures. Science education was introduced to all pupils in primary schools as early as year one using the Standard-based Curriculum Primary School. This curriculum is designed to foster science literacy by providing pupils with science-based knowledge that will enable them to become science-literate by grasping the concept of fundamental science that occurs all around them and being able to follow science learning at the primary level (Curriculum Development Division, 2017). The primary focus of science for primary schools is on scientific and critical thinking skills as the primary means of acquiring knowledge in science through an inquiry-based approach.

Literature Review

In Science Process Skills (SPS), which are also included in scientific skills, are taught to pupils beginning in the first year with only two fundamental skills and gradually increasing in complexity with age and level of achievement. SPS are required to solve problems or make decisions in a systematic manner (Curriculum Development Division, 2017). However, previous research indicates that SPS performance among primary school students remains unsatisfactory (Eng Tek Ong, & Bibi Hazliana Mohd Hassan, 2014; Tilakaratne, & Ekanayake, 2017). The problem is worsened by the fact that the majority of science teachers demonstrate a lack of readiness to deliver the SPS in the classroom. This situation occurred as a result of teachers failing to plan for the specific SPS that should be incorporated into teaching and learning. Given the critical role of pupils' SPS in facilitating meaningful science learning, it is inevitable that there will be a need to assess pupils' SPS performance (Ong Eng Tek et al., 2012). Hence, this study will concentrate on the development of pupils' integrated SPSs through classroom assessment.

SPS are viewed as a problem-solving ability in which a problem is represented, and a systematic process is followed to arrive at a solution (Amnah et al., 2013; Duda; Newcombe, 2019). SPS are therefore specialised skills that facilitate science learning, activate, or motivate pupils to become extremely committed to their learning or studies, as well as develop pupils' sense of responsibility for self-directed learning, and increase the persistence of learning and research methods.

The SPS can be categorized into basic SPS and integrated SPS (Carin & Sund, 1985; Collette & Chiappetta, 1986; Padilla, 1990; Wellington, 1994). Integrated SPS are considered as hierarchical higher skills than basic SPS (Collette & Chiappetta, 1986). Individuals with developed SPS may have a more persistent, more meaningful knowledge based that is far from false conceptualisations, as they take part actively in the process of obtaining information and they structure their information by themselves under supervision of their teachers Integrated SPS requires a more advanced knowledge based (Joseph et al., 2017). Integrated SPS include six elements: using space and time relationships, interpreting data, defining operationally, controlling variables, making hypothesis, and experimenting (Curriculum Development Division, 2017).

Classroom Assessment is a technique for determining a pupil's learning after he or she has successfully completed an assignment. This information is then stored in the form of reporting data. This data can be used as evidence to substantiate a claim, particularly one involving pupil learning (Black & Wiliam, 2018). According to Frey and Schmitt (2010), classroom assessment is used to enhance learning sessions by providing feedback to both students and teachers. This process occurs during the T&L session and has no impact on student grades.

Methodology

The research design for this study is qualitative that focusing on case study. Twelve year five pupils are selected in this study from purposive sampling. Data were gathered from six teachers and twelve fifth-grade pupils selected purposively for the multiple case study. For this study, the pupils' selection is based on their attitude and the different level of academic performance especially in science subject. All the data collected in this study is from interview sessions. Due to the Movement Control Order (MCO), the interview sessions were carried out in virtual where the researcher used the platform of Google Meet apps to meet all the twelve participants individually. The triangulation for a qualitative method is employed and analyzed using NVIVO 12 Plus software.

Results and Discussion

Pupil's Understanding Towards Integrated SPS

Pupils understanding towards six integrated SPS can be described as how the pupils perceive and define each integrated SPS based on their knowledge. According to the Primary Science Document Standard, all six integrated SPSs have been implemented to students since year 4. However, these integrated SPS are not introduced in part but as a whole. As a result, some students are shocked by the integrated SPS and are making slow progress in understanding and adapting to it. The first integrated SPS is based on the relationship between space and time. We can see from the verbatim that one pupil almost has the same idea as the real concept of using space and time relationships. His response demonstrates that he has a thorough understanding of the skill. Despite the fact that the pupil's performance level is four on the classroom assessment report, he manages to react sensibly to this talent.

"Using the space and time relationship is describing the establishment of parameters such as location, direction, shape, size, volume, weight and mass with time"

[IV:Idi Amin:18.12.20]

Other pupils, on the other hand, seemed to be struggling with the concept of using space and time relationships. They clearly misrepresent the context and description of the skill based on the excerpt. Damya, a pupil respondent, concluded that 'time' refers to local time, whereas 'space' refers to adequate time. This pupil has most likely misinterpreted this skill and requires additional instruction from the teacher.

"Using time for local time. Use a certain space to do something. For example, packing."

[IV: Damya:17.12.20]

Data interpretation is the next integrated SPS. Interpretation is the ability to read, make sense of, and infer valuable assertions from incoming data. In order to make logical inferences and generalisations, data produced or collected during investigations needs to be presented in precise terms. Averages, ratios, graphical representations, and even more advanced statistics can all be employed to aid in our decision-making (Joseph et al., 2017). Based on the excerpt, it appears that the pupil is attempting to provide the best explanation for data interpretation.

"Data interpretation is the correct description of an object and the events that occur on the object."

[IV:Idi Amin:18.12.20]

"Overall this technique offers a way to extract and examine data and obtain patterns"

[IV:Damya:17.12.20]

Some pupils believe it's a technique to extract data and analyse patterns, while others think it's a means to describe an object or event. Both responses are acceptable and demonstrate that these pupils utilised the skill in accordance with their understanding. Even if their comprehension does not encompass the entire concept of data analysis, it demonstrates that they are compelled to apply it to their limited knowledge. According to Yeany et al. (1986), an eleven-year-old pupil who is still learning concrete science concepts will have difficulty mastering abstract science topics. This is because it has been proven that a pupil's degree of reasoning has a consistent impact on the quantity of learning he can do. Data interpretation leads to logical assumptions and generalisations, which leads to future experiment expectations. As science teachers, we may help students in analysing ideas that have been formed based on findings. This is a skill that the theories, or concepts, must foster. This is the way science operates (Joseph et al., 2017). As a result, science teachers should engage students in activities that entail the development of interpretive abilities.

The next integrated SPS is defining operationally. According to the results of the verbatim interview, pupils have difficulty explaining the definition and concept of operational definition. This condition may cause confusion among pupils who are learning this skill. Because the students don't understand what the term "defining operationally" means, their responses are useless. The following is an example of an excerpt from their work:

"Give meaning to variables."

[IV:Damya:17.12.20]

The pupil just guesses the definition of defining operationally without realizing the precise context, as evidenced by this excerpt. Operational definitions, according to Joseph et al. (2017), are the foundation on which current investigations can be capitalised. The definition is usually not very extensive, yet it can effectively communicate what the thing is. Operational definitions are created to address situations in which there are no prior definitions. Surprisingly, one pupil gives a positive response to this skill.

"Defining operationally is a statement of a concept by stating the things that is done or observed".

[IV:Idi Amin:18.12.20]

Based on this excerpt, the pupil may have mastered the concept of operational definition, as the response provided looked compelling and nearly identical to the real meaning. This could be due to the fact that the pupil has been practising a lot of questions on how to answer operationally defined questions that he has got from tutoring sessions. As a result, the pupil can gradually improve their understanding. This result is reinforced by the idea that students can only succeed if they are given the opportunity to put their skills to use (Padilla, 1990). Students can only be taught to become masters of integrated process skills after extensive practise. It will be easier to build formal thinking patterns as a result of this.

One of the integrated SPS that looked challenging and tough to the pupils was controlling variables. Keeping one scientific variable fixed while adjusting the others to obtain consistent improvements in an experiment is known as controlling variables. A variable is an event, occurrence, phenomena, or anything else that can affect and effect the results of a study (Joseph et al., 2017). Based on the observations from the online class, it looks that the pupils have a basic understanding of the variables. This is seen through their discussion in the Google Meet classroom.

Teacher *Ok next is controlling variables, how many variables in science that you know?*
Pupil 4 *Three*
Teacher Correct, there are three…what is it?
Pupil 6 *Manipulated variables, fixed variables, responding variables*.

[OV:27.1.21]

Based on the interview verbatim, it is found that most pupil are confused and have no idea the what the variables mean.

"Controlling variables is a process of controlling an object."

[IV:Idi Amin:18.12.20]

"I am not so sure about this skill"

[IV:Zahin:17.12.20]

Pupils have no idea what variables mean, but they are taught how to identify different types of variables using a set of criteria. However, it's strange when a pupil claims to be able to manage a variable without truly understanding the concept. Another pupil thinks that controlling variables is the same as controlling an object, which is incorrect. This entire excerpt demonstrated that the pupil respondent lacks mastery of the skill of managing variables. In order to arrive at or uncover basic concepts, the entire approach of research and scientific investigations is heavily reliant on changing variables. In science experiments, control experiments are performed to categorise and control variables that can influence the outcome. Controlling any variable will aid a learner in recognising trends and staying focused on controlling variables in reality situations. As a result, if pupils do not grasp the skill of controlling variables, conducting a Science research or experiment may become difficult.

Making hypotheses is a further integrated SPS learned in primary science. A hypothesis has been proposed on how to solve an issue. It's a guess or an observation that will be modified or validated with more research. Making a hypothesis is described as making a general statement about the relationship between the manipulated variable and the responding variable to explain an observation or event, as mentioned in the curriculum document. The statement can be put to the test to see whether it is true (Curriculum Development Division, 2017). However, the pupils' responses reveal a wide range of responses, indicating their level of understanding.

"Making conclusion"

[IV:Zahin:17.12.20]

"Make a reason to explain the experiment that has been done."

[IV:Fatin:27.11.20]

The pupil respondent's response indicates that they are having difficulties describing this SPS due to a lack of understanding of the concept of hypotheses. Some pupils attempted to connect the concepts of conclusion and justification. They tend to use the term conclusion since some teachers taught pupils how to answer conclusion-type questions in the same way that they answered hypothesis-type questions. As a result, when the researcher inquires about their thoughts on forming hypotheses, the pupils may be perplexed. When she mentioned the explanation, the other pupil became perplexed with her ability to make inferences. When he mentions a statement about a relationship to explain a thing or occurrence, just one pupil gave a nearly accurate answer.

"A hypothesis is a statement about a relationship to explain a thing or event."

[IV:Idi Amin:18.12.20]

This pupil did not give an answer to the question on the link between the altered and responding variables. However, he understands that the term "forming hypothesis" refers to a relationship that might be used to describe a specific event. This scenario demonstrates how the pupil built his knowledge through mental activity. The basic constructivist belief is that knowledge is created by the learner's mental activity and cannot be communicated. Individuals are thought to integrate new information gained from personal experiences into their previous knowledge before making sense of it (Moeed, 2013).

The last integrated SPS is experimenting skill. The majority of the pupils are enthusiastic and enjoy conducting experiments. However, not every pupil grasps the true meaning of mastering experimental skills. Experimenting entails organising and carrying out an investigation to test a hypothesis, as well as collecting and evaluating data until a result may be reached (Curricululm Development Division, 2017). Essentially, the pupils like conducting experiments and all they understand is that they are exploring an event or object without considering the processes that must be taken prior to conducting the experiments.

"Activities that combine all science process skills"

[IV:Zahin:17.12.20]

"Make an experiment to find out what will happen."

[IV:Fatin:27.11.20]

Their thoughts are entirely focused on investigating and observing what will occur next. They are not aware that they are expected to apply all of the SPS they have learned. One of the pupil respondents expresses a contrary opinion about experimentation. According to him, experimenting is the activity that brings together all of the science process skills. This situation demonstrates that the pupil is aware of the twelve SPS used in the experiment. However, he is at a loss for how to articulate it in a scientific statement. It is unsurprising that pupils do not master experimenting, the highest level of integrated SPS, given their hazy understanding of the fundamental SPS. The fundamental SPS lays the groundwork for the acquisition of more complex integrated skills. As a result, if the pupil is unable to master the fundamental SPS, they will struggle with the integrated SPS. As a conclusion to this theme, the researcher discovered that the pupils struggled to master all six integrated SPS. They require additional explanation and hands-on activities to gain a firmer grasp on the integrated SPS.

Pupil's Understanding Towards Integrated SPS: Teacher's View

The teacher's perspective is essential because they are the primary facilitators of science teaching and learning as well as the primary assessor in classroom assessment. According to Frey and Schmitt (2010), assessments are best suited to guiding student learning improvements, and classroom teachers routinely construct assessments to track student progress. In this study's context, the teacher is the best person to have access to pupils' assessments and to validate their comprehension of the SPS.

Teachers have a range of perspectives on their pupils' comprehension of the integrated SPS. However, the majority of teachers surveyed prefer to assess their pupils' comprehension through group observation because they supervise more than forty pupils at a time As a result, drawing a specific conclusion from their personal observation is quite difficult for them. One of the teachers admits that his pupils perform at a moderate level.

"My pupils are still at a moderate level. The results are inconsistent. Pupils cannot apply integrated SPS without the teacher's help."

[IV:Azizi:21.22.20]

The teacher must agree that his or her pupils can apply integrated SPS, which is more advanced than basic SPS, unless the teacher assists them. This situation demonstrated that abstract skills should be developed through the teacher's facilitation capacity when teaching with a variety of approaches. Pupils should not be left alone with the expectation of self-teaching those skills. According to Amnah et al. (2013), the scaffolding method was ineffective because pupils did not make progress toward learning in a discovery setting. Apart from that, a small number of teachers agreed that integrated SPS is a more advanced level of science learning. Pupils require guidance from their teachers to facilitate their learning.

"Six integrated SPS is quite a high skill, and my pupils sometimes need direct guidance from the teacher. I often ask various questions to help pupils understand a situation and connect with related SPS in the activity. Therefore, only few pupils can achieve a consistent result. The rest of them, I try to help using written assessments that are suitable to the lesson and the level of pupils."

[IV:Siti Roha:19.11.20]

This teacher disclosed that she employed a variety of strategies to aid her pupils in mastering the SPS, particularly the integrated SPS. She prefers to employ the questioning technique and to make connections with the pupil's prior knowledge. This method is similar to inquiry learning's steps, in which the teacher stimulates pupils' thinking through probing questions. By increasing children's engagement and participation in science activities and exercises, inquiry science teaching encourages children to learn science and about science. Erg et al. (2011) corroborated this finding, stating that scientific inquiry exercises are typically the primary source of science process skill development and that inquiry is used to teach science process skills.

Besides that, one teacher has another point of view where he admits that his pupils having difficulties in mastering the skill of defining operationally and using space and time relationship.

"Two skills that pupils have difficulty mastering are defining operationally and space and time relationships. Just like before, this skill is seldom practised. I refer to the textbook; this skill is rarely emphasized, there is only one question in UPSR, alternating with the relationship of space and time, in 2017. I think it is not emphasized in every topic."

[IV:Adni:9.12.20]

The teacher demonstrates a lack of emphasis in a few SPS in this excerpt. He asserted that the skill was tested only once in a blue moon and was not heavily emphasised in the Science topics. Another teacher respondent expresses the same sentiments about the pupil's integrated SPS performance.

"The results are inconsistent. Not suitable for level 1. Guidance from teachers is required". "Experiment with teacher instruction and guidance. Hypotheses require pupils to think at a higher level."

[IV: Khairunnisa:21.11.20]

The teacher believes her pupil's performance in integrated SPS is inconsistent, as indicated in the excerpt above. Additionally, she stated that supervision by a teacher is necessary, particularly when conducting experiments. Apart from that, she asserts that hypotheses require pupils to think at a higher level, making it more difficult for teachers to assist pupils The teacher can use the iceberg theory method in this context because it is an introductory art in education. The traditional teaching mode places a premium on pupils learning at the teacher's pace and content, which is essentially a one-way communication. However, this unidirectional communication devolves into passive infusion, causing pupils to lack optimism and passively receive knowledge. Iceberg theory resolves the issue of teaching a lot of material in a short amount of time while still delivering the SPS. Additionally, under the guidance of the teacher, iceberg theory can assist pupils in mastering SPS and broadening their knowledge based (Zhou, 2016).

Apart of the negative respond, there is one teacher share a positive review on her pupils' understanding in integrated SPS.

"Consistent. Because various skills in SPS can be applied simultaneously"

[IV:Sareena:21.11.20]

The teacher expresses satisfaction with the pupils' overall comprehension of integrated SPS. She believes that various SPS skills can be applied through Science activities, which she believes is the most effective way to instil SPS in pupils' learning. This finding is supported by a study that found that even when teachers do not intend to incorporate science process skills into their lessons, the opportunity to do so is provided through the activities (Amnah et al., 2013). Many people believe that studying science is meaningful if skills and knowledge are acquired through a constructivist approach and that the learning environment should be designed to facilitate learning and acquisition. This study established that abstract skills should be acquired through the facilitation capacity of the teacher regardless of the method used.

Problems in Mastering Integrated SPS

According to the excerpt, teachers face few difficulties with integrated SPS. Integrated SPS are science process skills that incorporate or entail the use of a variety of basic SPS. These are higher-order cognitive skills. As a result, the need for experienced and knowledgeable teachers is critical to ensuring that the correct Science concept or skill is delivered. There is, however, a comment regarding the non-optional Science teacher.

"For a teacher who is not a science option, he may not know to teach the SPS."

[IV:Adni:9.12.20]

The teacher is worried about the non-option Science teacher's inability to teach the SPS. This is not a new problem, but it has had a significant impact on science education, especially for pupils who depends fully on teacher's guidance. How do we expect the teacher to clarify science process skills if he fails to provide the science content? In addition, one of the reasons provided by teachers that affects the process of teaching and learning integrated SPS is a lack of instructional time.

"Insufficient opportunity and time to deliver the content. Pupils are not clear or more familiar to mastery the topics compared to SPS."

[IV:Adni:9.12.20]

According to the teacher, pupils are more familiar with Science content than they are with the SPS. This is because the teacher spends more time to the science syllabus and does not have sufficient time to explain integrated SPS. According to Ongowo (2017), pupils cannot excel at skills they have not had the opportunity to practise or have been exposed to. Consistent practise sessions are required to achieve mastery of integrated SPS. As a result, instructional time is viewed as a critical factor in mastery of the integrated SPS. The following issue is that the pupil is unable to relate to the situation presented by the teacher.

"However, there are pupils who still not mastering the SPS for predicting and making inferences because it is difficult to understand and relate to the situation."

[IV:Laila:2.12.20]

According to this excerpt, the teacher discussed her pupils' difficulties with a few SPS because they were unable to relate to the given situation. As Ongowo (2017) points out, pupils require multiple opportunities to practise these skills across a variety of content and context areas. Educators must help pupils develop formal thinking habits in order to master integrated SPS. Apart from the teacher's response, a pupil admitted to his weaknesses in mastering manipulating variables.

"I put manipulating variables as my last choice…because I am confused which one is manipulated variable and which one is responding variable…it is quite confusing…"

[IV:Harraz:17.12.20]

The pupil expresses his confusion over the numerous types of variables that must be understood. He is unable to distinguish between responding and manipulated variables. This finding is corroborated by a study conducted by Amnah et al. (2013), in which pupils were unaware of the critical nature of identifying variables and their implications when attempting to draw conclusions from an experiment. Essentially, controlling any variable will assist the learner in recognising trends and remaining focused on variable control when confronted with problem situations in his or her life. The final impediment to the teacher delivering integrated SPS effectively is the pupil's inability to relate to science concepts.

"I choose making inferences as the toughest one, because my pupils find it difficult to relate to the science concept when carried out an activity."

[IV:Sareena:21.11.20]

According to the excerpt, the teacher reveals that her pupils struggle to connect a science concept to an activity. According to Yeany et al. (1986), certain pupils may be unable to acquire certain scientific process abilities until they have developed prerequisite cognitive abilities. This may explain why certain pupils develop at a slower rate than other children their age. If all stakeholders work cooperatively to resolve issues or obstacles, there should be no difficulty in mastering the integrated SPS.

Pupil's Effort to Understand SPS

Based on the excerpts, the most common tactic favoured by pupils was referring to their science teacher. They felt at ease and secure in approaching the teacher, believing that the teacher would direct them.

"If I do not understand the SPS taught in the classroom, I will ask the teacher to explain again. I will relate it to the simplest situation or problem."

[IV:Putra:71.11.20]

"If I do not understand one of the SPS taught in the classroom will ask the teacher to explain again. Sometimes I ask my friends, but I prefer to ask my teacher. I text my teacher using WhatsApp when I got home."

[IV:Aisyah:26.11.20]

Due to the fact that the interview was conducted during a movement control order, the pupils' responses refer to the current state of online learning. The majority of them are accustomed to using latest technology to communicate with teachers, such as WhatsApp and Google Meet chatrooms. During normal learning, when pupils are permitted to attend classes, they may choose to speak with the teacher immediately following class. According to Murziqin et al. (2019), in some instances, pupils must be debriefed in order to grasp some of the finer details of what they have witnessed. On the other hand, the tasks are designed to elicit pupil inquiry rather than teacher clarification. Not only must pupils participate actively in order to study science, but the teacher must also provide adequate instruction, support, and motivation when working on a scientific issue. The teacher acts as a facilitator, assisting pupils in actively participating in experiments, interpreting and explaining results, and negotiating findings interpretation with co-experimenters.

In addition to the teacher, some pupils feel comfortable referring their parents to the teacher. During the movement control order, pupils get to spend a lot of time with their families. The pupil took advantage of the opportunity to discuss various aspects of their assignments with their parents.

"Ask parents to explain; watch on Youtube or discuss"

[IV:Syifa:25.11.20]

Based on the current excerpt above, the pupil is looking for an answer on YouTube and then discussing it with her parents. The pupil may be fortunate in this situation because her parents will respond and guide her. Not every pupil benefits from the same circumstances as she does. Some pupils choose to share their experiences and to ask any questions they may have with their peers.

"If I don't understand one of the SPS taught in class, I would refer to my friends. I shy to tell my teacher."

[IV:Nursyazleen:17.12.20]

The excerpt indicates that the pupil admits to being too shy to approach her teacher. She is not interested in her teacher noticing that she did not comprehend the lesson that day. To facilitate the acquisition of new ideas and concepts, classroom activities are geared toward experimental learning based on concrete experiences and peer conversations. The term "learning" refers to the process of constructing knowledge through concrete experiences, collaborative practises, reflections, and interpretations (Murziqin et al., 2019).

Pupils Ask Peers to Explain on the Integrated SPS

According to the excerpt, there is a list of pupils who react to how their peers describe integrated SPS to them. The most popular responses are to provide examples during peer guidance.

"My friend will explain to me every single point, last time I got my friend from Chinese school, he explains in English."

[IV:Zahin:17.12.20]

"My friends help me to understand the SPS by showing me how they did it and then explaining it to me. But I'm the one helps my friends."

[IV:Nursyazleen:17.12.20]

When their peers describe the integrated SPS to them, the majority of pupils react similarly. They believe that some of their more intelligent friends have a better grasp of certain subjects and can guide them. Additionally, when the children discuss or facilitate among themselves, they will use a common language level that is understandable to all. In this view, pupils are scaffolding, with peers acting as tutors, guiding them as they construct new knowledge. According to Malik (2017), the gap between an individual's current developmental level as determined by independent problem solving and his or her potential developmental level as determined by problem solving under adult supervision or in collaboration with more capable peers. Some pupils prefer to discuss their lessons with their peers and share what they missed during the lessons.

"We change idea and opinion, sometimes we carry out the experiment together."

[IV:Haziq:26.11.20]

"We will discuss together with teacher".

[IV:Syifa:25.11.20]

These excerpts indicate that pupils may have an understanding of the details but it should double-check their understanding with another person. In general, they will seek out their closest classmates or someone who is similar to them in the classroom. As we can see, the pupil named Haziq expresses an interest in sharing his thoughts and viewpoints with his peers, demonstrating that both pupils have their own perspectives but frequently compare them. Another pupil indicates that he will discuss the matter with his friend, with or without the assistance of the teacher. This circumstance explains why pupils regard their peers or teachers as scaffolding. Scaffolding can be defined as the assistance provided by a teacher or peers to help a pupil progress toward his or her potential understanding. These interactions help pupils progress from their current or actual understanding to their potential understanding (Pol et al., 2015). Apart from that, there is a situation in which peers teach pupils how to answer integrated SPS questions.

"My friend teaches me how to answer the question, but he didn't give me the answers directly."

[IV/ Harraz/X-X]

Typically, pupils would practise their integrated SPS through teacher-provided worksheets. This is because they rarely conduct experiments for a variety of reasons, including time constraints, an inadequately equipped science room, and full utilisation of the science room (Widyaningsih, 2020). Additionally, during the COVID-19 pandemic outbreak and subsequent public lockout, all educators at all levels worldwide were tasked with conducting classes online.

In this regards, teachers work very well in the elements of developing and sustaining an appropriate atmosphere for all, establishing a physical space that includes all students, creating a culture that promotes justice and equality, promotes relational growth and community accountability, develops, and retains expectations for

student conduct, prepares and introduce processes and practices to facilitate student learning (Mustakim et al., 2020).

Science school teachers faced an immensely challenging situation because they needed to coordinate not only theoretical but also practical aspects of teaching, which necessitated the transition of experiments and laboratory activities to an online environment. Experiments were introduced via video recordings or live interactive demonstrations (Bacincakova, & Bernard, 2020). As a result, pupils used worksheets to practise their integrated SPS. In this situation, some peers are able to advise their classmates on how to respond while not directly providing the responses. It is recommended to future researchers to include students' perception or their views to structure a holistic framework and new pedagogy and approaches (Minghat et al., 2020).

Conclusion

The performance of pupils in integrated SPS is explained by their perceptions and the teacher's justifications regarding their understanding of six integrated SPS. According to their responses and sharing sessions during the interview, the majority of pupils are unable to master the integrated SPS. This perception is backed up by the teacher's justification that his pupils are performing at a moderate level. Additional factors have been identified that contribute to difficulties for pupils and teachers in mastering the integrated SPS. For instance, issues such as a lack of time and a non-optional science teacher exacerbated the situation.

Despite the difficulties, pupils demonstrate an effort to comprehend the integrated SPS based on their preference. Pupils have shown initiative by approaching their science teachers, parents, and friends for clarification and guidance. Some of them felt more at ease referring to textbooks. Nonetheless, the majority of pupils seek assistance from peers to clarify difficult skills. They believe that some of their more intelligent friends have a better grasp of certain subjects and can guide them. Additionally, when the children discuss or facilitate among themselves, they will use a common language level that is understandable to all. In this view, pupils are scaffolding, with peers acting as tutors, guiding them as they construct new knowledge.

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