MOJES MALAYSIAN ONLINE JOURNAL OF EDUCATIONAL SCIENCES APRIL 2022, 10 (2)

STUDENTS' VIEW ON STEM LESSONS: AN ANALYSIS OF NEEDS TO DESIGN INTEGRATED STEM INSTRUCTIONAL PRACTICES THROUGH SCIENTIST-TEACHER-STUDENTS PARTNERSHIP (STSP)

Mohamad Hisyam Ismail
***Hidayah Mohd Fadzil**
Rohaida Mohd Saat
Mathematics & Science Education Department,
Faculty of Education Universiti Malaya
**hidayahfadzil@um.edu.my*

Muhamad Furkan Mat Salleh
Science Education Department,
Faculty of Education, Universiti Teknologi MARA

ABSTRACT

Previous studies in STEM education's context found that many students failed to connect between the knowledge they learned in class, the skills they acquired and the applications of the knowledge to real-life situation. They also perceived STEM lessons as rigid, drab, fixed, and a limited platform because they could not see STEM as an integrated disciplines and the interconnecting concepts across the disciplines. For students' benefits, this study explores their views on STEM lessons to incorporate their needs in designing integrated STEM instructional practices through Scientist-Teacher-Students Partnership (STSP) initiative. Embracing a qualitative research design, the researchers adopted a purposive sampling strategy to select six (6) secondary school science students as informants. Semi-structured interviews were used to explore the informants' insights on STEM lessons. Based on the analysis of the interviews, three (3) themes have emerged, which are (1) Instructional practices in Science Classroom, (2) Issues in STEM learning, and (3) Students' demand in STEM lessons. However, this paper will only discuss the first theme of the study with four (4) categories namely, teacher-driven, content laden, drilling and practice techniques and instructional aids. This needs analysis study concludes that STEM teachers' instructional practices still heavily focus on a teacher-centered approach and preparing students for the examination. Hence, aspects like students' involvement, engagement and meaningful learning which are lacking in practice will be considered by the researchers in designing integrated STEM instructional practices through the STSP initiative.

Keywords: Integrated STEM, Instructional Practices, Scientist-Teacher-Student Partnership (STSP), STEM Lesson, Teaching and Learning

INTRODUCTION

Malaysian Education Blueprint 2013-2025 has positioned STEM education as one of the critical agendas for transforming the Malaysian education system to be at par with international standards. The effort demanded many graduates to enter these STEM fields due to the reason that nation's economic growth depends on preparing many students to embark into these fields. As projected by New Economic Model (NEM), Malaysia aimed to create 1.3 million jobs in STEM disciplines in various sectors by 2025, enabling infrastructure and supporting the development of industrial clusters. However, the projected goals and economic growth would face a significant distortion as Malaysia is experiencing shortfalls of 236,000 professionals in STEM-related fields (MOSTI, 2012). These shortfalls are the results of domino effects on the declining trend in the number of students choosing STEM-related subjects in recent years (Halim & Meerah, 2016). Only 42 percent of Malaysian secondary school students decided to do science. Furthermore, MOE has identified a 'worrying trend' where there is an approximately 15 percent increase in the number of students who have met and passed the requirement to enrol in science stream classes at upper secondary but chose not to do so (MOE, 2016).

Past studies showed that many students became uninterested and unmotivated to choose science and STEM subjects (Alan et al., 2019; Christensen et al., 2014; Frykholm & Glasson, 2005; Schwichow et al., 2016; Subotnik et al., 2010; Swarat et al., 2012). One of the most significant contributors to this problem is the way science subjects are taught in school, particularly the instructional approach employed by the teacher during the teaching and learning process. Alan et al. (2019) reported on the STEM teachers' incompetency, especially in using scientific inquiry and investigation to conduct hands-on activities and experiments that affect the quality of STEM learning. Schwichow et al. (2016) also reported the lacking pedagogical content knowledge of science teachers that contributes to these problems. Mohd Shahali et al. (2017) reported on teachers' lack of STEM knowledge and skills that affect them to be less critical, creative, and innovative. Abdullah et al. (2015) also highlighted that teachers face problems to integrate STEM with their students due to limited content knowledge even though they have participated in STEM training courses. They also struggled to engage and encourage students to be involved in the activities that they have designed. Sinatra et al. (2015) reported similar findings, where teachers had problems engaging and encouraging students to participate in STEM activities due to limited content knowledge. Consequently, students cannot solve problems, lack creative and critical thinking skills because they do not understand the context in which the STEM-related problems are embedded (Frykholm & Glasson, 2005).

Likewise, the study by Bunyamin and Finley (2016) revealed the findings where STEM teachers focused more on the theoretical aspect of STEM knowledge instead of its' practical implications. The 'routine' classroom practices which constricted to completing the syllabus and survival for the exams, hindered students' opportunity to be more critical and explore knowledge in a more authentic learning context. Most experiments are conceptualized, physical actions are imagined, chemical reactions and biological processes are described, or perhaps the students were given videos related to the concepts for them to watch. The findings also highlighted that students are not learning because the teachers tend to provide answers for the problem given rather than helping students to find the solution themselves. Students are told to memorize rather than be encouraged to find the answers on their own. There is no space for the students to apply their critical thinking to find the solution themselves out of their curiosities due to the time constraints. Most teachers were still comfortable adapting teacher-driven activities that cause students to lack opportunities to be more innovative, creative, and critical due to the lack of skills to integrate STEM in their science classroom (Ismail et al., 2019).

On the other hand, Saleh and Aziz (2012) reported that teachers' instructional practices in Malaysia were lacking interaction, whereby they did most of the talking and instructing while only several students contributed their views. Besides, science teachers were showing materials from a textbook. They conducted demonstrations and laboratory activities occasionally to verify the concepts taught in the classroom and explained some exercises given at the end of the textbook to familiarise students with examination questions (Saleh & Yakob, 2014; Saleh & Aziz, 2012; OECD, 2009). Teachers struggled to effectively practice students-centred lessons and reduce their domination in the class (Saleh & Liew, 2018).

To make sure STEM lessons are effective to be conducted, Ufnar and Shepherd (2019) suggested the strategic approach for the process of designing and planning instructional practice. It is crucial to make sure students experience lessons that provide them with a broaden perspective of the knowledge and its' connection to the real world. Therefore, establishing partnerships with the community of practice or experts in the STEM field is one of the effective initiatives that should be embraced. As such, the partnership could involve scientists where their expertise could be incorporated in designing STEM lessons for school students to learn science meaningfully. The STEM lessons could also be designed for students to enhance their scientific skills, higher-order thinking, and problem-solving skills based on the scientists' perspectives as STEM practitioners. The teachers could also benefit from this partnership through the process of upskilling and updating aspects related to the interdisciplinary approach to integrate STEM with the help of scientists. According to literature, the collaboration between science teachers and higher education or qualified scientists has become a common approach for science education reformation (Houseal et al., 2014; Wormstead, et al., 2002). Therefore, since this study is a part of a larger study that focuses on the analysis of needs from students' insights on STEM lessons prior to the designing of integrated STEM instructional practices through the STSP initiative, the researchers explore students' views to incorporate their needs for the STEM lessons. For the discussion of this paper, it is only focused to answer this research question: What are students' views on their teachers' instructional approaches during STEM lessons?

METHODOLOGY

To explore students' views on the current STEM lessons specifically on teachers' instructional approaches, the researchers adopted a basic interpretive qualitative study for the research design. This strategy is appropriate for collecting rich information to address the research question. As Merriam (2009) stated, the purpose of qualitative research is to gain an understanding of the meaning that individuals construct, how they make sense of their world, and the experiences they have in it. Additionally, it enables participants to 'place a high value on context and process' as a result of their experiences (Lattrell, 2010). Thus, it is believed that exploring participants' responses regarding the current STEM lessons that they have experienced and also their need for meaningful instructional practices is the most appropriate technique to be used. These phenomena under study could only be explored using qualitative inquiry (Merriam, 2009). For the sampling technique, the researchers employed the purposive sampling technique (Creswell, 2009) for choosing participants to be involved in this study. Six (6) secondary science students have been selected to participate in this study. In choosing the participants, the researchers have set a specific criteria where the students must come from science stream classrooms and their age is 16 to 17 years old. These criteria are important to make sure that they have experience in STEM lessons and would be "knowledgeable informants" (Lincoln & Guba, 1985) for the researchers to gather as much data for this study. The primary source of data is verbal data, gathered through the interview process. The interview structure enables researchers to respond to participants' responses throughout the session, for example, by probing for clarification in order to develop a more complete understanding of the participants' emerging responses (Merriam, 2009). The interview adhered to a set of peer-reviewed and validated interview protocols. The interviews were conducted one-to-one by using the Zoom platform according to the time preferences of the participants. The researcher designated a specific time for participants to choose. The interview process took two weeks in total with six participants. The entire interview process was captured and recorded. The researchers analyzed the data using the constant comparative method (Merriam, 2009). All audio recordings were transcribed verbatim. After becoming familiar with the transcriptions' data, the data were read several times and then chunked and coded. The emergence of codes resulted in the emergence of categories and themes. Data collection and analysis processes were conducted iteratively until saturation was achieved (Patton, 2015) because information received from the participants started to become redundant (Merriam, 2009).

FINDINGS AND DISCUSSION

From the analysis of the data, the researchers obtained many inputs based on participants' insights on STEM lessons prior to the designing of integrated STEM instructional practices through the STSP initiative for students' meaningful learning. Based on the analysis conducted, three (3) themes have arisen as students' views on the STEM lessons that they have experienced. These responses are important to be incorporated prior to designing the integrated STEM instructional practice, which are (1) Instructional practices in Science Classroom, (2) Issues in STEM learning, and (3) Students' demand in STEM lessons. However, for this paper, the researchers will only discuss the first theme of the study with four (4) categories under this theme namely, teacher-driven, content laden, drilling and practice techniques and instructional aids. The following sub-sections describe the theme and categories more extensively:

Instructional Practices in Science Classroom

This theme reflects the instructional practices used by the science teachers that the participants experienced. The instructional practices in the science classroom reflect all teaching methods, techniques and approaches used by their teachers during the teaching and learning process in Science and STEM lessons. Based on the participants' responses, four main categories have been classified under this theme namely: (1) teacher-driven, (2) content laden, (3) drilling and practice techniques and (4) instructional aids. The subsequent sub-headings will describe the four categories more extensively: Based on the pre-test and post-test scores, the statistics descriptive of students' achievement are presented in Table 2.

Teacher-driven

This is one of the aspects that were highlighted by all participants when it comes to science teachers' instructional practice. All participants mentioned that their teachers preferred using a teacher-centred approach during the teaching and learning process rather than embark on a student-centred approach. The participants even mentioned that they just do and follow what has been instructed by the teachers rather than taking time to explore more on the STEM activities conducted due to time constraints and also limited access to materials provided. The following excerpts showed the participants' concerns:

> …we have many STEM activities and projects. Basically, the **teachers will prepare the guidelines and we just follow the guidelines provided by the teacher**. It is like manual and procedures of activities that we have to follow. To me, I just follow the procedures and wait for the results.
>
> (Participant A)
>
> …and talking about the instructional approach of my teacher in science lesson, **most of the time the teacher will explain first** what are the STEM activities that we will do. Besides, the **teacher will write on board, what we have to** do within the time given and **we just follow what have been instructed**.
>
> (Participant B)
>
> …my **teacher controls the lessons**, and to me it's good because we have many boys in my class, haha. However, the limitation should be there, because talking about STEM activities, the element of exploration is important. Sometimes, **the teacher even explain first the concepts and observation that we will get** rather than give freedom to us experience and observe on our own. So I think this part need to be improved.
>
> (Participants C)
>
> …usually we only know to do any STEM activities on the day that we are in the lab. The **teacher will explain the activities** that we will conducted, and **talking about the procedures** about conducting the activities, the **teacher usually control the class** and also time for every activities. Means that, we do one by one together, and we keep reminded the time left for us before we do the second activity and so on.
>
> (Participant E)

The participants also mentioned that they feel curious and excited when they conducted STEM activities. They have the intention to explore more on their own however the teachers do not allow them to do so due to a few reasons.

> …I want to explore more, because some activities really interesting for example when we have to prepare salt solution to just to make sure the egg is floating, I want to use different amount of salts to be dissolved in distilled water just to see is there any differences on the level of egg floating. **However, I cannot do that because the teacher said, just follow the procedure given** on the amount of salts that u need to dissolve and just report the observation that u have observed. This is sometimes the restriction that I cannot explore more. I don't know why I cannot do that. Maybe because of time allocation for the activity is limited.
>
> (Participant A)

> …of course sometimes when we observe something interesting through the activities, we tend to be excited and want to explore more. Like when we do parachute activities in physics class. Why the time taken is different when we use different length of thread for the parachute. Even **I have experienced being reminded by the teacher, just to follow the procedure**s given because I try to have more thread to carry the egg rather that use only 4 threads, hahahaha. Actually I want to explore, if I use more long thread to tie the parachute, is it the parachute floating longer than using only 4 threads but I can't.
>
> (Participant B)

> …**usually we just do what have been instructed**. And even the time is not enough for me to do more or explore more. Yes, sometimes we feel like to know more the concepts, the reasons why all these happen, but then due to the time, lack of preparation for us as well because **we only know to do that activities on that day, like I mentioned just now**. So we need time to read and understand the procedures. It's good if the teacher inform us earlier and we have time to read earlier and be more prepared in understanding the procedures and also what to do.
>
> (Participant E)

As highlighted, most science teachers still heavily focused on teacher-driven activities for science and STEM lessons. The teachers sometimes do not give their students chances to design and to explore ideas or solutions for problems or tasks assigned. The time limitation, lacking trust for students to explore on their own and also poor lesson planning are the reasons why teachers are not comfortable using student-driven activities. Laopaisalpong (2011) and Plangwatthana (2013) in their studies highlighted that student-driven activities through integrated STEM lessons provide students with the experience of engineering design and technological knowledge and become STEM literate are capable of dealing with complex problems. However, if more teacher-driven activities are used in the science lesson, students will become lack critical thinking skills. Moreover, students also cannot solve problems due to a lack of exposure to complex problems (Frykholm & Glasson, 2005). On the other hand, it can also impose negative perceptions towards STEM-related subjects as stable, rigid, fixed, and a narrow platform for developing and constructing desirable identities (Holmegaard et al., 2014; Claudio, 2001). As learners failed to value and make connections between their prior knowledge, unable to make connections between Science disciplines, and skills they have learned through the subject, the learning is not meaningful (Gasiewski et al., 2012; Lou et al., 2011).

Content Laden

This is the second category that emerged based on the analysis of participants' responses. This category explains how science teachers deliver the syllabus and curriculum to the students during teaching and learning in science or STEM classrooms. Most of the participants mentioned that their science teachers are really guided by the syllabus and sometimes the teachers are not flexible on explaining the extended concepts involve behind the topic covered during the lesson. The teacher even mentioned only focusing on the syllabus content and do not waste time to know more about the concepts. The excerpts indicated what the participants have highlighted:

> …like in my chemistry class. **the teacher always refers to the textbook and notebooks** during her teaching process. Might be she not confident with the syllabus because she also teaching other subjects in my friend's class. **She even reminds us many times, only to focus on the textbook and also the syllabus written on the textbook**. No need to read extra because she really concerns about the syllabus.
>
> (Participant A)

> …and talking about this, teacher should be more flexible on the example use to explain scientific concepts of the lessons. This is important for students to have better understanding. Don't use the same example given in the textbook because I also can read from textbook. **Teacher tends to use the same explanation and even example provided in the textbook**.
>
> (Participant B)

> I have experienced where my physics **teacher keeps mentioning just use and read from textbook**. The teacher even teaches and **explain using the same example in the textbook**. When I ask more especially related to application concepts, the **teacher always remind only to follow syllabus** and ask me to find the answer on my own.
>
> (Participants E)

> …and our main reference of course **textbook and syllabus from ministry**. But to me, teacher must be creative to plan the lesson rather than **spoon-feed students with the only content in the textbook**.
>
> (Participants F)

Moreover, some participants even mentioned, their science teachers are too concerned about syllabus delivery or finishing the content of the lesson rather than concerned about students' understanding and knowledge acquisition.

> …and talking about this, the **teacher only use and refer to the topic in the textbook** and most of the time, we don't have enough time to finish the experiment or STEM activities because teacher needs around 30 minutes to discuss and explain the topic and she wants to finish on-time. **Sometimes, I want to ask some questions because I don't get it, but the teacher keep mentions to read on my own just to make sure she can finish all syllabus** on time.
>
> (Participant B)

> …I think, the **teacher wants to finish the syllabus rather than asking or concern about our understanding**. That' why I don't like physics because I don't understand many things. The lessons also not interesting.
>
> (Participants E)

> Of course, to make sure **all content and syllabus are delivered**. That's why **sometimes students do not understand** on certain topics because **teacher is**

> **rushing to finish up the syllabus**. And this is always happen if the class cancel or cannot be conducted due to many reasons from the teachers and school.
>
> (Participants F)

Ismail et al., (2017) reported that many teachers were too comfortable to depend on content and materials provided by the ministry rather than challenge themselves to come out with interesting science lessons. The consequence of this can cause students to lack of chances to explore more on the concepts learned, lack of innovative, creative, and critical thinking skills due to no spaces for the students to apply their STEM skills and find the solution themselves out of their curiosities due to way how STEM lesson was planned (Ismail et al., 2019). Moreover, Saleh and Aziz (2012) in their study on Science instructional practices in Malaysia have reported science teachers to tend to show all materials from a textbook and teachers did most of the talking and instructing rather than concerning about students' understanding of the lesson taught. Laboratory activities were conducted just to verify the concepts taught during the science lesson and not because of providing a platform for students to explore and develop understanding and scientific skills. On top of that, the concern is more on familiarizing students with examination questions rather than having a platform for students to experience hands-on activities and strengthen their scientific concepts (Saleh & Yakob, 2014; OECD, 2009).

Drilling and Practice Technique

This is another aspect highlighted by most of the participants when they mentioned their science teachers' instructional practice during science and STEM lessons. Based on their responses, the teachers tend to ask students to memorize the important keynotes and sentences rather than to understand the whole concepts of science that they have been taught. Moreover, students are trained to familiarize themselves with the questions and exercises that can help them to score for their examination. The teacher was even more focused on drilling the students on the technique on how to answer the questions rather than concerning students' conceptual knowledge through the lessons delivered. The following excerpts reflected what participants have highlighted:

> …and for the discussion of the activities, usually the teacher will provide us the answer and ask us to **memorise the important words that actually give marks to the questions** that being asked. We have to remember the differences on how to write inference, hypothesis and conclusion. Because **if we don't follow the real technique to answer, we will not get any marks**.
>
> (Participant C)

> …talking about discussion of the questions provided during activities, usually after we share our answers, the **teacher will write the correct answer and we were asked to memorise the answers**. The teacher wants us to **familiarise with the answer and the technique on how to get marks** on when answering for the examination. This is more important during the discussion of the questions given.
>
> (Participant D)

> To me, at the end, the result for examination is more important than understanding everything, hahaha. And that's why the **teacher more emphasize on training us on how to tackle what questions ask and the right to write the answer**. Yes, my science teacher really emphasizes on **practicing and drilling technique for me to memorise and familiarise with the questions** that always being asked for specific topics.
>
> (Participants E)

> …while doing STEM activities, the concepts involved need to be explained based on topics of the lesson. I still remember, the teacher gave us set of past year questions and **we need to analyse the type of questions that usually appear** for that particular lesson. Then, from there, **we will given the technique on how to answer and also were asked to memorise word by word the correct answer** in order to get full marks for that question.
>
> (Participants F)

When the researchers try to explore more and asked specific examples of the drilling technique that they experienced, these were their responses:

> …for example like if we want to **write the hypothesis**, we have to **write the sentence with 'the more…, the more…, or the higher…, the higher or the higher…, the lesser…**, depending on the experiments that we conducted. To me, I don't understand why it's compulsory to write the sentence of hypothesis like these. But I must write like these. If not, I will not get any mark.
>
> (Participants C)

> …erm like **when you give the inference, the compulsory term to be used is 'because'.** Because means you explain something and **if the term 'because' is not presence in the inference, then no marks for the inference** even though you are explaining the reason of it. This is what the teacher trained us.
>
> (Participants E)

> Actually many things and I can't remember all… erm, like when drawing graft, so there must be a title and the **tittle need to be underlined**. For calculation, at the end **we must make sure the unit must be written**, **if the answer is correct but no unit, then we will not get full mark** and even **sometimes not getting marks at all even though the answer is correct.** So we need to memorise and familiarise with all these important aspects.
>
> (Participants F)

As mentioned by the literature, most teachers have implemented this technique without realizing it they are using this technique in their teaching and learning process (Blasingame & Bushman, 2007; Yenice, 2013). Teachers tend to use this technique because they believe the drilling and practice technique enables students to grasp and master more effective concepts, principles and procedures (Tasir & Wahab, 2000). However, Kani and Sa'ad (2015) highlighted that this technique can cause students to rely on memorization alone to pass for examination, rather than truly comprehending the whole conceptual science knowledge. Besides, if learning becomes too predictable, students may lack mastering skills that they are expected to acquire. They may simply be memorizing based on what has been drilled by their teachers, which may present difficulties later on when attempting to complete more complex tasks or learn more advanced lessons. Moreover, since STEM learning requires students to be independent in exploring the knowledge and skills based on activities that they have conducted, thus, the students may feel difficulty in completing tasks on their own as they are too relying on their teachers to show and train them for getting the correct answer (Ismail et al., 2019).

Instructional aids

This is the last category highlighted by participants under the theme 'instructional practices in Science classroom'. This category explains the instructional aids used by their science teachers during teaching science and STEM lessons. Based on the participants' responses, their teachers use different types of instructional aids in delivering the lesson to the students. Some participants even mentioned that the instructional aids that suppose to help the lessons to become more interesting, however not effective and not even help to make them more understanding. The following excerpts showed their responses:

> My science teacher use LCD and slide show. **Most of the lesson, she uses slide show**. And frankly speaking, **sometimes I don't focus on the lesson** because she's keep talking and explaining just depending on sentences on slide
>
> (Participants A)

> Basically, my teacher will stand in the middle at front class and **holding textbook to explain**. During conducting activities, we will depend on our exercise book, or any handouts provided by the teacher. **She's rarely hold any marker pen only when it is needed to write important terms or sentence** on board.
>
> (Participant B)

> My teacher **sometimes show video to the students** especially during the beginning of the lesson. Usually like youtube videos. However, I think teacher can utilise other learning materials to make sure students get interested and more easy to understand everything. Not just only depending on youtube videos.
>
> (Participant C)

> **My teacher use powerpoint slide**. The slide is **not interactive, not colourful and wordy.** There are many content and long sentences on slide. But everything there and we have to focus. Sometimes we **cannot focus because we feel sleepy** in class.
>
> (Participant D)

The researcher even ask further why the instructional aids used by teachers are not effective and these are their responses:

> In my personal opinion, when **she's too depend on slideshow**, she tends to talk many things and the **class become dry because it is like one way interaction**.
>
> (Participants A)

> To me because of **lack of interaction**. We were asked to do activities and answering questions on book or handouts provided. Besides, during discussion, every group will present the answer and we were asked to write the answer if we didn't get the correct answer.
>
> (Participants B)

> Because the **video is just for the beginning,** not explaining about the whole concept. Besides, **element interaction between teacher and students are limited** and the **students' engagement also not at the best level** because there's **no activities or learning materials that can spark our interest.**
>
> (Participants C)

> …erm… to me because the **teacher too depends on slide**. The **slide also very dry** like I mentioned just now and the **interaction also very limited** because teacher has to cover many things and to make sure syllabus are covered.
>
> (Participant D)

To create authentic learning and meaningful experiences for the students are the most challenging aspect during the teaching and learning process. Even though the teachers use different types of instructional aids, however, if it is not fully utilised and the teachers' pedagogical approach is not good, the lesson is not effective as well. Mohd Shahali et al. (2017), highlighted the issue of the pedagogical approach in teaching STEM where they mentioned, even though the teachers are equipped with training and exposure to STEM knowledge, however, it is still not enough due to time allocated for the courses was limited. On top of that, if the instructional aids used by the teacher is also not effective, this is extremely worrying because it may deplete students' participation in learning by providing them with no impact on learning while simultaneously causing them to be uninvolved. Dinc (2011) and Bose et al. (2013) also asserted that ineffective teaching aids in school can impair students' learning processes, particularly in the area of science conceptual knowledge. To avoid such problems, the teacher must equip themselves with enough and proper training not only on pedagogical approaches but also on preparing and utilizing the instructional aids for students' meaningful learning. It has been proven in numerous studies that students' meaningful learning increases motivation to learn and students' academic achievement (Hodges, 2015; Nilson, 2016; Theobald et al., 2020).

CONCLUSION

In conclusion, it is believed that teachers play a very important role during instructional practices in Science and STEM lessons. Scientific knowledge and concepts, the acquisition of students' scientific and STEM skills and also the independent learning process through element exploration while conducting activities are really depending on teachers' instructional practice. The lesson must be planned carefully in order to help students on achieving the outcomes of the lesson. Besides that, since this is a need analysis study that focuses on students' views during STEM lessons, therefore, the findings gathered are the aspects that are important to be considered for designing the instructional practices. The 'needs' from other parties which are scientists and science teachers also will be gathered and going to be assembled before the process of designing integrated STEM instructional practices through the STSP initiative take place.

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