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Teacher's Facilitating Strategies in Conducting Science Investigatory Project

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Abstract: Teacher's Facilitating Strategies in Conducting Science Investigatory Project. **Objective:** The study assessed the science teacher's facilitating strategies in conducting the Science Investigatory Project (SIP) in the new normal in terms of formulating a problem, developing a design, and constructing an explanation. **Methods:** A descriptive-correlational research method was utilized using a survey questionnaire administered to 293 STEM students and 59 STEM research teachers. **Findings:** Findings revealed that teachers have agreed that the facilitating strategies in conducting SIP in terms of formulating a problem, developing a design, and constructing an explanation have been practiced in the new normal setting. Students strongly agreed that the facilitating strategies had been mostly practiced by the teachers in the new normal. **Conclusion:** STEM teachers have adapted to the sudden shift in the educational system. They have been prepared with skills and have been practicing various facilitating strategies that have assisted students in conducting their SIPs in the new normal.

Keywords: facilitating strategies, science teacher, science investigatory project

Abstrak: Strategi Fasilitasi Guru dalam Melaksanakan Proyek Investigasi Sains. ***Tujuan:*** *Penelitian ini mengkaji strategi fasilitasi guru IPA dalam melaksanakan Science Investigatory Project (SIP) pada era normal baru dalam hal merumuskan masalah, mengembangkan desain, dan menyusun penjelasan.* ***Metode:*** *Metode penelitian deskriptif-korelasional digunakan dengan menggunakan kuesioner survei yang diberikan kepada 293 siswa STEM dan 59 guru penelitian STEM.* ***Temuan:*** *Temuan mengungkapkan bahwa guru telah setuju bahwa strategi memfasilitasi SIP dalam hal merumuskan masalah, mengembangkan desain, dan membangun penjelasan telah dipraktekkan pada era normal baru. Siswa sangat setuju bahwa strategi fasilitasi banyak dilakukan oleh para guru di masa normal baru.* ***Kesimpulan:*** *Guru STEM telah beradaptasi dengan perubahan mendadak dalam sistem pendidikan. Mereka telah dibekali keterampilan dan telah mempraktekkan berbagai strategi pendampingan yang telah membantu mahasiswa dalam melaksanakan SIP di era normal baru.*

Kata kunci: *strategi fasilitasi, guru IPA, proyek investigasi IPA.*

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INTRODUCTION

Science Investigatory Project (SIP) is an undertaking for science class students which need an application of certain scientific principles and ideas that could cultivate the information, skills, attitudes, and values of the students to participate in the solution of problems actively and effectively being faced by the community through inquiry process and investigation. Science teachers were essential in SIP instruction and assessment, as their strategies and techniques paved the way for students to conduct SIPs and compete. Teachers can help students learn by making the educational process more accessible to them in some way.

According to Sanchez & Rosaroso (2019), the journey of science teachers in implementing SIP instruction is not without challenges, particularly in the supported curriculum. The lack of computer facilities, functional libraries, and laboratory resources are among the most common issues raised by teachers. Apart from the fact that there are no face-to-face classes, the teachers' problems in SIP instruction remain a dilemma in the new normal. As a result, teachers, as facilitators in the new normal, faced significant challenges in assisting students with their SIPs.

Involving students in research has been shown to be beneficial for the student but a great challenge for the teachers (Aparecio, 2018). The journey of teachers in SIP-teaching and learning, on the other hand, has not been explored, particularly during pandemic. As a result, it is critical to think about their experiences and best practices as they consciously and unconsciously develop students' research skills and prepare them for research and development.

Based on the abovementioned premise, the researcher conducted this study to assess the science teacher's facilitating strategies in conducting SIPs in the new normal. This study aimed to fill the gap on the problems met and determine the practices in teaching SIPs especially during pandemic in the perspective of science teachers and Science, Technology, Engineering, and Mathematics (STEM) students. It is also beneficial for the department to know the facilitating strategies in every area of conducting SIPs being practiced by the teachers in the new normal set-up.

Teachers' Facilitating Strategies in SIP in the New Normal

Due to its relevance to students' lives and the universally applicable problem-solving and critical thinking skills it uses and develops, science education is one of the most important subjects in school. These are life skills that allow students to generate ideas, make informed decisions, and even comprehend the evidence that informs public policy. (Arrieta et al., 2020). It basically integrates science and technology in the social, economic, personal and ethical aspects of life. The integration across areas and other disciplines will lead to a meaningful understanding of concepts and its application to real-life situations (Deped Science Curriculum, 2016).

Science teachers are challenged to employ better methodologies and activities to make the learning process more interesting especially during a pandemic. Teaching Science specifically conducting investigatory projects in secondary school is not that easy because of the more complicated theories and procedures needed to be done which make it a great challenge faced by teachers due to distance learning making it difficult to facilitate students during implementation of the methodology. A science teacher is considered someone intellectual, a nature lover, and with great interest about the world. It takes a lot of training and experiences including involvement in experiments and travel to the most isolated and dangerous places to be able to find more data leading to knowledge that can greatly impact the world (Sanchez & Rosaroso, 2019).

Instead of making learners remember and copy textbook content, classrooms are now considered as working communities in which the teacher is largely responsible for promoting intellectual dialogue and involvement by the students. Aside from daily classroom structure, one of the teacher's key duties is to foster conversation in a way that draws on students' ideas, pays respect to existing theories and facts, and equitably promotes those views (National Academies of Sciences, Engineering, and Medicine, 2019).

Instruction is structured and student learning is supported instead of information being provided. In many investigations require students to collect data to answer a question, analyze that data, and develop an explanation, then return to perform further analysis and generate a new explanation before communicating their findings. Below are variables that will be considered by the researcher as focus of the study in determining teachers facilitating strategies in conducting SIP.

Formulating a problem.

Formulating a problem defined as the phase of conducting SIP in which students make sense of phenomena or the timely and relevant problem in the community. The students want to investigate scientifically and formulate statement of problems through making observations and drawing on existing knowledge and experiences. This term refers to the part of conducting SIPs in which students choose a research topic, identify relevant problem, formulate a statement of problem and hypothesis, present objectives and significance of the problem, and make a review of related literature through primary and secondary sources.

Basically, it is designing a research topic and formulating a research problem. The National Academies of Sciences, Engineering, and Medicine (2019) emphasized that teachers have a crucial role in cooperating with students to discover, create, and execute contextualized phenomena that enable students to ask and react to questions in a number of ways. Relevance necessitates a link to the interests of the learners, such as their communities, cultures, locales, and experiences, as well as real-world difficulties. If teachers chose phenomena or design challenges that are important to the community, the accompanying student questions will be relevant. Students construct a problem, make meaning of occurrences, and develop challenges based on observations and prior knowledge and experiences throughout the investigation. Formulating a problem is a step-in investigatory project which student-researchers select a topic to research on and develop a question that intrigues the students wanting to find answer and propose a solution (Gubalane, 2021).

Developing a design

Developing a design is defined as research project being developed by the students highlighting the formulated questions as well as the research process or methods about how these phenomena or the timely problem in the community being investigated scientifically work and will be studied in the natural and engineered world. It basically refers to the part of research project where students develop a design and/or methods/procedure as to how the data gathering will be done in the natural and engineered world and what research design will be utilized. Moreover, this variable includes part of SIP where students choose specific sampling technique and utilized various statistical tools.

Students create and build a design while also asking questions and developing techniques to understand how these phenomena operate in both the natural and man-made environments They collect and analyze data and information

in order to identify patterns and assess evidence. They build on and apply their prior research's grasp of essential disciplinary concepts and cross-cutting subjects. Teachers are crucial in assisting students in using the tools and techniques required to collect data, as well as establishing clear standards for what constitutes evidence. They try to get students to make evidence-based decisions. Teachers assist students in identifying and incorporating connections to prior knowledge, as well as how a research ties to cross-cutting concepts or discipline fundamental principles learned in earlier courses (National Academies of Sciences, Engineering, and Medicine,2019).

Constructing an explanation.

Constructing an explanation is the student's ability to construct an explanation on the causes of phenomena or the timely problem in the community being investigated scientifically and create arguments for how the evidence obtained throughout the investigations and testing of solutions to issues supports the explanation. This refers to the student's ability to construct an explanation and/or interpretation on the results and findings gathered based on their conducted SIP. Specifically, this includes the part of SIP in which students presents the result, make an interpretation and analysis of data and formulate a generalization and/or conclusion.

Students provide arguments for how the evidence acquired from investigations and tests of challenge solutions supports the explanation for the reasons of occurrences and the interactions between the system's components (National Academies of Sciences, Engineering, and Medicine,2019). Teachers must establish clear expectations for the formation of arguments that demonstrate how evidence supports or refutes a claim or explanation. When students take part in design challenges, the instructor serves as a design coach as well (Purzer, 2017).

Since teachers play a vital role in SIP instruction, it is recommended that they should facilitate the students with various strategies, not only during the execution of their projects, but also during the planning and evaluation stages. Because SIP instruction is primarily based on scientific method and research, it should be taught using scientific method steps and integrated with basic research skills to ensure the success of the SIP process. To improve the success of the SIP process, government and private administrators should build research infrastructure in basic education to provide access to vast amounts of information in print and electronic resources.

The related readings and literature had significant contribution for the review of ideas related to this research especially on what facilitating strategies are suited and have been practiced by the teachers in conducting science investigatory projects. The abovementioned literatures were related to the present study since all discussed the significant features of the teachers facilitating strategies in conducting SIPs which was separated per variable presented. As a whole, the difference between the reviewed literatures and the present study were the time of conduct, the location, the respondents and the data gathered.

Objective of the Study

The study assessed the science teacher's facilitating strategies in conducting Science Investigatory Project in the new normal. Specifically, it determined the profile of the respondents, the teachers' facilitating strategies in conducting science investigatory project in terms of formulating a problem; developing a design; and constructing an explanation. It also tests the significant relationship on the respondents view to the facilitating strategies in conducting science investigatory project and their profile.

METHODS

Participants

The study's respondents were the 59 STEM teachers handling research/capstone projects and 293 STEM students, both grades 11 and 12, in all senior high schools in Surigao del Norte, Philippines. Total enumeration was employed for the teacher-respondents. However, random sampling was applied to the student respondents, and the sample size was determined using the Cochran (1977) formula, which is considered appropriate in situations with large populations.

Research Design and Procedures

A descriptive-correlational research method was utilized in this study to assess the teacher's facilitating strategies in conducting SIP in the new normal and investigate relationships between variables without the researcher controlling or manipulating any of them. This method produces static features of the situation and establishes the relationship between different variables (McBurney & White, 2009). For the data gathering, a certificate from the Office of the Dean of Graduate Studies was secured before conducting the study. Upon approval, the researcher conducted a dry run to refine the questionnaires, validity, and reliability of the test. Then, an invitation and informed consent form was given to the participants indicating voluntary participation in the study and understanding all the rights of withdrawal and refusal. Respondents answered the survey questionnaires. The answered questionnaires were collected, and checked which respondents' responses were tallied, treated, and analyzed using the appropriate statistical tools. Strict confidentiality was assured to the participants, which was specified in the informed consent form.

Instrument

A researcher-made survey questionnaire based on the article of National Academies of Academies of Sciences, Engineering, and Medicine (2019) was utilized in the study. The questionnaire is composed of two parts. Part 1 covers the profile of the respondents. Part 2 covers the survey questions on the teachers' facilitating strategies in conducting SIP in terms of formulating a problem, developing a design, and constructing an explanation for both teacher and student respondents. Indicators were categorized per area as specific topics in the conduct of SIP. For each question, the respondents expressed their agreement on a four-point Likert-type scale by marking the corresponding number on the scale that best represents their agreement with the question. To determine teachers facilitating strategies in conducting science investigatory project, the following scale and interpretation was used (Table 1).

The instrument's content validity by experts in the field of science and research. The expert's comments and suggestions were considered in the final draft, and the instrument's reliability was established using Cronbach's alpha. (Table 2). Reliability testing of the instrument was presented in Table 2.

Table 1. Scale, qualitative description, and interpretation used

Scale	Parameter	Qualitative Description	Verbal Interpretation
4	3.50-4.00	Strongly Agree	Most Practiced
3	2.51-3.49	Agree	Practiced
2	1.51-2.0	Disagree	Less Practiced
1	1.00-1.49	Strongly Disagree	Not Practiced

Table 2. Reliability testing for components of instruments' and their corresponding Cronbach's alpha

Components	No. of Items	Cronbach's alpha	Interpretation*
Formulating a Problem	15	0.84	Good
Developing a Design	15	0.80	Good
Constructing an Explanation	15	0.74	Acceptable

Data Analysis

The responses were treated using descriptive and inferential statistics. Mean ± standard deviation (SD) statistical analysis was used to describe teachers' facilitating strategies in conducting SIP. Frequency and Percent Count were used to summarize the profile of the respondents. Pearson-r was utilized to measure the strength and the direction of the relationship between the two variables and was explicitly used to determine whether there is a significant relationship between the teachers' facilitating strategies in conducting SIP and the profile of the respondents. Spearman Rank correlation, Point Biserial correlation, and Eta squared were utilized to measure the strength of association between the teachers' facilitating strategies in conducting SIP and the profile. A two-sample t-test was used to determine the relationship between teachers' facilitating strategies in conducting SIP and student's views.

■ RESULTS AND DISCUSSION

Profile of Teacher-Respondents

A total of 59 STEM teachers participated in the study. Most of the teacher respondents are of age thirty-one (31) with the mean average of 31.08. According to Chiang and Wang (2015) that the group with age above 30 tended to make their own decisions to teach rather than others' influence compared with the other age group. Moreover, with greater intrinsic values in teaching and seeing a teaching job a mission proportionately more, the group of above age 30 expressed themselves as more psychologically suitable for the teaching profession than their younger counterpart. This suggested that students are of great hands having teachers that are more suitable in the job.

Moreover, most of the STEM teachers who handled SIPs are female with 71.2%. As emphasized by Wahsheh and Alhawamdeh (2015) that the female teachers are keen to make the students cooperate in various class activities and the female teachers manage to fix and develop teaching methods and techniques according to the results of the assessment. However, most of the teacher-respondents are still Masters Degree Unit Earner and on the process of finishing their Master's Degree with 52.5%. As to teaching experience, majority of the teacher-respondents are on their five (5) years of teaching with the mean average of 5.03 and their number of relevant seminars and trainings attended falls on the mean of 4.20 which can be supported on the fact that the implementation of the K-12 system in the Philippines began in the 2012-2013 academic year and the separation of students per strand have just on its onset. This means also that opportunities have just come to the teacher-respondents to be employed in Department of Education specifically in Senior High School Curriculum and in terms of seminars and trainings attended. Based on the data, it can be implied that the teacher respondents are heterogenous in which probably their views towards facilitating strategies in conducting SIP vary each other.

Table 3. Profile of teacher-respondents

Profile		f(n=59)	Percent
Sex	Male	17	28.8
	Female	42	71.2
Highest Educational Attainment	College Graduate	12	20.3
	Masters Degree Unit Earner	31	52.5
	Masters Degree Graduate	10	16.9
	Doctors Degree Unit Earner	2	3.4
	Doctors Degree Graduate	4	6.8
		Mean	**SD**
Age		31.08	7.64
Teaching Experience		5.03	5.05
Number of Relevant Seminars and Trainings Attended		4.20	2.44

Profile of Student-Respondents

Table 3 shows the result of the profile of the student respondents as to age, sex, grade level, parent's highest educational attainment, and parent's occupation. It can be gleaned that majority of the student-respondents are of age seventeen (17) with the mean average of 17.38 which basically proved as stated that students in Senior High School falls on age range of 16-18 as highlighted by Seniorcareto (2022).

In addition, most of the student respondents who participated in the survey are females with 56.66% in which most of them also are Grade 11 that also coincides in Table 4, the distribution of student respondents in which STEM grade 11 has the greatest number of enrolled students compared to grade 12 in the entire research locale. This has supported the claim of Genovese (2020) that women are more likely to participate than men. As to parent's highest educational attainment, they both falls on High School Graduate with the percentage of 27.65% and 31.40% to both mother and father respectively which also has an impact on the input or assistance they can give to their children. The more educated the parent was, the higher educational aspirations and attainment the child had (Clearinghouse

Table 4. Profile of student-respondents

Profile		f(n=293)	Percent
Sex	Male	124	42.32
	Female	169	57.68
Grade Level	Grade 11	166	56.66
	Grade 12	127	43.34
Mother Highest Educational Attainment	Elementary Level	24	8.19
	Elementary Graduate	24	8.19
	High School Level	52	17.75
	High School Graduate	81	27.65
	College Level	36	12.29
	College Graduate	71	24.23
	Master's Degree Unit Earner	1	0.34
	Master's Degree Graduate	4	1.37

Father Highest Educational Attainment	Elementary Level	23	7.85
	Elementary Graduate	30	10.24
	High School Level	47	16.04
	High School Graduate	92	31.40
	College Level	39	13.31
	College Graduate	56	19.11
	Master's Degree Graduate	5	1.71
	Doctors Degree Graduate	1	0.34
Mother Occupation	Government Employee	23	7.85
	Housewife	180	61.43
	Teacher	21	7.17
	Self-Employed	28	9.56
	Private Employee	34	11.60
	Others	7	2.39
Father Occupation	LGU Official	8	2.73
	PNP/BFP	14	4.78
	Farmer	45	15.36
	Construction Worker	36	12.29
	Laborer	12	4.10
	Technician/Engineer	17	5.80
	Tricycle driver	56	19.11
	Private Employee	44	15.02
	Self-Employed	39	13.31
	Teacher	15	5.12
	Others	7	2.39
		Mean	**SD**
Age		17.38	0.75

for Military Family Readiness, 2020). As to the parent's occupation, most of the mother of the student respondents are housewife with the percentage of 61.43% while most of the father of the student respondents are tricycle driver with the percentage of 19.11%. Academic achievement of students as moreover emphasized by Adzido, Dzogbede, Ahiave, and Dorkpah (2016) that in school setting, support strategies such as improving occupation and income among families by government must be focused on for it can affect students' academic achievement. Based on the data, it can also be implied that the student respondents are heterogenous in which probably their views towards the employment of facilitating strategies in conducting SIP by their teacher vary each other.

Facilitating Strategies in Conducting SIP as Perceived by Teachers and Students

The facilitating strategies in conducting SIP as perceived by teachers and students are presented in Table 4. The teachers practiced formulating a problem, developing a design, and constructing an explanation, which was perceived as most practiced by students. Overall, the facilitating strategies in conducting SIP are practiced as perceived by the teachers (3.43±0.39) and students (3.63±0.38).

The result parallels the study of Farrugia et al. (2019) that the teacher used facilitating strategies in formulating a problem to drive the research project, including data collection, analysis, and conclusions. These also help students narrow in on the focus of their

research and critical variables, guiding them through the research process. As emphasized by Mandernach et al. (2018), supplemental resources can be a powerful tool in a distance learning setup. When used appropriately, they can help motivate, engage, and support students as they make their way through other course elements. Additionally, supplemental materials can provide teachers with a way to fill in perceived gaps within the prescribed instructional materials and offer teachers different approaches to motivating students (Foss et al., 2022; Marple et al., 2017; Walan, 2020). Complementary supplemental learning materials can also aid teachers in meeting the diverse needs of all learners (Zhang, 2021). Delivering this properly helps the students develop specialized know-how and enhance their multidisciplinary competencies, specifically in stating objectives, making hypotheses, and doing RRL (Ford, 2021). As the teachers have employed various facilitating strategies, students, in return, accept responsibility for his/her learning, actively participates and are authentically engaged, and show confidence in the teaching-learning process (Kentucky Department of Education, 2020). This is related to the study of Nguyen et al. (2021) that active learning methods by allowing students to experience meaningful learning are known to increase motivation, engagement, and learning in traditional classrooms that also positively impact the remote learning environment. Integrating these elements into online courses will improve the student experience despite challenges in the new normal setup.

In developing a design, extending time on this matter is very important for teachers to consider for their students. According to Richman (2020), more students will be better able to share their learning if they have the needed time. Sampling helps a lot in research (Singh, 2018). It is one of the most critical factors determining the accuracy of your research/survey result. With this, giving correction and feedback is relevant, as Ahea et al. (2016) emphasize that giving students an explanation of what they are doing correctly and incorrectly, with the feedback focusing on what they are doing correctly. When a student is explained what is correct and incorrect about their work, it is most beneficial to their learning process. A student researcher must know the statistical tools used to conduct a research study. This will help to conduct an appropriately well-designed study leading to valid and reliable results in their SIP (Ali and Bhaskar (2016), hence it was focused by the teachers in the field based on the result. Thus, teaching these specific concepts has been hindered by an internet connection. Communication failure was encountered in the new normal setting due to poor connectivity, no availability of strong internet access, no electricity, and no computer; thus, a particular gap has occurred (Geverola et al., 2022; Motala & Menon, 2020; Muthuprasad et al., 2021).

In constructing an explanation, the teachers have employed various facilitating strategies; students, in return, actively participate, authentically engaged, and show confidence in the teaching-learning process (Kentucky Department of Education, 2020). Learning becomes more authentic when students are given a choice. Communicating with students about what they are choosing and why and encouraging ownership in their learning, including their mistakes, will make them more self-aware, which helps them also decide better when given a choice in their learning (Gehr, 2020). Soliciting ideas to students in this specific regard, as per suggested by Ford (2021), is essential because it helps them develop their specialized know-

how and enhance their multidisciplinary competencies, specifically on whether the research design and procedure are appropriate. Additionally, the gap, as also perceived by Tsang (2017), is that little has been in place to equip learners with these vital skills in terms of inviting students for an explanation about their finalized research design, methodology, sampling technique, and statistical tools. Hence, time for the presentation of outputs plays a role in students' knowledge acquisition and is often a mode of assessment in all disciplines. It is a type of assessment that requires students to express their knowledge and understanding of a topic using the spoken word. It allows students to record not only their research but also a variety of cognitive and transferable skills. However, this means that all of these facilitating strategies are practiced by the teachers handling science investigatory projects in the new normal as the students perceive.

Students were provided with lectures and courses that directly referred to constructing an explanation of doing SIP. This helps the students develop specialized know-how and enhance their multidisciplinary competencies, specifically on ethics and approach in presenting the result based on the data gathered (Ford, 2021). More students will be better able to share their learning—during discussions and analysis—if they have the time they need (Richman, 2020). Constant communication or student progress monitoring aids teachers in determining the effectiveness of their instruction, whether for individual students or the entire class (McLane, 2022), especially in the critical part of conducting SIP, which is the presentation, interpretation, and analysis of the result as well as making a conclusion for it gives the last impression. It essentially provides information that can assist students in learning more and learning faster, as well as teachers in teaching more effectively and making better decisions about the type of instruction that will be most effective. As claimed by Gurung (2021), a particular gap has existed: communication failure was encountered in the new normal setting due to poor connectivity, no availability of strong internet access, no electricity, and no computer. Constant communication or student progress monitoring was given focused on by the teachers through evaluation as to how effective their instruction is, either for individual students or for the entire class (McLane, 2022), especially in the vital part of conducting SIP, which is the presentation,

Table 4. Facilitating strategies in conducting SIP as perceived by teachers and students

Variables	Teachers		Students	
	MeanSD	**Interpret-ation**	**MeanSD**	**Interpret-ation**
Formulating a Problem	3.45±0.40	Practiced	3.65±0.37	Most Practiced
Developing a Design	3.45±0.41	Practiced	3.64±0.39	Most Practiced
Constructing an Explanation	3.39±0.37	Practiced	3.60±0.39	Most Practiced
Overall	**3.43±0.39**	**Practiced**	**3.63±0.38**	**Most Practiced**

Legend: *1.00-1.49 (Not Practiced); 1.51-2.00 (Less Practiced); 2.51-3.49 (Practiced); 3.50-4.00 (Most Practiced)*

interpretation, and analysis of the result as well as making a conclusion for it gives the last impression. It is a facilitating strategy that provides information that can help students learn more and learn faster. It is also in relation as perceived by the teacher respondents, and a particular gap has existed as it was claimed by Gurung (2021) that communication failure was encountered in the new normal setting due to poor connectivity, no availability of strong internet access, no electricity, and no computer.

Relationship Between Profile and Facilitating Strategies in Conducting SIP as Perceived by Teacher-Respondents

Table 12 shows the result as perceived by the teacher respondents on the significant relationship between their profile and facilitating strategies in conducting science investigatory projects. It shows the null hypothesis that there is no significant relationship between the facilitating strategies of teachers in conducting science investigatory projects concerning their profile, specifically age, sex, teaching experience, number of relevant seminars and training attended, and highest educational attainment, which is not rejected. These decisions arrived because the obtained p-values for these profiles along the three strategies are greater than 0.05. This means that the facilitating strategies employed by the teachers to the students in conducting science investigatory projects in the new normal are similar despite their profile differences.

Although the result revealed no significant association, it is observed that the teachers facilitating strategies were practiced

Table 4. Relationship between profile and facilitating strategies in conducting SIP as perceived by teachers

Profile	Strategies	r	p	Decision on Ho	Interpretation
Age	Formulating a Problem	-0.07	0.62	Not Rejected	Not Significant
	Developing a Design	-0.04	0.76	Not Rejected	Not Significant
	Constructing an Explanation	-0.08	0.56	Not Rejected	Not Significant
Sex	Formulating a Problem	-0.01	0.93	Not Rejected	Not Significant
	Developing a Design	0.02	0.89	Not Rejected	Not Significant
	Constructing an Explanation	0.06	0.66	Not Rejected	Not Significant
Teaching Experience	Formulating a Problem	-0.17	0.19	Not Rejected	Not Significant
	Developing a Design	-0.11	0.42	Not Rejected	Not Significant
	Constructing an Explanation	-0.03	0.82	Not Rejected	Not Significant
Number of Relevant Trainings	Formulating a Problem	-0.07	0.59	Not Rejected	Not Significant
	Developing a Design	0.04	0.74	Not Rejected	Not Significant
	Constructing an Explanation	0.01	0.92	Not Rejected	Not Significant
Highest Educational Attainment	Formulating a Problem	-0.23	0.08	Not Rejected	Not Significant
	Developing a Design	-0.10	0.41	Not Rejected	Not Significant
	Constructing an Explanation	-0.20	0.14	Not Rejected	Not Significant

Legend: p value < 0.05 Significant

by the teachers that guided the students who are conducting SIP in the new normal; however, it needs more emphasis on implementation to deliver enhanced quality education (Crawford, 2021; DeMatthews et al., 2020). The data supported the thesis that the teachers employed various facilitating strategies designed for distance learning even though the relationship is not statistically significant. As Saxena (2020) highlighted, despite sudden changes, teachers were constantly adapting to the new normal. They have had to upskill themselves almost overnight to adjust to the new modes of teaching, ensuring that students can still learn in the current environment.

Relationship Between Profile and Facilitating Strategies in Conducting SIP as Perceived by Students

Table 5 shows the result as perceived by the student respondents on the significant relationship between their profile and facilitating strategies in conducting science investigatory projects. The table shows the null hypothesis that there is no significant relationship between the facilitating strategies of teachers in conducting science investigatory projects as perceived by the student-respondents concerning their profile as to age, grade level, highest educational attainment, and occupation of parents are not rejected. These decisions have arrived because the obtained p-values for these profiles along the three strategies are greater than 0.05. This means that the perceptions of the facilitating strategies used by their teachers of students who vary on these profiles along these facilitating strategies do not significantly differ.

Although the result revealed no significant association, it is observed that the students perceived the facilitating strategies employed by the teachers that guided them in conducting SIP in the new normal; however, it needs more emphasis on implementation to achieve an enhanced teaching-learning process.

However, it can be gleaned from the table that a p-value of 0.02 and 0.03 was obtained when the perceptions of the male and female students on the facilitating strategies of their teachers in conducting an investigatory project as to formulating a problem and developing a design were found to significantly differ. Since these values are less than 0.05, the null hypotheses are rejected, implying that the relationship is statistically significant. The result is unlikely due to chance which means that the probability of effect and difference exists in the population. It is observed that the r-values are negative such as -0.14 and -0.13. This means when compared based on the statistical data; males rated the facilitating strategies of their teachers to a relatively greater extent than females. This also means that males perceived most of the facilitating strategies of their teachers in terms of formulating problems and developing a design more than females. Generally, females show advantages in verbal fluency, perceptual speed, accuracy, and fine motor skills, while males outperform females in spatial, working memory, and mathematical abilities or problem-solving and design (Hurst, 2021). It is essential to keep in mind that these differences are relatively small.

When teaching students how to conduct science investigatory projects, especially in the new normal, it is essential for teachers to develop teaching and facilitating strategies that keep students engaged and equipped. If not, this can lead to disruptive behavior, lackluster grades, and a big problem for teachers. Thus, this study was developed to determine the most practiced facilitating strategies of the teachers in conducting SIPs in the new normal.

Doing an investigatory project considers a significant achievement for any STEM student. Through scientific investigation, Schreiner (2020) stressed that students learn to apply what they've learned, such as scientific concepts, theories, principles, and natural laws. They can conduct research using their higher-order process or thinking skills. Without the facilitating strategies of the teachers in charge, the students who participated in SIPs would not have gained anything. Thus, assessing teachers facilitating strategies is very relevant since it will give clues as to how to fill the gap for some students who are having difficulty doing their SIPs.

It is revealed that there is a need to enhance the practiced facilitating strategies such as the process on the conduct of orientation to the students on the basic concept/ knowledge about SIP, particularly on stating objectives and/or significance of the SIP as well as making the hypothesis through printed or digital platform; there is also a need to regularly ask students to draw out their understanding on formulating a problem by making RRL based on the research topic

Table 5. Relationship between profile and facilitating strategies in conducting SIP as perceived by students

Profile	Strategies	r/eta^2	p	D	Interpretation
Age	Formulating a Problem	0.03	0.67	Not Rejected	Not Significant
	Developing a Design	-0.05	0.42	Not Rejected	Not Significant
	Constructing an Explanation	-0.02	0.68	Not Rejected	Not Significant
Sex	Formulating a Problem	-0.14	0.02	Rejected	Significant
	Developing a Design	-0.13	0.03	Rejected	Significant
	Constructing an Explanation	-0.10	0.10	Not Rejected	Not Significant
Grade Level	Formulating a Problem	-0.01	0.84	Not Rejected	Not Significant
	Developing a Design	-0.02	0.73	Not Rejected	Not Significant
	Constructing an Explanation	0.04	0.51	Not Rejected	Not Significant
Mother Highest Educational Attainment	Formulating a Problem	-0.05	0.41	Not Rejected	Not Significant
	Developing a Design	-0.02	0.69	Not Rejected	Not Significant
	Constructing an Explanation	0.01	0.88	Not Rejected	Not Significant
Father Highest Educational Attainment	Formulating a Problem	-0.04	0.45	Not Rejected	Not Significant
	Developing a Design	0.01	0.83	Not Rejected	Not Significant
	Constructing an Explanation	0.03	0.59	Not Rejected	Not Significant
Mother Occupation	Formulating a Problem	0.02	0.33	Not Rejected	Not Significant
	Developing a Design	0.02	0.27	Not Rejected	Not Significant
	Constructing an Explanation	0.02	0.29	Not Rejected	Not Significant
Father Occupation	Formulating a Problem	0.05	0.12	Not Rejected	Not Significant
	Developing a Design	0.05	0.12	Not Rejected	Not Significant
	Constructing an Explanation	0.05	0.13	Not Rejected	Not Significant

Legend: p value < 0.05 Significant

preferred by the students; additionally is the giving of scaffold via teleconference and supplementary learning materials (SLM) on the correct format and approach on identifying the appropriate research design, methods, sampling technique, and statistical tools and on the approach on presentation, interpretation, and analysis of the result as well as making a conclusion. The findings suggested that action should be taken seriously to equip teachers and assist learners in the conduct of SIP.

Significant Relationship between Teacher's Facilitating Strategies in Conducting SIP and Student's View

The significant relationship between the teacher's facilitating strategies in conducting SIP and the student's view is presented in Table 6. From the student's point of view, the teacher's facilitating strategies were statistically significant. The result suggests that the teacher's facilitating strategies in conducting SIP are significant to students.

The finding is supported by the study by Astuti (2015), which shows the teachers' rapport with students, including the encouragement given to students and the building of trust and respect with the students, can help improve the effective delivery of the lesson. Teachers' planning decisions include the selection of classroom activities, the way feedback is given, classroom management, and the choice of learning resources. In addition, Crawford (2021) highlighted that the future of learning and teaching practice requires innovators and early adopters to digest and assess why we teach and learn and how we engage in such practices with purpose. This requires careful and critical reflection on how we were, what we are now, and where we may go next.

The pandemic has changed the whole dynamics of education, as highlighted by Ravi (2021). It shifted from the traditional classroom learning model to modern technological learning. From the comfort of our own homes, we could learn everything and access all study materials. During this pandemic, teachers' roles and responsibilities have expanded. They needed to learn more than the students to prepare for their new adventure. Knowing some of the root causes of the current problem in instruction delivery has aided teachers and the department in developing strategies and finding solutions to the problem.

■ CONCLUSIONS

Based on the findings of the study, the following conclusions were drawn. STEM teachers who are handling science investigatory projects (SIP) have adapted with the sudden shift of educational system. They have been prepared with teaching skills and have been practicing various facilitating strategies which guide students in the conduct of their SIPs in the new normal. Teachers' facilitating tactics in conducting SIP in the new normal are unaffected by their age, sex,

Table 6. Teacher's facilitating strategies in conducting sip and student's view

Variable	N	df	Mean	SD	t Stat	p-value	Remarks
Teacher's Facilitating Strategies	293	83	3.630	0.364	3.862	.000	**Significant**
Student's View	59		3.430	0.363			

Legend: p value < 0.05 Significant

teaching experience, number of relevant trainings attended, or maximum educational level. Male students were thought to be better in conducting SIP particularly when it came to formulating a problem and developing a design.

In light of the aforementioned conclusions, the administrators may design activities that would help teachers be engaged with various facilitating strategies. STEM Teachers should enhance their skills and qualities in delivering SIP instruction by attending seminars, trainings, and workshops related to research and facilitating strategies through webinars and conducting Learning Action Cell. STEM Teachers should explore and develop alternative resources as per proposed in the intervention program to be utilized for upgrading knowledge and competence in learning and applying concepts about science investigatory project in an interactive and conversational way which can be accessed both online and offline. Students should open their mind and heart to the various strategies to be employed by their teacher for it will help them develop their full potential, especially in conducting SIP. Follow up study may be conducted to find out and validate the outputs of the students in their conducted SIPs.

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