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Analyzing classroom dialogue forms in synchronous science classes via Google Meet

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Abstract

This study aimed to identify the forms of classroom dialogue in synchronous science classes through Google Meet and explore the difficulties that hinder effective classroom dialogue in synchronous science classes from the point of view of science teachers. The study used a descriptive approach and the sample consisted of 10 science teachers teaching grades (5-8). A class observation card was used to analyze the forms of classroom dialogue. The study results showed that science teachers frequently used whole dialogue in science classes compared to non-whole dialogue. The teacher's thinking through ideas with students had a higher relative weight than other forms of the whole dialogue. In addition, the results indicated a lack of students only talking in science classes. The results showed some difficulties in activating classroom dialogue in synchronous science classes. Several recommendations and suggestions are proposed to enhance science teaching through the online form.

Keywords: Analyzing classroom, forms, synchronous, science class, Google Meet

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1. INTRODUCTION

Dialogue is one of the most pedagogical tools that a teacher can use to improve students' learning in the science classroom (Brandel et al., 2024; Blair et al., 2024). It is one of the most famous methods throughout human history, and Socrates used it to direct his students' ideas and urge them to the issues he posed to research conclusions based on arguments and evidence (Song et al., 2021). It is important to build knowledge socially through interaction between individuals. Van der Veen & Van Oers (2017) and Wang et al., (2019) indicated that effective dialogue plays an important role in students' understanding of scientific concepts, scientific literacy, and enhancement of students' thinking. Effective dialogue must involve both students and teachers (Alexander, 2008; Chase et al., 2019; Liberali, 2017; Yin et al., 2020).

Classroom dialogue is characterized by five features as pointed out by Alexander (2008), which are: Firstly, it should be a group dialogue so that the teacher and students complete the learning tasks as one group and not in isolation from each other. Secondly, the dialogue must be reciprocal between the teacher and students, where students share their ideas with the teacher and vice versa. Thirdly, the dialogue must be supportive and helpful to help students express their opinions freely without fear of embarrassment and violence from the teacher. Fourthly, the dialogue should be cumulative so that the teachers can build on their ideas with their students' ideas. Finally, the dialogue should be purposeful and planned by the teachers to make it easier for them to achieve the teaching and learning goals with the participation of the students.

Science teachers, as Soysal (2020) pointed out, can use classroom dialogue to identify the students' previous or existing experiences, link them to new knowledge, and provide opportunities for students to practice communication, inquiry, and problem-solving skills. Moreover, teachers use classroom dialogue to identify alternative concepts among students, help them build new knowledge, and link this knowledge to existing ones (Chen et al., 2020; Kang & Han, 2019; Pehmer et al., 2015; Webb et al., 2019).

Classroom dialogue, which takes place in the classroom, is a productive social process through which investigative learning and problem-solving are supported. It is a reciprocal process between the teachers and their students and between the students themselves (Backer, 2017; Howe et al., 2019; Soysal, 2020; Van der Veen & Van Oers, 2017). In addition, the classroom dialogue must be cumulative so that the teachers build their ideas on students' ideas. It must be purposeful and planned by the teachers to make it easier for them to achieve the educational goals with the participation of students (Warwick et al., 2020). France (2021) argued that effective dialogue can be enhanced by defining the time available for dialogue, the nature of interactions that occur, and the type of questions asked that enhance students' thinking.

The vital role that dialogues play in science learning can be summarized through three main reasons pointed out by Dobber & Van Oers (2015). These are: 1) helping students build knowledge and improve their critical thinking; 2) helping students to form a realistic and practical vision of science; and 3) enabling students to acquire some 21st-century skills such as problem-solving, communication, and social interaction skills.

Science subject is the subject where many social scientific issues can be discussed during the process of teaching and learning. During the discussion of these issues, students should think, express ideas, and interact with the teacher and other students to identify other points of view (Ma et al., 2024; Ma et al., 2024; Forman et al., 2017; Kumpulainen & Rajala, 2017; Van der Veen & Van Oers, 2017). Consequently, classroom dialogue should always be part of the teaching and learning process of the subject.

Many researches have been conducted to study classroom dialogue and demonstrate its importance in the educational process (Cavagnetto & Hand, 2012; France, 2021; Watters & Diezmann, 2016). For example, studies by Cavagnetto & Hand (2012); France (2021); and Watters & Diezmann (2016) have indicated the importance of using classroom dialogue as a teaching and learning tool to enhance students' learning in science. Brendel et al., (2019), O'Leary et al., (2020), McFadden & Roehrig (2019), and Schindler et al., (2018) have confirmed that

classroom dialogue in science classes is the main tool for developing students' understanding of scientific concepts and helps them to think, speak and express their opinions as an effective member of the educational process. Howe et al., (2019) and Liberali (2017) indicated the importance of classroom dialogue in academic achievement for students; while others focused on achieving learning outcomes (Sari et al., 2019; Sherry et al., 2019). Moreover, Mercer et al. (2019) and Mwangi et al., (2021) confirmed that classroom dialogue can enhance students' academic achievement in science by stimulating students' motivation for learning and discovery, which leads eventually to achieving a deeper understanding of the scientific content. Diez-Palomar et al. (2021) showed the importance of classroom dialogue in enhancing students' communication and problem-solving skills during their engagement in productive dialogue in small groups.

Benus (2011) divided the classroom dialogue into two main patterns: the whole-class dialogue and the non-whole-class dialogue. The current study used this classification to analyze the forms of classroom dialogue in science classes. The following is a description of those forms:

1. The whole-class dialogue is the dialogue that takes place for the whole class and includes several forms, which are:

Teacher talking to students: it is mostly a one-way dialogue so that the teacher speaks to students, and students' speech is very little compared to the teacher's speech. This type of dialogue aims to provide instructions for students at the beginning of class activities or as a prelude to the beginning of the lesson. Alshaqsi & Ambusaidi (2018) stated that the teacher uses this form at the beginning of the unit to clarify and summarize some procedures and events, present educational goals, encourage and motivate students, and clarify instructions for group work and individual activities.

Teacher talking with students: The teacher uses this type of dialogue to help students express their ideas and opinions, and encourages them to listen to each other and repeat what the students have addressed in another way.

Teacher thinking through ideas with students: The teacher uses this type of dialogue to think about new ideas not only from the student's ideas but also by reformulating more scientific ways of expressing ideas to the teacher. Moreover, students practice critical thinking skills by using this form of dialogue.

Student-to-student talk: in this form, students talk to each other about a specific idea related to the topic of the lesson without interrupting the teacher's speech. France (2021) and Sybing (2021) have emphasized the importance of students' dialogue with each other in developing some skills among students, such as the ability to ask questions and present ideas, provide explanations, justifications, and evidence that support the ideas presented by students, and respect for different points of view. Moreover, Hardman (2019) argued that allowing students to dialogue and talk among themselves can enhance their ability to apply what they have learned in their real lives.

2. Non-whole class dialogue: This dialogue is determined by the type of educational activities that students perform in the classroom, so it does not include the entire class. It is divided into:

Group work: Students work in small groups. While working at the group level, students engage in dialogue to exchange ideas. Sari et al., (2019) stated that the work of students in groups has a significant role in developing active participation and activities. Therefore, it is necessary to give students a greater sense of control over the teaching and learning process, and provide them with many opportunities for discussion and expressing opinions.

Individual work: In this type of classroom dialogue, students work on their own, and a student may talk to a colleague about an activity to understand what is required.

Regarding the research conducted on classroom dialogue using Benus (2011) in a normal classroom in the Omani context, Alshaqsi & Ambusaidi (2018) found that the most common patterns of science class dialogue were: teacher-to-student dialogue, a teacher with student dialogue, and teacher thinking with student dialogue. The least common patterns of science class dialogue were student-to-student dialogue and all ~~k~~inds of non-whole classroom dialogue (individual workgroup work- movement). However, the current study used this classification to analyze classroom dialogue forms in synchronous (electronic environment) science classes in grades (5-8) in science lessons in the Sultanate of Oman.

1.1. Purpose of study

The classroom environment represents the appropriate place to use dialogue effectively (Ford & Forman, 2015). However, the spread of the COVID-19 virus has led to profound changes in the education sector (Murphy, 2020). As part of the pandemic precautions to minimize transmission of the virus, the majority of educational institutions in Oman, including schools, changed from face-to-face classrooms to online learning systems (Syahrim & Abdalla Salih, 2020). In Oman, the Ministry of Education has prepared educational platforms to provide various educational services to students, where two platforms have been used: Google Classroom platform for Grades (5-12), and Al Mandhara platform for Grades (1-4). These platforms include various educational content such as images, videos, texts, presentations, audio materials, assessments, and interactive activities (Long et al., 2024). These tools facilitate synchronous and asynchronous communication between teachers and students while also ensuring learning accessibility at all times (Setyawan et al., 2020). Therefore, it is worthwhile to explore how effective these platforms are in enhancing and promoting classroom dialogue in science classes between teachers and their students. The study attempted to answer the following two research questions:

1. What are the patterns of classroom dialogue in synchronous science classes via Google Meet in grades (5-8)?

2. What are the difficulties faced by Omani science teachers in activating classroom dialogue in synchronous science classes?

2. METHODS AND MATERIALS

2.1. Research design

The study used a descriptive method of collecting data based on two research tools; an observation card and a focus group interview.

2.2. Participants

The participants were 10 female science teachers selected intentionally by the researchers. They were selected from one educational governorate in the Sultanate of Oman. These teachers taught general science in grades (5-8). The targeted sample technique was used as teachers were chosen after their approval to allow the researchers to attend and record their synchronous lessons and make observations about their teaching. Thirty (30) synchronous lessons (three lessons per teacher) were recorded and analyzed. The focus group interviews with teachers were conducted to answer the second research question.

2.3. Data collection instruments

The researchers adopted the observation card prepared by Benus (2011) to analyze the forms of classroom dialogue in science classes. This tool has some features such as comprehensiveness, accuracy, and reliability. The card consisted of two domains: whole-class dialogue and non-whole-class dialogue. The whole-class dialogue is divided into four forms, which are: the teacher talking to students; the teacher talking with students; the teacher thinking through ideas with students; and the student-to-student talk. The non-whole-class dialogue is determined by the type of educational activities that students carry out in the classroom, and it is divided into

group work, individual work, and movement work. In this study tool, the movement work dialogue was deleted because it was difficult to apply it during distance learning.

To verify the validity of the tool and its relevance to the objective of the current study, it was presented to ten specialized educators, including educational supervisors at the MoE and a group of science teachers with more than ten years of teaching experience. The original tool was translated and reviewed before and after its translation. The judges' comments were taken, such as the accuracy of the translation and the suitability of the tool to apply. The percentage of judges' agreement for each card's domain was as follows: 90% for whole-class dialogue and 80% for non-whole-class dialogue. The judges' suggestions were also taken into consideration by making some linguistic modifications and reformulating other phrases. For example, adding more detailed descriptions of the teacher's thinking through ideas with student dialogue and adding the time factor for each form of dialogue. The reliability value for the overall observation tool was 84% by using the interrater method using the Cooper equation. Table 1 shows the observation card.

Table 1

Items of the observation card

Classroom dialogue patterns	Code	Description	Frequency	Time (mint)
		Whole class dialogue		
Teacher talking to students.	TT	The teacher speaks to his students and the student's speech is very little compared to the teacher's speech.		
Teacher talking with students.	TW	The teacher uses this type of dialogue to help students express their ideas and opinions and encourages them to listen to each other and repeat what the students have addressed in another way.		
Teachers think through ideas with students.	TH	The teacher uses this type of dialogue to think of new ideas not only from the students but by reformulating more scientific ways of expressing ideas by the teacher.		
Student-to-student talk	ST	Students talk to each other about a specific idea related to a topic of the lesson, and students talk to each other without interrupting the teacher's speech.		
		Non-whole - class dialogue		
Group work	GR	Students work in small groups and they engage in dialogue to exchange ideas.		
Individual work	IV	Students work on their own and may talk to a colleague about the activity to understand what is required.		

The observation card was ready to be implemented after its validity and reliability were checked. The researchers attended ten science classes with ten female science teachers in grades five, six, seven, and eight. The researchers asked the teachers to record other science lessons. The observation card was implemented in all 30 lessons that were attended or recorded.

The focus group interview was conducted after analyzing the observation cards. A semi-structured interview was used to be applied to the focus group; to answer the second research question; and to triangulate the results of the first study question. A focus group is one of the methods used to collect qualitative data by asking a set of questions or an open question to a group of individuals who have a common topic. In the current study, the

researchers prepared one open question and directed it to the sample members to collect their ideas, opinions, and points of view on the subject of the study. The interview was conducted as follows:

Preparation for the interview: the researchers coordinated with the study sample members to determine the time of the interview. The researchers prepared an electronic link for the virtual interview using Google Meet and sent it to the study sample.

Formulation of focus group interview questions: the researchers formulated an open question. The question was: what are the difficulties you faced in activating classroom dialogue using Google Meet from your point of view? While receiving the answers, the researcher asked the study sample members sub-questions to get more detailed explanations and information about the difficulties; for example, can you explain this by giving examples? How does that affect the dialogue in the classroom? Can you clarify more? What do you think?

Recording the responses of the study sample: the researchers recorded the interview that took place via Google Meet after obtaining consent from the study sample to make it easier for the researchers to take notes and analyze the interview.

2.4. Data analyses

For the first research question, frequencies and times were calculated for each pattern of classroom dialogue while analyzing about thirty video recordings of science lessons and using evidence to support the results of analyzing the observation card. For the second research question, the percentage of each difficulty facing science teachers was calculated after the analysis of the focus group interview.

3. RESULTS

3.1. Results of research question one

To determine the patterns of classroom dialogue in synchronous science classes via Google Meet in grades (5-8), the frequencies and times of the classroom dialogue patterns were calculated using the observation card to analyze about 1444.7 minutes of thirty video recordings for science lessons via Google Meet. Table 2 shows the frequencies and relative weights of classroom dialogue patterns.

Table 2

Frequencies and relative weight of classroom dialogue patterns

Patterns of Classroom Dialogue	Frequencies	Time (minute)	Relative weight (%)
Whole-classroom dialogue			
Teacher talking to students	320	342.8	23.65
Teacher talking with students	47	186.40	12.90
Teachers thinking through ideas with students	286	699	48.38
Students to students talk	2	8.39	0.58
Non-whole - classroom dialogue			
Group work	4	46.13	3.19
Individual work	51	163.10	11.29
Total	710	1444.7	

The results in Table 2 show that the most common classroom dialogue is the whole-classroom- dialogue with 92.2%; while the non-whole-classroom dialogue is only 7.8%. As for the patterns of whole-classroom-dialogue, they are as follows: the teacher talking to students comes with higher frequencies about 320; the teacher thinking through ideas with students about 286; the teacher talking with students about forty-seven; and finally, students to students talk at about two. For non-whole-dialogue, individual activities are ranked first with fifty-one, and group work is ranked second with about four.

3.2. Results of research question two

The focus group interview was analyzed from the point of view of the teachers to determine the difficulties they faced in activating classroom dialogue in synchronous science classes from their point of view. Table 3 illustrates the difficulties that science teachers may face in activating classroom dialogue from their point of view.

Table 3

The difficulties that science teachers face in activating classroom dialogue in synchronous science classes

Mani Difficulties	Sub-difficulties	%
Technical Difficulties	Weak or interrupted Internet	100%
	Lack of eye contact between the teacher and students.	
Difficulties related to the teacher	Teachers lack technological skills for distance learning.	70%
	Students' management and control	
Curriculum difficulties	The density of scientific materials and the abundance of investigations.	90%
Difficulties related to students	Student Attendance	80%
	Students' motivation to learn	

The results in Table 3 show that science teachers found some difficulties that may hinder or challenge the activation of the classroom dialogue. These difficulties, which were proposed by several science teachers, were as follows: technical difficulties; curriculum difficulties; difficulties related to students; and difficulties related to the teacher.

3.3. Interpretation of results

The results show that the highest frequency form of classroom dialogue is the teacher talking to students. This is because the nature of interaction via Google Meet puts a greater role on the teacher because students do not see their classmates, which requires the teacher's intervention to clarify, guide, provide information, or organize students' participation. Moreover, the student's lack of knowledge about the application may sometimes prompt the teacher to help them with how to use it, how to write in the chat, or how to use the hand-raising feature while receiving students' answers.

However, by analyzing the time taken for each form, we noticed a discrepancy in the time taken for the teacher to talk to the students' dialogue. This dialogue takes from one to twelve minutes per lesson. This is because it is used by teachers to review previous lessons and prepare for the new lesson. This discrepancy may be due to several factors, including the nature of the topic of the lesson, the previous knowledge of students about it, the difficulty of the topic, and the importance of the topic. This is consistent with what was indicated by the results of previous studies (Alshaqsia & Ambusaidi, 2018; Benus, 2011) that the duration of the dialogue depends largely on the nature of the topic and the previous experiences and knowledge of students. The following educational situation in Table 4 shows the longest dialogue of the teacher talking to students that the teacher used to review the previous lesson with students.

Table 4

An educational setting for the use of teacher-talking-to-student dialogue in the eighth grade.

Person	Dialogue
Teacher	Let's go back to some of the most important points that were studied in the previous lesson.
Teacher	I told you earlier that this chapter is considered one of the most important units of the book because most of the final exam questions will be from this unit, so we must focus on it.
Teacher	Who can remind us? Where the magnetic force is greatest, is it at the ends (N/S) or in the middle of the magnet? Yes Fatema
Fatema	At the ends of the magnet.
Teacher	Excellent! Now, what happens when the different poles of a magnet come together?

Group of students	Attract
Teacher	Yes. Now we will go to another important point. How do we make magnets? Note (silent for 2 minutes)
Teacher	Can you hear me? Is everything clear?
Group of students	Yes, teacher.
Teacher	Ok. I asked an important question. How do we make a magnet? Listen to me. We can make a magnet by rubbing a piece of iron with a permanent magnet in one direction, either from left to right or from right to left, and in this case, the piece of iron will turn into a temporary magnet. Is this clear?
Group of students	Yes.
Teacher	Ok. Now, let's move on to the success criteria for today's lesson.

We noted through the content of this table that the dialogue that took place between the teacher and the students in general and between the teacher and one of the students expresses the teacher's desire to determine the previous knowledge of the students about the subject of magnets and to highlight the importance of this lesson and its weight in final exams, which take a longer time. The teacher was interviewed to find out why this long time was spent, and he stated that, first and foremost, students need to remember previous information because there is a long period between the synchronous lessons per week. Second, 12 out of 33 students did not attend the previous lesson, forcing me to repeat some key points that were covered in previous lessons. Third, this lesson is new to the eighth-grade students and it contains a lot of physics information that needs to be understood by the students. Fourth, the topics of this unit (Magnetism and Electricity) were included in the final exam, and they had a higher proportion than the topics of other chapters. These results confirmed what Johnson's (2018) study found that the teacher may spend sufficient time reviewing previous lessons before moving on to more complex lessons in an attempt to ensure that the students were able to understand as much as possible.

The results also revealed that science teachers use the form of teacher-talking-to-student dialogue in several situations, as shown in Table 5.

Table 5

Frequencies and the relative weight of Teacher talking to student dialogue uses

Uses	Frequencies	Time (minutes)	Relative weight
Explain investigative activities	85	73.20	21.4%
Remind students of the organizational controls for class management	78	29.51	8.6%
Show success criteria	28	38.56	11.3%
Reviewing previous learning	129	200.41	58.7%
Total	320	342.08	

It is noted from Table 5 that the use of the teacher's talking to students' dialogue in clarifying the investigative activities was repeated 85 times, and the time taken for it was 73.20 minutes. The reason may be due to the nature of the currently developed science curricula based on the Cambridge curricula, which contain a large number of investigative activities that need an explanation from the teacher. This is consistent with Gillies's (2020) study, which indicated that students need more clarification and explanations to accommodate the investigative activities.

The teachers also used this form of dialogue to remind the students of the organizational controls for class management. This is due to the recent use of the Google Meet application by the students, which confused the

teacher during the lesson because of microphones and the interference of voices, as well as the organization of dialogue and the distribution of group activities. These difficulties were mentioned by the study sample about the difficulties of activating classroom dialogue in distance education, as well as the results of Sousa's (2021) study that revealed similar difficulties.

Teachers thinking through ideas with students obtained second place in terms of repetition. This is due to the nature of science subjects, which need to develop different thinking skills, whether those skills are related to basic, integrative science processes or problem-solving and investigation. This result reflects the findings of Brendel et al., (2019); Kang & Han (2019); McFadden & Roehrig (2019); and Schindler et al. (2018) that show the nature of science classes need to employ dialogue to help students think, speak, and express their opinions by making them active members in the learning process, as well as develop their awareness towards the importance of dialogue in achieving a deeper understanding of scientific subjects, as indicated by Mercer et al., (2019). Table 6 shows the teaching situation for the teacher thinking through ideas with students in synchronous science classes.

Table 6

Dialogue of Teacher thinking through ideas with students in grade five.

Person	Dialogue
Teacher	Now, grade five students. What is the scientific question of this experiment?
	Go ahead, Yasmeen. Answer the question
Yasmeen	I expect that the length of the doll's shadow changes with the position of the light lamp.
Teacher	Yes, Yasmeen, this is the conclusion. Now, I asked you about the question that we should solve by experimenting.
	Anyone can answer?
	Note (some students used the hand-raising feature)
Teacher	Yes, Samia.
Samia	The question is what are the factors that affect the size of a doll's shadow?
Teacher	Well, done, Samia.
	So, the scientific question is what are the factors that affect the size of a doll's shadow?
Teacher	Grade five, do you see the image displayed on the screen?
Students	Yes
Teacher	Ok, now I will ask you a question and you should write the answer using the chat feature in Google Meet. Ok students, is it clear?
Students	Ok teacher
Teacher	In what location will the doll's shadow increase in size? Is it in location (1) or location (2) place?
	Write the answer
	Note: (students used the chat feature to write the answer)
Teacher	Well, done grade five. Approximately, all of you have answered correctly. Yes, it is in location (1).
	But what is the reason? What affected the size of the shadow? What is the factor?
	Note: (Some students raising hands)
Teacher	Yes, Azza.
Azza	The size of the shadow is affected by the distance of ~~the~~ doll from the light. The closer the doll is to the light, the larger the shadow.

Teacher	Excellent Azza. Well, when the body is far away from the light source; then, the shadow size becomes smaller and vice versa.

It is noted from Table 6 that the teacher used the dialogue to help students investigate the factors that affect the size of the shadow.

4. DISCUSSION

Due to the conditions of the COVID-19 pandemic the use of Google Meet to complete students' learning, and the teachers' inability to carry out practical experiments, the teacher used a video clip showing how the position or location of the doll affects the size of the doll's shadow. The type of questions asked by the teacher may have a role in enhancing the dialogue of the teacher's thinking with students. The study of Chen et al., (2020) confirmed that diversity in asking questions has an important role that contributes to strengthening the dialogue interaction between the teacher and students and encouraging students to express their ideas. The teacher also plays another role in motivating students by generating new ideas. This is also consistent with the study by Watters & Diezman (2016), who highlighted the importance of activating dialogue and encouraging students to share their knowledge and opinions by asking various questions, and focusing on scientific language while managing classroom dialogue with the teacher.

We also note that the teacher promoted this form of dialogue (teacher thinking through ideas with students) by activating the tools of Google Meet, such as using the chat feature, which had a role in urging students to participate in discussions, dialogue, expressing opinions, and building ideas with each other. Setyawan et al., (2020) pointed out that the use of Google Meet in teaching students had a significant impact on enriching students' thinking.

The results of the teacher's talking with students in dialogue may be due to the nature of this form of dialogue, which focuses only on helping students express their ideas and opinions and encouraging them to listen to each other. Moreover, this dialogue became less frequent because teachers used other forms of dialogue, such as thinking through ideas with students' dialogue.

The results show that student-to-student talk dialogue did not attract the attention of science teachers. Only two teachers out of ten teachers used this form of dialogue, and only two lessons out of 30 lessons used it. This result reveals a flow in the activation of this form, which can be derived from the nature of Google Meet. Hardman's (2019) study showed that in face-to-face classes, the dialogue between students is greater compared to online teaching. This is due to the existence of a stimulating environment for this form of dialogue, such as the convergence tables, the group system, and the ease of its management by the teacher. Unlike what is happening in Google Meet, where each student is far from the other, students can communicate with each other via the chat feature or when the teacher authorizes them. These results contradict the results of some previous studies about the necessity of activating dialogue among students conducted by France (2021), Harman (2019), and Sybing (2021), because of its importance in developing necessary skills, such as the ability to ask questions, provide explanations, justifications, and evidence that support the ideas presented; respect different points of view; as well as enhance students' ability to employ what they have learned in their real life.

Despite the importance of dialogue that takes place among students in groups, the frequency of its occurrence amounted to four times, and it was done by only one teacher out of ten in the sample. This is due to the difficulty of implementing group activities using Google Meet. To do so, the teacher must create links for virtual classes for each group. In addition, there is difficulty in following up on the work of groups by the teacher, and this, in turn, may lead to students' lack of discipline within the virtual groups. Therefore, the dialogue in groups among students may be ineffective and not purposeful for the content of the activity. This result contradicts the findings reached

by Sari et al., (2019) that students' work in groups has a great role in developing the active participation of students by giving them a greater sense of control in the learning process and providing them with many opportunities for discussion, dialogue, and expression of opinion.

The dialogue in individual work is used by students to discuss a specific question and how to solve it. The chat feature of Google Meet was also used to achieve goals. Moreover, some teachers used programs such as the ClassPoint application, chats on the Google Classroom platform, and other technical applications that enabled teachers to set up some individual activities, which had an impact on the interaction of students in this form of dialogue.

Regarding the difficulties that science teachers faced in activating classroom dialogue in synchronous science classes, teachers found some difficulties, such as technical difficulties represented by the interruption of the internet or the poor signal of the Internet. The teacher (Q) indicated that "the poor signal of the Internet and its buffering sometimes led to confusion between the teacher and students. The teacher committed to a specific time for the lesson, and this, in turn, makes the teacher hasten to complete the lesson for the students without discussing them or asking them questions". Another teacher (A) added "Internet interruption distracts students and reduce their focus, and thus requires the teacher to re-explanation, so the student can participate and interact with the rest of his colleagues". Teacher (B) stated that "the synchronous classes did not enable the teacher and students to make eye - contact as before the COVID 19 pandemic. This has led to a negative impact on the interaction of students. From my point of view, it is considered one of the biggest difficulties that had caused in reducing dialogue in synchronous classes".

The teachers also indicated some difficulties related to the teachers themselves. Teacher (N) mentioned in the interview that "the problem may be related to us; there is a lack of some technical skills." For example, "the skills of creating lessons using some available programs, such as Powtoon, may motivate students' interaction, conservation, and discussion between the teacher and his/her colleagues." Moreover, teachers declared during the focus group discussion that they face difficulty in planning and controlling the time of lessons in synchronous lessons and recognizing the best ways to use Google Meet to manage and control students during the lessons. Wallan (2020) indicated that most science teachers have weak skills in using technology in teaching science. The teacher (K) stated "I have struggled in searching for new and innovative programs and applications that may motivate students to perform group activities as well as individual activities. The reason for this may be that I have not ever used technology in teaching except to display pictures or videos related to the topic of the lesson." In addition, De Silva et al., (2016) and Prado Ortega et al., (2020) suggested that competence and support for teachers are the most influential factors in their acquisition of knowledge of technological tools and their ability to link them to appropriate teaching methods.

About eighty percent (80%) of the study sample mentioned that the density of science content is one of the difficulties that may hinder the activation of classroom dialogue in synchronous science classes. Teacher (M) said, "We suffer as science teachers from applying a lot of investigations, explorations, and practical experiments, especially after changing the curricula and adopting the new Cambridge curricula. This is a good and useful thing for the students and teachers, but in light of the COVID-19 pandemic and depending on distance learning, it has been made complicated for the teachers." In other words, we can only implement experiments by showing videos related to the experiment, and this, in turn, reduces students' interaction and participation in classroom dialogue. Previous studies by Carins (2019) and Van Uum et al., (2016) indicated the importance of practical science is based on building knowledge and developing cognitive skills among students that enable them to apply their understanding of scientific principles to daily phenomena. The practical activities motivate students to work as participants in generating knowledge instead of being negative recipients. To do so, students should be given opportunities to interact with each other, ask scientific questions, present their ideas and opinions, and discuss them with their teachers and colleagues.

In the focus group interview, teachers stated that there are difficulties related to the students, including the lack of attendance at the lessons. Teacher (D) mentioned: "I have thirty-one students in grade six. The number of attendees in some classes does not exceed twelve students. The reason may be due to the lack of motivation and interest in the synchronous class." Another teacher (S) said: "When the student's motivation is greater, this will affect their interaction with the teacher and other students, and the way they present, discuss, and debate topics will also differ." Kang & Han's (2019) study indicated that giving students the opportunity for discussion and dialogue in the classroom may increase their motivation toward learning. In addition, the use of various learning activities may contribute significantly to increasing students' motivation toward the subject, thus leading them to achieve educational goals (Fortus & Touitou, 2021).

5. CONCLUSION

In light of the previous results, the study recommends the necessity of providing training courses for teachers to familiarize them with technical programs such as Google Meet. This would enable them to activate the non-whole dialogue in synchronous science classes. Moreover, the study recommends the science supervisor conduct training workshops for science teachers to introduce them to the importance of students' dialogue with themselves and ways to activate it in science classes.

Finally, the study recommends conducting further research on how different forms of classroom dialogue, facilitated by technological applications, can be activated and their subsequent impact on students' academic achievement and learning motivation. Exploring the use of various digital tools and platforms to encourage interactive discussions, collaborative learning, and real-time feedback could provide valuable insights into how technology can enhance the learning experience. This research could examine how technologies such as online discussion forums, video conferencing, and collaborative learning software influence student engagement, critical thinking, and problem-solving skills. Additionally, investigating the relationship between these technological forms of communication and students' intrinsic motivation, self-efficacy, and academic performance could offer practical implications for improving educational practices, particularly in classrooms with diverse learning needs. By understanding how technological dialogue can promote a more dynamic and participatory learning environment, educators can develop more effective strategies to foster greater student involvement and improve learning outcomes across various subjects and disciplines.

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