Asia Research Network Journal of Education
Vol. 2, No. 1, pp. 1-16, Jan. – Apr. 2022

Teachers' Perspective of Science Flexible Learning

Maria Cindy F. Cardona*
Iligan City National School of Fisheries, Iligan City, Philippines

Amelia T. Buan and Ellen D. Inutan
Mindanao State University- Iligan Institute of Technology, Iligan City, Philippines
*Corresponding author email: mariacindy.fernan@g.msuiit.edu.ph

Received: 7 Feb 2022 Revised: 21 Mar 2022 Accepted: 16 Apr 2022

Abstract: The unprecedented shift in educational systems has given rise to a new environment known as the new normal education. In situations like this, science teachers need to be responsive to adapt to the new instructional approaches that strengthen curriculum practice. This qualitative descriptive study investigated the science teachers' perspective of science flexible learning in terms of teaching practices, challenges encountered, approaches to helping students become self-regulated learners, and the perceived effective science teaching strategies for flexible learning. The data were gathered from eight (8) science teachers through a focus group discussion (FGD). Transcripts of the interviews were closely examined, and themes were generated through inductive thematic analysis. The data revealed that the teaching practices of science teachers were characterized by implementing flexible teaching approaches with maximal parental involvement. Communication barriers and the integrity of student assessment were among the issues that science teachers faced because flexible learning is new to our educational system. In addition, self-regulating strategies such as scaffolding learning through collaborative activities were employed. Furthermore, science teachers hope this teaching modality will effectively implement a practical hands-on activity, adopt transdisciplinary learning tasks, and utilize technology for communication and instruction. The findings of this study suggest that, regardless of the modality, learning science can still be meaningful and relevant to real life if appropriate content and tasks are included in the lessons.

Keywords: Flexible learning, teachers' perspective, science teaching approaches

1. Introduction

The COVID-19 outbreak has been ongoing for over two years and continues throughout the country. Along with the people's health, economy, and welfare, education was considered one of the most affected sectors during the COVID-19 pandemic (Pitogo & Ecle, 2021). As a result, education should continue, and learning should not come to a halt in the face of the pandemic (Anzaldo, 2021). Because of the significant changes in education, educators face a massive challenge in their teaching, while students are uncertain. The pandemic has caused a delay in students' and teachers' normal learning

and teaching within the school. Nations reacted in a variety of ways because of the disruption in education. For example, while some countries offered multiple entry points, technology/media options, and different paths for learners to take, others heavily relied on synchronous and asynchronous online technologies. In addition, many countries concentrated their efforts on providing digital "content" or "materials" at the K – 12 and higher education levels, particularly those with the existing lecture or content-centric practices (Bozkurt et al., 2020).

To adapt to the country's pandemic situation and ensure educational continuity, the Department of Education (DepEd) issued the Most Essential Learning Competencies (MELCs), which serve as a guideline for implementing the revised K–12 curriculum. Even if the lectures are offered via different modalities, and without face-to-face physical classroom interactions, the MELCs narrow down all of the key teachings, concepts, and skill sets that a student must know, acquire, and understand. Furthermore, as a critical response to the pandemic, DepEd has paved the way for modular distance learning implementation (Park, 2021). Modular learning is distant learning that uses Self-Learning Modules (SLM) based on DepEd's most essential learning competencies. The modules include sections on motivation and assessment that serve as a comprehensive guide to teachers' and students' desired competencies. In addition, teachers monitor students' progress through home visits and feedback mechanisms to guide those who require special attention (Gumapac et al., 2021). According to DepEd's National Learner Enrolment and Survey Forms (LESFs) for SY 2020-2021, 8.8 million of the 22.2 million enrollees preferred modular distance learning as their learning mode.

Additionally, while most Filipino teachers are products of face-to-face schools and their teaching practices, misconceptions about distance education are on the rise, such as their technical skills in reintegrating pedagogy and knowledge of different assessment approaches in this learning environment. Hence, educational institutions must design appropriate and compelling content and effectively deliver it to their current faculty set up to achieve better learning outcomes (Adnan and Anwar, 2020; Diate and Mordeno, 2021). Rotas and Capahay (2020) disclosed that the difficulty encountered by students is the ambiguity of content, which stems from the content itself. These threaten the students' learning progression because teachers are not equipped with the necessary technical knowledge and skills about distance education (Bozkurt et al., 2020; Hardman and Ntlhoi, 2021).

Science teachers have long struggled to engage students in science and assist them to build an understanding of its concepts. The current distance learning modality, which most schools adopt as a new educational set-up, has significantly impacted teachers' teaching experiences. The Science teachers reflected on the changes in their approaches and how they teach science concepts in distance learning, the challenges they encountered, and what approaches helped students become self-regulated learners and their perceived effective science teaching approaches in a flexible learning modality.

2. Methodology

The teaching practices of science teachers in distance learning were investigated using a qualitative descriptive study approach. This study used an in-depth focus group discussion (FGD) to obtain data from eight (8) participants.

Participants

Eight (8) science teachers whose fields of specialization include Biology, Chemistry, and Physics and who are handling science classes in modular distance learning modalities participated in the FGD. Added to this, their distance learning teaching practices were also investigated.

Data Collection

To explore the experience of science teachers in a distance learning modality, an FGD was done. The conduct of the participants' FGD commenced after the letter addressed to the Schools Division Superintendent to conduct this research study. Another letter was crafted to inform the school principal that teachers were chosen to be the subject of this research. Informed consent was given to science teachers to provide them with information about the study's purpose and participants' expectations. Eight (8) science teachers participated in the FGD, conducted face-to-face, ensuring that health and safety protocols were observed throughout its duration.

Further, the conduct of the FGD was audio-recorded with the consent of the participants. In addition, the audio-recorded interviews of science teachers were transcribed for content analysis. Transcripts of the interviews were closely examined for initial notes and familiarization. Codes were created based on shared ideas or feelings expressed in the transcripts. Finally, by collating and sorting the codes, patterns and themes were generated, later named and defined. Interconnected themes from the different responses were compared to determine relevant and meaningful derivatives to the analyzed data presented.

Data Analysis

The gathered data were analyzed using content analysis. The data analysis started with transcribing the audio-recorded focus group discussion of the science teachers. The FGD was transcribed individually. The transcripts were carefully studied for familiarization, and initial coding was conducted. Initial codes were generated by identifying the patterns of the responses to the questions given. The codes were then collated, and initial themes were identified. In addition, the initial themes were reviewed to check if they made sense and accounted for all the coded extracts and the entire data set. Finally, the themes were named and labeled based on the researcher's understanding and from the findings of related literature. Verification of the data to check if their description is an accurate representation was also done.

3. Results and Discussion

3.1 Teaching Science Concepts in Distance Learning Modality

Teaching a hands-on subject like science in a distance learning modality is challenging for educators. The instructional practices used in the traditional learning mode are now replaced with emerging pedagogies that promote engaging and meaningful science learning experiences. Two major themes emerged based on the analyzed FGD data of science teachers on how they teach science concepts in distance learning. First, the implementation of simplified distance learning teaching approaches is one of the emerging themes where the doable codes activities and accessible learning resources belong, as shown in Table 1.

Table 1. Themes and supporting quotes on science teaching in distance learning

Teachers' Responses	Codes	Themes
TR2 ["As a teacher, I simplified the activities in the module to make it easier for students to answer."]	Doable activities	Flexible teaching approaches
TR5 ["I made sure I give less and modified performance tasks to the students"]		
TR4 ["I give the students the option on how to answer."]		
TR1 ["I give activities using materials readily available at home."]		

Table 1 *(Cont'd)*

Teachers' Responses	Codes	Themes
TR6 ["I copied the questions in the module then I embed them in a game."]	Accessible learning resources	
TR7 ["I actually made a YouTube account where I uploaded the video. Since students are fond of YouTube, they can easily access the videos."]		
TR1 ["I give instructions to the parents on how to do the activities."]	Mentor parents on helping students	Utmost parental involvement
TR4 ["I teach them how to do the activities, so they too can help their children."]		
TR3 ["Teach the parents techniques on how to explain the instructions to them so they can easily understand the topic."]	Consult parents on students' performance	
TR7 ["We have consultation with parents for us to know which of the activities students like to do… progress of the students while they are learning at home."]		
TR8 ["I asked for help from parents in terms of making follow-up with the students since they are the ones at home… I also asked what they like to study or do."]		

With distance learning, educators are focused on developing new teaching methods and activities to meet current needs (Tuychieva et al., 2020; Cevikbas & Argün, 2017). In support, some science teachers modify the given tasks and activities and provide other options to make them more doable for students, such as the following quotes:

> *"I simplified the activities in the module to make it easier for students to answer."* [TR2]
> *"I give the students the option on how to answer."* [TR4]
> *"I made sure I give less and modified performance tasks to the students."* [TR5]

These coincide with the claim of Mitchell (2020) that when it comes to distance learning, simplicity is often the key. The goal should be for all instructional learning materials to be as easy to access as possible for students and teachers. Keeping things simple can also make them more accessible to students. The statement of one (1) teacher-respondent is supported by various studies that teaching science in distance learning is possible by utilizing alternative materials such as household products in doing experiments and requiring science projects that students can work on from the comfort of their homes, both of which are aligned with the standard learning competencies (Ateş & Eryilmaz, 2011: Zulirfan et al., 2020; Pacifico & Prudente; 2021 and Robledo, 2021). Additionally, the tasks must be designed so that instructions are clearly stated. Hence, students feel that they can do it even on their own (self-supported) to develop their confidence in performing well in science learning tasks (Aque et al., 2021).

Apart from this, easy access to learning resources was also done using the game application and video lessons on YouTube. Integrating games into the learning process positively impact learning goals (Vlachopoulos & Makri, 2017) and improves students' scientific knowledge and performance (Sung & Hwang, 2013). Hence, easy access to these available game applications helps students learn more about science while at home and develop a love of learning on their own time (Lynch, 2017). Further, the study conducted by Pecay (2017) revealed that integrating YouTube into science enhances instruction. YouTube as a science learning resource allows learners to access it and view it on the go using their smartphones and other devices (Pappas, 2015). These studies support the following quotes:

> "*I copy the questions in the module then I embed in a game; students can access it using their mobile phone."* [TR6]
> *"I actually made a YouTube account where I uploaded the video. Since students are fond of YouTube, they can easily access the videos."* [TR7]

The science teachers emphasized the importance of utmost parental involvement in the distance learning setup. Parental involvement is deemed necessary in the educational process, especially when students encounter difficulties (Vellymalay, 2012). This emerged as the second theme where the codes mentoring parents on helping students and consulting parents on students' performance at home belong. The following statements matched with the results of the study of Irma et al. (2019) and Wardani and Ayriza (2020), implying that if parents understand the learning materials, it greatly aids the success of the learning process at home.

> *"I give instruction to the parents how to do the activities."* [TR1]
> *"I Teach the parents techniques on how to explain the instruction to their so they can easily understand the topic."* [TR3]
> *"I teach them how to do the activities, so they too can help their children."* [TR4]

Additionally, as Lui et al. (2010) pointed out, parental involvement should be considered in developing learning materials and the implementation of instructional strategies in distance learning modality. Further, parental involvement should include parents' role in determining which given activities motivated and engaged their children more in learning.

> *"We have consultation with parents for us to know which of the activities students like to do… progress of the students while they are learning at home."* [TR7]
> *"I asked help from parent in terms of making follow-up with the students since they are the ones at home… I also asked what they like to study or do."* [TR8]

These statements suggest that parents become the immediate figure of learning facilitation in the absence of teachers. However, learning will only occur when the parents allow it to happen. When they facilitate their children's learning with vigilance and honesty, then students will definitely learn (Galang et al., 2021). Therefore, the teaching approaches used by the science teachers in the distance learning modality were implemented with the hope of helping students acquire mastery of the science learning competencies that DepEd sets despite the new modality.

3.2. Challenges Encountered by Science Teachers in Distance Learning

As viewed by science teachers, teaching science concepts in distance learning entails a lot of considering the learners, the learning environment, and other factors that affect the teaching-learning process. In the process, science teachers had a dilemma on how science is taught in the context of the learners. Hence, the challenges encountered by science teachers in teaching science need to be investigated to know the actual situation of teachers and their teaching practices in distance learning. Table 2 shows the teachers' responses, the codes, and the themes of the challenges encountered in teaching science. The integrity of assessment, where the codes parent-answered modules and academic cheating among students belong, and communication barriers between students and teachers emerged as themes in science teachers' responses to their challenges.

Table 2: Themes and supporting quotes on challenges encountered by Science teachers in distance learning

Teachers' Responses	Codes	Themes
TR7 ["I cannot properly assess the students if it's their work or their parents' work."]	Parent-answered modules	Integrity of assessment
TR3 ["It's obvious that it's the parents who answered the activities, so it is difficult to know whether there is learning."]		
TR4 ["When students submit their modules, then you see parents writing the answer."]		
TR2 ["The answers are photocopied from his classmates' work, it's all the same."]	Academic cheating of students	
TR7 ["When you see the answers, they are exactly the same with his classmate or worst no answer at all."]		
TR5 ["I feel my students are disconnected with me."]	Feeling of disconnection	Communication barriers between students and teachers
TR6 ["It's really difficulty to connect with the students."]		
TR1 ["It's really difficult when you don't see them in person."]	Student-teacher relationship gap	
TR8 ["I cannot see the students' expressions."]		

The traditional assessment practice has evolved to meet the needs of modern society (Chaudhary & Dey, 2013). As such, in the distance learning modality, teachers expressed that the integrity of assessment is an issue that needs to be addressed. Furthermore, due to the teacher-learner proximity during instruction, monitoring students' tasks for assessment becomes crucial for teachers. According to Ahmad (2020), implementing distance education during the pandemic raises various problems, especially learning assessment. The statements support this result:

> *"I cannot properly assess the students if it is their work or their parents' work."* [TR7]
> *"It is obvious that it is the parents who answered the activities, so it is difficult to know whether there is learning"* [TR3]
> *"When students submit their modules, you see parents writing the answer."* [TR4]

This finding matches with the recent study by Anzaldo (2021) that some parents pamper their children and do their tasks instead of them. Parents answer the modules in place of their children for different reasons. Another challenge that teachers encounter in the view given is when students submit apparent outputs to others. The following quotes are consistent with the study results of Lucky et al. (2019) that cheating can falsely raise distance learning assessments.

> *"The answers are photocopied from his classmates' work… it is all the same."* [TR2]
> *"When you see the answers, they are exactly with his classmate or worst no answer at all."* [TR7]

In addition, Castroverde and Acala (2021) found it difficult for teachers to check outputs with no answers because it indicates that they have nothing to record about the students' performance. Students' lack of responses suggests that they are uninterested in learning. It is undeniable that the existing student assessment system for the Department of Education (DepEd) was already questionable before this transition to distance learning

(Capahay, 2020), making it more difficult for teachers to evaluate a student without evidence of learning in this new normal. Another theme that emerged was the concern about the communication gap between teachers and students in distance learning, where the codes feeling of disconnection and student-teacher relationship fall. Distance learning harmed communication, particularly between students and teachers (Alawamleh et al., 2020). The quotes support this claim:

> *"It's really difficult when you don't see them in person."* [TR1]
> *"I cannot see the students' expressions."* [TR8]
> *"I feel my students are disconnected with me."* [TR5]
> *"It's really difficult to connect with the students."* [TR6]

Science teachers recognize the value of communication because they feel disconnected from their students in this mode and feel dissatisfied in helping the students learn. These statements were consistent with Niemi and Kousa (2020). They posited that the teachers' main challenges in distance learning are inauthentic interaction and a lack of the ease that in-person teaching provides. Moreover, the study of Watts (2010) is consistent with the present study's findings that distance education students feel disconnected from classmates and teachers because they can neither see nor hear each other. The physical separation of learners and teachers in distance education can lead to challenges, specifically, keeping them connected. As Moore asserted in his theory of transactional distance, the space between the students and the teachers is primarily a communication gap. Hence, teachers must create opportunities for this communication to continue since dialogue is key to successful distance learning.

3.3 Approaches in Helping Students Become Self-Regulated Learners

Self-regulated learning has been recognized as an essential element of students' effective learning and academic achievement. A self-regulated learner can independently and effectively plan for learning, choose and use appropriate learning strategies and reflect and monitor learning progress (Ambreen et al., 2016). Self-regulation skill is a manifestation of learner autonomy, in which the learners take control and responsibility for their learning in the context of the learning environment (Murray, 2014). In distance learning, teachers must be committed to creating a learning environment where learners can gradually learn how to learn and develop their self-regulation skills to become more autonomous learners. Thus, they merely convert knowledge facilitators from knowledge providers (Sherry, 1995). Table 3 shows the themes that emerged in the approaches to helping students become self-regulated learners.

Table 3: Themes and supporting quotes on approaches in helping Students become self-regulated learners

Teachers' Responses	Codes	Themes
TR6 "…teachers will assist or facilitate the students…" TR2 "… simplify the activities and learning materials so it's easier to understand…" TR3 "… Instead of asking the students to make an essay about the importance of the solutions in our life, I asked them to do it in bullet forms." TR5 ["Individual follow-up of students and parents in complying with the modules."] TR2 ["Call the attention of parents or the students for not submitting the required activities."]	Ideas generation	Scaffold learning of students
TR1 ["I will give activities that the students themselves will work on their own in their own homes; give them tasks that encourage them to really work hard."]	Providing hands-on activities	Implementation of collaborative activities
TR4 ["Interesting small group activities shall be given to students; limited only to neighbors for example, but it should not be imposed and there must be choices."] TR5 ["We should motivate our students to contact their classmates to share their ideas… because through this they can develop themselves to work well with others."] TR6 ["Students will help each other in a project so that they will not be burdened."]	Encouraging group outputs	

The first theme emerged by scaffolding students' learning where the codes ideas generation and monitoring progress belong. From the data, science teachers expressed that they take the responsibility of making follow-up by assisting learners in accomplishing their tasks and giving them simplified activities and learning materials as supported by the quotes:

> *"Teachers will assist or facilitate the students."* [TR6]
> *"Simplify the activities and the learning materials, so it is easier to understand."* [TR2]

This finding matched with the study of Murphy (2007) that much of the responsibility for developing self-regulated learners' rests with the teaching/learning materials. The science teachers claim that simplifying the learning materials as a way of scaffolding their instruction in distance learning is supported by the results of the study by Feng and Chen (2014) that scaffolding is effective in developing self-regulated behavior. Moreover, the teachers' role as facilitators also includes monitoring learners' progress. When teachers monitor learners' progress, they learn more and become more aware of their performance.

> *"Individual follow-up of students and parents in complying with the module."* [TR3]
> *"Call the attention of parents or the students for not submitting the required activities."* [TR2]

Another theme that emerged in the FGD of science teachers on the approaches to helping students become self-regulated learners is implementing collaborative activities, including providing hands-on activities and encouraging group outputs as codes. In a

collaborative learning strategy, learners become less dependent on the teachers while collaborating with peers (Yasmin & Naseem, 2019), thus helping them become self-regulated learners. These statements support the code on providing hands-on activities, such as those working on tasks in a real-life setting with tangible material and equipment, stimulating self-regulation learning (So et al., 2019).

> *"I will give activities that students themselves will work on their own in their own homes; give them tasks that encourage them to work hard."* [TR1]
> *"Interesting small group activities shall be given to students; limited only to neighbors for example, but it should not be imposed and there must be choices,"* [TR4]
> *"Students will help each other in a project so that they will not be burdened."* [TR6]

Additionally, science teachers also mentioned that one strategy they used to implement collaborative activities is by encouraging group outputs from students in the distance learning modality. Doing small group science projects is preferred by science teachers since communities of learners have more significant knowledge resources than the individual. According to Schraw et al. (2006), collaboration in small groups provides an opportunity for explicit discussion of scientific concepts and reflection that promotes self-regulation. The same result was revealed by Timmons et al. (2016) that students respond to opportunities for self-regulation significantly more often in small groups. Hence, giving the students the opportunities to work in a group for a meaningful science project is an approach that can develop their self-regulation skills.

3.4 Perceived Effective Science Teaching Strategies for Distance Learning

Sciences that have engaged in distance teaching and learning share one common challenge: they need to prove that science can be taught at a distance. Based on the FGD analyzed data, science teachers have varied perceptions of what science teaching strategies are effective for distance learning. Table 4 shows the four (3) emerging themes: implementation of practical hands-on activities, utilization of technology for instruction and communication, and adoption of interdisciplinary performance tasks.

Table 4: Themes and supporting quotes on perceived effective science teaching strategies for distance learning

Teachers' Responses	Codes	Themes
TR6 ["The teachers will give simple activities for simple science experiments, where the students can use household materials, and a lot of practical home experiments can be found on the internet."]	Using household materials for simple experiments	Implementation of practical hands-on activities
TR5 ["The activities that we will implement are those that use household substances."]		
TR1 ["Give simplified and not complicated activities. And, if possible, involve parents in the activities that we will give to the students."]		
TR3 "["The activities that students perform at home should involve the parents and other family members, so that we are able to address the need for grouping so that learning takes place."]	Modifying activities that encourage parental involvement	

Table 4 *(Cont'd)*

Teachers' Responses	Codes	Themes
TR1 ["I think video lesson is effective for science because per experience in the face-to-face learning, students are motivated and easily learn the topic."]	Creation of science video lessons	Utilization of technology for instruction and communication
TR8 ["I should make follow up with the students and parents in messenger or through phone call. Through this, I would be updated on the performance of the students in their module, and I would know how the parents follow up the academic tasks of their children."] TR4 for students for the improvement of their knowledge. I think I will create group chat for students and group chat for parents as well."]	Connect with students and parents using available technology	
TR3 ["Teachers will collaborate in planning for the projects, making sure that there is learning on the part of the students."] TR1 ["The level teachers will have to plan on what is the most appropriate project of the students in relation to the competencies, and at the same those that they find the value in their lives."]	Collaboration among teachers	Adoption of transdisciplinary tasks
TR7 ["One thing that I have in mind is regarding the performance tasks, which can be fused with other subjects. In doing so, the students will not be burdened, at the same time the teacher will have lesser outputs to check. It's just like one but has a great impact."] TR3 ["The output should involve more than 1 subject so that there will be a quality output… students will have to do their best since there are many subjects involved."]	Creation of quality output	

Hands-on learning has become common in science education, and it's an essential aspect of the curriculum. It enables students to become critical thinkers who can apply what they've learned and, more crucially, the learning process to various situations in their lives. (Holstermann & Bögeholz, 2010). Science teachers in the current study believe that implementing practical hands-on activities in distance learning effectively teaches science. According to Sadi and Çakıroğlu (2011), hands-on activity enriched instruction improves students' science achievement.

Moreover, using real-life scenarios in problem-solving activities allowed the students to learn and increase their performance in the achievement test (Buan et al., 2021). This emerged as one of the themes, including the "use household materials for simple science experiments" and "modify activities that encourage parental involvement" as its codes. Since students are learning from the comfort of their own homes, it is practical to use household materials for science experiments, as supported by the following quotes:

> *"Teachers will give simple activities for simple science experiments."* [TR6]
> *"The activities that we will implement are those that use household substances."* [TR5]

This matched with the result of the study of Reeves and Kimbrough (2004) that kitchen Chemistry experiments involving familiar materials and measurements done in familiar surroundings enhanced students' appreciation of the relevance of chemistry in their lives. However, this finding contradicts the results of Seddon and Ridge (1987) that the performance of those children using scientific apparatus had improved significantly compared to those using household equipment.

Technology has transformed education over the last few decades, empowering teachers and students in every teaching-learning process. Technology becomes a tool that teachers use to enhance student learning in distance learning that replaces interpersonal communication between them. The science teachers claimed that they used technology in distance learning. Based on the analyzed FGD data, utilization of technology emerged as another theme that includes "creating science video lessons" and "connecting with students and parents using available technology" as its codes. The findings of studies support the following statements conducted that video lectures increased students' retention (Geri, 2012), improved motivation in learning (Lalian, 2018), and increased achievement as well as engagement of students (Bonafini et al., 2017). This is further supported by Umayam's (2018) study, which revealed that teachers could keep students engaged in new and innovative ways that motivate them by using video-based lessons.

> *"I think video lesson is effective for science because per experience in the face-to-face learning, students are motivated and easily learn the topic."* [TR1]
>
> *"I should make follow up with the students and parents in messenger or through phone call."* [TR4]
>
> *"I think I will create a group chat for students and group chat for parents as well."* [TR6]

Maintaining open lines of communication with parents is also critical for students' success. Teachers must communicate with parents in order to facilitate distance learning and ensure that students have the best possible learning experiences. As a result, technology plays an important role because it provides a variety of communication platforms for students and parents. These statements by science teachers imply that by communicating with students and parents, teachers plan for ways to stay in touch with them in this new environment. Teachers use online platforms such as email and social media technology to communicate with their students, either through their parents or directly to their students, according to the findings of Alea et al. (2020).

Furthermore, evidence from various studies shows that using technology in distance learning improved student-teacher interaction (Nhadi, 1999; Wondemtegegn, 2018; Salman et al., 2021), as well as a parent-teacher, shared responsibility in supporting students' learning (Suryani, 2013). As a result, a collaborative learning environment can be beneficial, particularly when advanced technology is used to aid learning. The adoption of interdisciplinary performance tasks emerged as the third theme in the FGD of science teachers on their perceived effective distance learning strategies. Interdisciplinary learning is a perspective in science that brings two or more disciplines together in a coherent way so that students can make meaningful connections and associations (You, 2017). According to the following statements, science teachers believe that collaboration among teachers at a grade level is critical in developing projects for students to complete at home. Teacher collaboration is identified as one factor that positively influences student performance in a study by Mora-Ruano et al. (2019).

> *"Teachers will collaborate in planning for the projects, making sure that there is learning on the part of the students."* [TR3]
>
> *"The level teachers will have to plan on what is the most appropriate project for the students.* [TR1]

In addition, Daradoumis et al. (2002) claimed that collaborative learning situations are beneficial to all students in distance learning who are dealing with an overload of tasks and other responsibilities. Science's investigative nature creates a unique

environment for group work, especially collaborative learning. When assigning science projects to students, collaborative learning can be used. As mentioned by science teachers, these science projects can be integrated into other learning areas such as English, Math, and others to produce high-quality student outputs. Interdisciplinary tasks in distance learning allow students to explore a variety of perspectives and viewpoints. The following quotes back up this claim.

> *"For performance tasks, it can be fused with other subjects."* [TR7]
>
> *"Output should involve more than 1 subject so that there will be a quality output."* [TR3]

It also suggests that science teachers prefer to collaborate on projects with other teachers. As a result, they will have fewer outputs to check, students will not be overburdened with tasks, and they will be expected to produce high-quality outputs. According to Tytler et al. (2019), implementing interdisciplinary tasks engages students in authentic tasks and innovation.

4. Conclusion

This study contributes to the understanding of teachers' perspective of science flexible learning in terms of their teaching practices in the new normal, the challenges they encountered, the approaches to helping students become self-regulated learners, and the perceived effective science teaching strategies for flexible learning.

The teaching practices of science teachers are characterized by implementing flexible teaching approaches with maximal parental involvement. Since distance learning is something new to our educational system, teachers have encountered potential roadblocks and challenges, including communication barriers and student assessment integrity. In addition, other strategies were carried out, particularly the self-regulating approaches, which include scaffolding of learning through collaborative activities, mainly to help learners cope with the modality of learning from home. When teachers are sensitive to potential difficulties, they play a vital role in helping students adjust to this new reality. Further, science teachers hope this teaching modality will effectively implement the practical hands-on activity, adopt transdisciplinary learning tasks, and utilize technology for communication and instruction.

The findings of this study suggest that, regardless of the modality, learning science can still be meaningful and relevant to real life if appropriate content and tasks are included in the lessons.

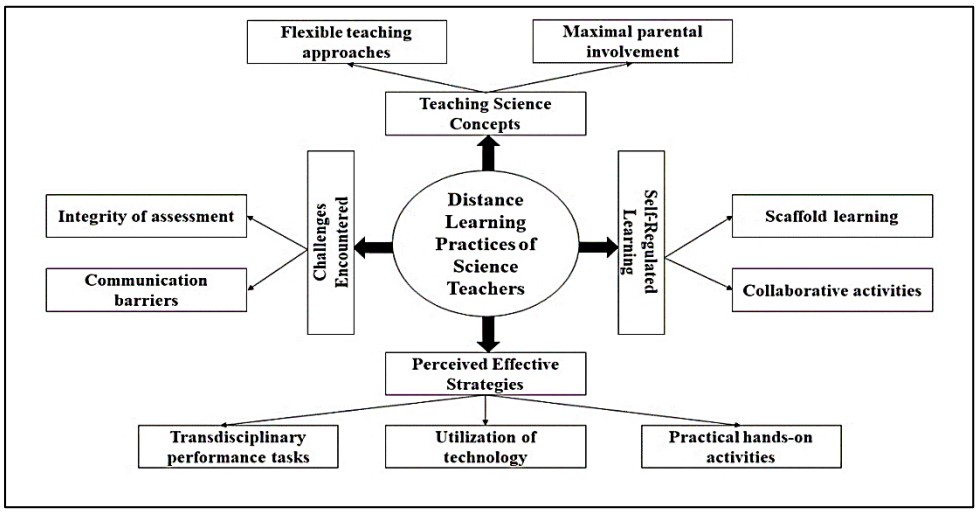

Figure 1. Distance Learning Practices of Science Teachers

Declaration of competing interest

The authors declare that they have no competing interests that could have appeared to influence the work reported in this paper.

Acknowledgment

The authors would like to thank the Department of Science and Technology-Science Education Institute (DOST-SEI) for the research funds.

Appendix 1. Focus Group Discussion Questions

1. Describe how you teach Science concepts nowadays?
2. What challenges have you encountered in teaching Science through distance learning modality?
3. In what ways do you help your students become independent learners?
4. Based on your experience, what approach is effective for distance learning?

References

Adnan, M., & Anwar, K. (2020). Online learning amid the COVID-19 pandemic: Students' Perspectives., Journal of Pedagogical Sociology and Psychology 2(1), 45-51. http://www.doi.org/10.33902/JPSP.%202020261309

Ahmad, I. F. (2020). Alternative assessment in distance learning in emergencies spread of coronavirus disease (Covid-19) in Indonesia. *Jurnal Pedagogik*, *7*(01), 195-222. https://tinyurl.com/bdeehttv

Alawamleh, M., Al-Twait, L. M., & Al-Saht, G. R. (2020). The effect of online learning on communication between instructors and students during Covid-19 pandemic. *Asian Education and Development Studies*. https://www.emerald.com/insight/2046-3162.htm

Alea, L. A., Fabrea, M. F., Roldan, R. D. A., & Farooqi, A. Z. (2020). Teachers' Covid-19 awareness, distance learning education experiences and perceptions towards institutional readiness and challenges. *International Journal of Learning, Teaching and Educational Research*, *19*(6), 127-144. https://doi.org/10.26803/ijlter.19.6.

Ambreen, M., Haqdad, A., & Saleem, W. A. (2016). Fostering self-regulated learning through distance education: A case study of M. Phil secondary teacher education program of Allama Iqbal Open University. *Turkish Online Journal of Distance Education,* 17(3). https://eric.ed.gov/?id=EJ1106363

Anzaldo, G. D. (2021). Modular distance learning in the new normal education amidst Covid-19. *International Journal of Scientific Advances*, *2*(3), 233-266. DOI: 10.51542/ijscia.v2i3.6

Aque, A., Barquilla, M., Buan, A., & Bagaloyos, J. (2021). Asynchronous Learning: Its Effects on Academic Performance and Students' Motivation In Science. *THABIEA: Journal of Natural Science Teaching*, *4*(1), 17-32.

Ateş, Ö., & Eryilmaz, A. (2011, June). Effectiveness of hands-on and minds-on activities on students' achievement and attitudes towards physics. *In Asia-Pacific Forum on Science Learning and Teaching* (Vol. 12, No. 1, pp. 1-22). The Education University of Hong Kong, Department of Science and Environmental Studies. https://tinyurl.com/yckp33dd

Bonafini, F., Chae, C., Park, E., & Jablokow, K. (2017). How much does student engagement with videos and forums in a MOOC affect their achievement. *Online Learning Journal*. https://www.learntechlib.org/p/183772

Bozkurt, A., and Sharma, R. C. (2020). Emergency remote teaching in a time of global crisis due to Corona Virus pandemic. *Asian Journal of Distance Education*, *15*(1), i-vi. https://tinyurl.com/2p8twr75

Buan, A. T., Ali, A. Z. M., & Gomez, R. (2021, March). Development and validation of contextualized lesson in mathematics. *In Journal of Physics: Conference Series* (Vol. 1835, No. 1, p. 012100). IOP Publishing.

Cahapay, M. B. (2020). Rethinking education in the new normal post-COVID-19 era: A curriculum studies perspective. *Aquademia*, 4(2), ep20018. https://doi.org/10.29333/aquademia/8315

Cahapay, M. B. (2020). Reshaping assessment practices in a Philippine teacher education institution during the Coronavirus disease 2019 crisis. *Pedagogical Research*, 5(4). https://doi.org/10.29333/pr/8535

Cahapay, M. B. (2021). Involvement of parents in the remote learning of children amid COVID-19 crisis in the Philippines: A transcendental phenomenology. *International Journal of Sociology of Education.* http://dx.doi.org/10.17583/rise.2021.7317

Castroverde, F., & Acala, M. (2021). Modular distance learning modality: Challenges of teachers in teaching amid the Covid-19 pandemic. *International Journal of Research, 10(8), 7-15*. http://doi.org/ 10.5861/ijrse.2021.602

Cevikbas, M., & Argün, Z. (2017). An innovative learning model in digital age: Flipped classroom. *Journal of Education and Training Studies*, 5(11), 189-200. https://doi.org/10.11114/jets.v5i11.2322

Chaudhary, S., & Dey, N. (2013). Assessment in open and distance learning system (ODL): A challenge. *Open Praxis, 5(3)*, 207-216. http://dx.doi.org/10.5944/openpraxis.5.3.65

Daradoumis, T., Xhafa, F., & Marquès, J. M. (2002). A methodological framework for project-based collaborative learning in a networked environment. *International Journal of Continuing Engineering Education and Life Long Learning*, 12(5-6), 389-402. https://telearn.archives-ouvertes.fr/hal-00190097

Diate, K., & Mordeno, I. C. (2021). Filipino Physics Teachers' Teaching Challenges and Perception of Essential Skills for a Supportive Learning Environment. Asia Research Network Journal of Education, 1(2), 61–76. Retrieved from https://so05.tci-thaijo.org/index.php/arnje/article/view/251765

Feng, C. Y., & Chen, M. P. (2014). The effects of goal specificity and scaffolding on programming performance and self-regulation in game design. *British Journal of Educational Technology, 45(2), 285-302*. https://doi.org/10.1111/bjet.12022

Galang, A. D., Conde, R. L., & Sudarsana, I. K. (2021). Mga kwento ng guro at kwentong mag-aaral: student assessment processes, challenges and solutions In the New Normal Setup Leading To Quality Assurance Inputs. *Jurnal Penjaminan Mutu, 7(2)*. https://tinyurl.com/2zcjzpyn

Geri, N. (2012). The resonance factor: Probing the impact of video on student retention in distance learning. *Interdisciplinary Journal of E-Learning and Learning Objects, 8(1), 1-13*. https://www.learntechlib.org/p/44757

Gumapac, J. R., Aytona, E. M., & Alba, M. G. R. (2021). Parents Involvement in Accomplishing Students Learning Tasks in the New Normal. *International Journal of Research in Engineering, Science and Management*, *4*(7), 367-380.

Hardman, J., & Ntlhoi, T. (2021). Online Quizzes as Mediating Tools for Teaching Information Communication Technology to First Year Students at a College of Education in the Developing Context of Lesotho. *Asia Research Network Journal of Education*, 1(2), 50–60. Retrieved from https://so05.tci-thaijo.org/index.php/arnje/article/view/251470

Holstermann, N., Grube, D., & Bögeholz, S. (2010). Hands-on activities and their influence on students' interest. *Research in Science Education*, 40(5), 743-757. https://doi.org/10.1007/s11165-009-9142-0

Irma, C. N., Nisa, K., & Sururiyah, S. K. (2019). Keterlibatan orang tua dalam pendidikan anak usia dini di TK Masyithoh 1 Purworejo. Jurnal Obsesi: *Jurnal Pendidikan Anak Usia Dini*, 3(1), 214-224. https://tinyurl.com/4mxherp8

Lalian, O. N. (2018). The Effects of Using Video Media in Mathematics Learning on Students' Cognitive and Affective Aspects. *AIP Conference Proceedings, Volume 2019*(1). https://doi.org/10.1063/1.5061864

Lucky, A., Branham, M., & Atchison, R. (2019). Collection-based education by distance and face to face: Learning outcomes and academic dishonesty. *Journal of Science Education and Technology*, 28(4), 414-428. https://doi.org/10.1007/s10956-019-9770-8

Liu, F., Black, E., Algina, J., Cavanaugh, C., & Dawson, K. (2010). The validation of one parental involvement, measurement in virtual schooling. *Journal of Interactive Online Learning*, 9(2).) https://tinyurl.com/yczw53vf

Lucky, A., Branham, M., & Atchison, R. (2019). Collection-based education by distance and face to face: Learning outcomes and academic dishonesty. *Journal of Science Education and Technology*, 28(4), 414-428. https://doi.org/10.1007/s10956-019-9770-8

Lynch, M. (2017) *How does gamification effect the learning process?* https://tinyurl.com/2whvzxak

Mitchell, L. (2020). 6 Strategies for Successful Distance Learning https://www.edutopia.org/article/6-strategies-successful-distance-learning.

Mora-Ruano, J. G., Heine, J. H., & Gebhardt, M. (2019, August). Does teacher collaboration improve student achievement? analysis of the German PISA 2012 sample. In *Frontiers in Education* (Vol. 4, p. 85). Frontiers. https://doi.org/10.3389/feduc.2019.00085

Murphy, L. (2007). *Supporting learner autonomy: theory and practice in a distance learning context*. https://tinyurl.com/2p9c942e

Murray, G. (2014). *The social dimensions of learner autonomy and self-regulated learning*. http://sisaljournal.org/archives/dec14/murray

Ndahi, H. B. (1999). *Utilization of distance learning technology among industrial and technical teacher education faculty*. https://tinyurl.com/4a6x5jz8

Niemi, H. M., & Kousa, P. (2020). A case study of students' and teachers' perceptions in a Finnish high school during the COVID pandemic. *International Journal of Technology in Education and Science.* https://ijtes.net/index.php/ijtes/article/view/167

Pacifico, E., & Prudente, M. (2021). *Grade 12 STEM students' perceptions and experiences in home-grown chemistry experiments*. https://tinyurl.com/2p8n4jtt

Pappas, C. (2015). *Advantages and possible limitations of online learning*. https://tinyurl.com/2p9fyas6

Park, C. L., Williams, M. K., Hernandez, P. R., Agocha, V. B., Carney, L. M., DePetris, A. E., & Lee, S. Y. (2019). Self-regulation and STEM persistence in minority and non-minority students across the first year of college. *Social Psychology of Education*, *22*(1), 91-112.https://doi.org/10.1007/s11218-018-9465-7

Pecay, R. K. D. (2017). YouTube integration in science classes: Understanding its roots, ways and selection criteria. *Qualitative Report*, 22(4). https://nsuworks.nova.edu/tqr/vol22/iss4/6/

Pitogo, V. M., & Ecle, K. (2021). Insights into Undergraduate Students' Experiences of Emergency Remote Learning during COVID-19 Pandemic: A Phenomenology Study. *Asia Research Network Journal of Education*, *1*(2), 77-95.

Reeves, J., & Kimbrough, D. (2004). Solving the laboratory dilemma in distance learning general chemistry. *Journal of Asynchronous Learning Networks*, 8(3), 47-51. https://tinyurl.com/ymxz3dpc

Robledo, D. A. (2021). Biology at Home: The six attributes of home-based Biology experiments (HBEs) for remote authentic learning. *Psychology and Education*, 58(3), 4319-43123. https://tinyurl.com/mryvracy

Rotas, E. E., & Cahapay, M. B. (2020). Difficulties in remote learning: voices of Philippine university students in the wake of COVID-19 crisis. *Asian Journal of Distance Education*, 15(2), 147-158. https://tinyurl.com/668chf

Sadi, Ö., and Çakıroğlu, J. (2011). *Effects of hands-on activity enriched instruction on students' achievement and attitudes towards science.* http://www.scientiasocialis.lt/jbse/?q=node/219

Salman, I., Benyamin, P. I., & Wartoni, W. (2021). *Monitoring model and evaluation of ICT utilization in the new normal era in distance learning in Madrasah*. http://doi.org/10.4108/eai.11-11-2020.2308302

Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting self-regulation in science education: Metacognition as part of a broader perspective on learning. *Research in Science Education*, 36(1), 111-139. http://doi.org/10.1007/s11165-005-3917-8

Seddon, G. M., & Ridge, J. S. (1987). The effects of using scientific and household apparatus on the results of a primary school experiment. *Research in Science & Technological Education*, 5(2), 149. https://tinyurl.com/2p8uvm8m

Sherry, L. (1995). Issues in distance learning. *International journal of educational telecommunications*, 1(4), 337-365. https://tinyurl.com/mrxy78yh

Sung, H. Y., U & Hwang, G. J. (2013). A collaborative game-based learning approach to improving students' learning performance in science courses. *Computers & Education.* http://dx.doi.org/10.1016/j.compedu.2012.11.019

So, W. W. M., Chen, Y., & Wan, Z. H. (2019). Multimedia e-learning and self-regulated science learning: A study of primary school learners' experiences and perceptions. *Journal of Science Education and Technology*, *28*(5), 508-522.

Suryani, A. (2013). Home-schooling interaction: remodeling a framework of parents-teachers relationship for supporting students' learning. *Jurnal Social Humaniora (JHS)*, 6(10), 1-19.

Timmons, K., Pelletier, J., & Corter, C. (2016). Understanding children's self-regulation within different classroom contexts. *Early Child Development and Care*, 186(2), 249-267. https://tinyurl.com/5953x2s2

Tuychieva, S. M., Nematova, G. A., & Arzikulov, M. U. (2020). Innovative methods for distance learning. *Central Asian Journal of Education*, 5(2), 1-7. https://files.eric.ed.gov/fulltext/EJ1306583.pdf

Tytler, R., Williams, G., Hobbs, L., & Anderson, J. (2019). Challenges and opportunities for a STEM interdisciplinary agenda. In *Interdisciplinary Mathematics Education* (pp. 51-81). Springer, Cham. https://tinyurl.com/mr2rkf9h

Umayam, C. (2018), Five (Easy-to-Implement) *Ways video can have a powerful impact on teaching and learning*. https://tinyurl.com/36tmdnv3

Vellymalay, S. K. N. (2012). Parental involvement at home: Analyzing the influence of parents' socioeconomic status. *Studies in Sociology of Science*, 3(1), 1. http://doi.org/10.3968/j.sss.1923018420120301.2048

Vlachopoulos, D., & Makri, A. (2017). The effect of games and simulations on higher education: a systematic literature review. *International Journal of Educational Technology in Higher Education*, 14(1), 1-33. http://doi.org/10.1186/s41239-017-0062-1

Wardani, A., & Ayriza, Y. (2020). Analisis kendala orang tua dalam mendampingi anak belajar di rumah pada masa pandemi Covid-19. Jurnal Obsesi: *Jurnal Pendidikan Anak Usia Dini*, 772. https://doi.org/10.31004/obsesi.v5i1.705

Watts, L. K. (2010). *The role of dialogue in distance education: A qualitative study*. The University of Nebraska-Lincoln. https://tinyurl.com/4f5wpmd4

Wondemtegegn, S. A. (2018). University students' perception and utilization of technology for learning: The Case of Haramaya University. *Online Journal of Communication and Media Technologies*, 8(1), 130-149. https://tinyurl.com/4hw9727y

Yasmin, M., & Naseem, F. (2019). Collaborative learning and learner autonomy: beliefs, practices and prospects in pakistani engineering universities. *IEEE Access*, 7, 71493-71499. https://doi.org/10.1109/ACCESS.2019.2918756

You, H. S. (2017). Why teach science with an interdisciplinary approach: history, trends, and conceptual frameworks. *Journal of Education and Learning*, 6(4), 66-77. http://doi.org/10.5539/jel.v6n4p66

Zulirfan, Z., Yennita, Y., & Rahmad, M. (2020, October). STEM at Home: provide scientific activities for students during the Covid-19 pandemic. In *Journal of Physics: Conference Series* (Vol. 1655, No. 1, p. 012068). IOP Publishing. http://doi.org/:10.1088/1742-6596/1655/1/012068