T.P.A.C.K AND R.E.A.C.T IN A VIRTUAL SPACE: AN INVESTIGATION OF THE IMPACT OF VIRTUAL INSTRUCTION ON STUDENT LEARNING

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ABSTRACT

Educators are confronted with the challenge to deliver quality education amidst Pandemic situations. In a virtual space, teachers are challenged to deliver a high-instructional level to enhance their motivation and attitude which in effect promote attainment of learning outcomes. The researchers came across the potential of TPACK and REACT in this process. Though researches available confirm their effectiveness in a conventional teaching approach, their use in the virtual space is very limited. Using the parameters of the Educational Action Research, the researchers used a TPACK intervention in a virtual space and employed the REACT tactical steps to use technology for interactions to enhance their motivation, sustain a positive attitude of learning and assure attainment of learning outcomes. Data gathered revealed that there is a potential to assure a 65% attainment of learning via the delivery of TPACK-REACT as this intervention increases the motivation and sustains their positive attitude towards Science class. Principals, subject leaders, and teachers are encouraged to experiment with the use of this in a virtual space to ensure better educational delivery.

Keywords: TPACK, REACT, Virtual Space, Attainment, Motivation.

INTRODUCTION

During COVID-19 pandemics in the Philippines, schools are obliged to switch to distance learning. Many people have chosen to continue their education using the modular learning technique, particularly in locations where technology resources are restricted. However, because there is little interaction between and among students and teachers, this post jeopardizes the learning process. Interactions are crucial for good learning (Bouhnik & Marcus, 2006). Some well-resourced schools and families can provide their pupils online distance learning, putting them in a much better position to learn. Interactions between students, students and teachers, teachers and parents, students and content, and students and a system increased the productivity of the learning enterprise. While many of them tried with various methodologies, pedagogical research in a virtual realm, particularly in a K-12 setting,

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is quite restricted. As a result, educators are in a better position to be creative and innovative, as well as to uncover best practices for delivering high-quality education.

Technological Pedagogical Content Knowledge (TPACK) and Relating Experiencing Applying Cooperative Transferring (REACT) show a promising framework at the instructional level when they are used effectively. With technology's undeniable importance in the virtual world, TPACK provides a framework for learners to develop 21st-century abilities through the use of technology. Educators use it to plan and develop techniques to make the teaching-learning process more successful (Atun & Usta, 2019; Mishra & Koehler, 2006). REACT, on the other hand, lays out a set of actions that can assist students enhance their achievement, knowledge, cooperative skills, decision-making abilities, conceptual understanding, self-motivation, and positive attitude toward the subject or lesson (Gunter, 2018).

This study would make use of the TPACK model and integrate the three components for instructional planning concentrating more on student intellectual development. The teacher would be using REACT as a teaching strategy to produce highly motivated students who will attain good results in their performance tasks. Unified, both TPACK and REACT as framework and approach respectively would result in motivated students and enhanced learning outcomes.

Research Questions

With the purpose of enhancing student attainment and motivation through the use of TPACK and REACT in a virtual space, the researchers intend to seek answers to the following research questions.

1. What is the level of attainment of students after the use of TPACK-REACT in the lesson?
2. What is the impact of the integration of TPACK -REACT in a virtual space on the following?
   The attitude of students towards Science;
   Scientific attitude, and Motivation
3. What is the implication of this study to instructional planning and delivery in online distance learning?

REVIEW OF THE RELATED LITERATURE

Educational technologies have always been a part of the curriculum planning and design of every educator nowadays. It covers and enhances the 21st-century skills of the learners that the field of education has now. Effective teaching and learning processes, according to Malubay & Daguplo (2018), require not only subject matter mastery but also pedagogical expertise, technological integration, and the interdependence of these three. According to the study, integrating technology allows a teacher to be proficient in using information and technology tools in the execution of their classes based on their subject and pedagogy knowledge. That is also why, in order to promote the successful use of educational technology in the field of education, several college programs have introduced a course covering theories and skills in "*Educational Technology*" (Atun & Usta, 2019).

In his study, Shulman (1987) stressed that pedagogical content knowledge (PCK) emphasizes the need for teachers to combine their subject-matter knowledge with topic-specific pedagogical practices to create successful teaching outcomes. This concept was influenced by Mishra and Koehler's TPACK (technological pedagogical and content knowledge) framework in education (2006). According to the findings of the study, the context of TPACK is a complex fusion of three types of information: content knowledge (CK),

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pedagogy (PK), and technology knowledge (TK). According to the study, a teacher who can navigate between different sorts of knowledge becomes significantly more than an expert in teaching the subject matter than a teacher who only focuses on pedagogy or technology. Furthermore, the research demonstrated that these theoretical and practical bodies of knowledge may result in the forms of flexible knowledge required to successfully integrate technology into education. This means that TPACK assists in the development of knowledge required for selecting appropriate teaching methods for using technology in imparting related subject matter, correctly teaching and learning concepts, application of skills to encourage active participation among students, proper classroom management, and execution of appropriate guidance while teaching the subject matter using tools in ICT (Aktas & Ozmen, 2020).

Effect of ICT Integration on Teaching and Learning Process

Many research have been conducted on the use of ICT in education and how it may affect educational quality. These findings focused on several areas of ICT's influence. Teachers can respond to the demands of international education by employing ICT to replace traditional teaching methods with knowledge transfer using technology-based tools and facilities (Ghavifekr & Rosdy, 2015). When it comes to studying topics in the classroom, ICT improves students' excitement and interest (Dela Rosa, 2016).

ICT integration is significant in the sphere of education; according to Basri et al. (2018) because it has lately developed programs and possibilities that help students acquire knowledge. ICT is increasingly considered part of a student's education. As a result, according to Ghavifekr & Rosdy (2015), the use of ICT tools leads in a more active and interesting learning environment, which will aid both teachers and students in accomplishing a successful teaching and learning process. As a result, a well-prepared teacher who uses ICT tools and resources might be one of the most important aspects in ensuring the success of technology integration in the teaching and learning process (Ghavifekr & Rosdy, 2015).

Effect of TPACK on the Attainment of Students

Technology has been a component in assisting students in achieving and excelling in school. This could be due to the learner's enthusiasm for the technology tool and the ability it provides to better perceive concepts (Harris et al., 2016). Even though TPACK is renowned as a program for instructors, it may also be used as a framework for K to 12 educations, according to a research report authored by Atun & Usta (2019) who investigated the effect of the TPACK model on learner performance. They also confirmed that using the TPACK approach to organize classes helped students improve their critical thinking and problem-solving skills. When the framework was used to construct lessons for blended learning, Aguinaldo (2017) concurred, stating that the model, when paired with traditional classroom activities, would guide the student to use past knowledge and develop further abilities utilizing online learning tools.

The related literature and studies were drawn to support the concept of TPACK and its impact on the attainment of the learners. The framework focusing on the three forms of knowledge which are content (CK), pedagogy (PK), and technology (TK) may help an educator to impart a flexible knowledge in integrating ICT to teaching and guiding the student to enhance their skills and coping with the demands of technological revolution.

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REACT Strategy

Attainment of learning outcomes is anchored on student's motivation to learn. Learners are motivated to learn in an environment that is interactive and with relevant activities utilized by the teachers. Husein claimed in a 2017 study that there were effects on student motivation on grammar success and transfer of learning in oral communication using learning materials with the usage of the REACT approach. According to Utami et al. (2016) students were motivated to enhance Geography abilities as well as achieve higher learning outcomes when they used REACT. Furthermore, according to Marlan (2017), there was a significant effect of REACT on pupils' mathematical achievement. He went on to say that the students' mathematics skills improved as a result of the teachers' inventiveness in implementing the technique. Widada et al. (2019) did a study to increase mathematical problem-solving skills using the REACT approach and discovery learning. According to the findings, learners who were taught using the REACT technique had higher learning achievement than those who were taught using the traditional teaching strategy. Similarly, Gunter (2018) stated that by adopting Context-Based Learning REACT, students' understanding of Science classes was increased. He also stated that it improved students' perceptions of the education and the quality of the environment. Similarly, Gunter (2018) stated that by adopting Context-Based Learning REACT, students' understanding of Science classes was increased. He also stated that it improved students' perceptions of the education and the quality of the environment.

Based on the above literature and studies, it was proven that utilizing REACT strategy brought an impact on students' motivation and attainment. Husein (2017) and Utami et al. (2016) claimed that using REACT strategy learners were motivated in different learning areas such as Oral Communication, Geography, and Science. As a result, once motivated, students were more likely to engage in meaningful and productive academic activities (Filgona et al., 2020). Learners also achieved more learning outcomes when they used the REACT technique, according to Marlan (2017) and Widada et al. (2019), who indicated that the learners' Mathematical and Scientific skills improved. Learners viewed and connected learning to a real-life situation using the abilities they had gained.

The COVID-19 epidemic necessitates the adoption of a new learning approach. As a result of social distancing policies, many countries, including the Philippines, have implemented online learning. Teachers are finding it difficult to cope with the abrupt change in the educational system. To effectively conduct online learning, they must be able to blend technology, pedagogy, and content expertise. Global trends in higher education are evolving towards employing digital pedagogies as a result of significant advancements in information technology and the necessity to acquire 21st-century skills (Goradia, 2018). In light of this, Koehler and Mishra (2008) developed the Technological Pedagogical Content Knowledge (TPACK) framework to integrate technology with teaching. The framework has now been explored and implemented in various educational institutions. TPACK is an upgrade to better educational quality when seen from the standpoint of teacher training. The usage of ICT is thought to improve the quality of teaching and learning. It may be inferred that teachers must be competent in their knowledge of individual components of TPACK but not in the integration of these components for effective teaching, although agreeing that a balanced combination of content knowledge, methodologies, and technologies is necessary (Mutanga et al., 2018). On the other hand, being aware of any barriers to child development and incorporating the use of information communication technology when applicable is critical in inclusive classrooms. They must differentiate the curriculum in order to assist the development

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of cognitive skills and to ensure full involvement of students who face learning challenges.

Muniandy (2020) stated that REACT approach can be considered as one of the Cooperative Learning strategies under Group Investigation or group roles. REACT is an acronym for Relating, Experiencing, Applying, Cooperating, and Transferring. This can be defined as students' participation in a group learning environment. The students' participation and response to the lessons are excellent. This method is intended to present students with the most comprehensive learning experience possible in order to help them acquire the ability to behave, understand, skill, and act (Utami et al., 2016). Many studies have shown that the REACT learning paradigm with virtual simulation has an impact on critical thinking skills and student learning activities (Nisa et al., 2018; Cahyaningrum & Febriana, 2019). The transfer of student learning accomplishment in the skill domain from conventional to REACT learning models promotes learner achievement.

In the light of this literature and study, the researchers have weighted on the quality of education the unification of TPACK and REACT can provide to students in a virtual space. The unification of TPACK and REACT strategy is vital in effecting positive change in learners' achievement, motivation and attitude and helps teachers see the learning needs of each learner. As such learners' diversity and background knowledge posit a critical need in distance learning to ensure successful learning outcomes. It recognizes their varied skills, cognitive development, and readiness level imperative for a certain 21st-century learning instruction. It is expected to improve learners' knowledge, skills, and attitudes.

Figure 1 shows the unification of the TPACK-REACT to be used in planning and delivery in a Virtual Science class. The fusion of the different elements of TPACK primarily knowledge, content, and pedagogy forms the tactical steps of REACT that are crucial in the planning and the development of teaching and learning activities. The overlapping of the three TPACK components provides the relating and transferring steps of REACT that are very crucial to attainment, attitude, and motivation.

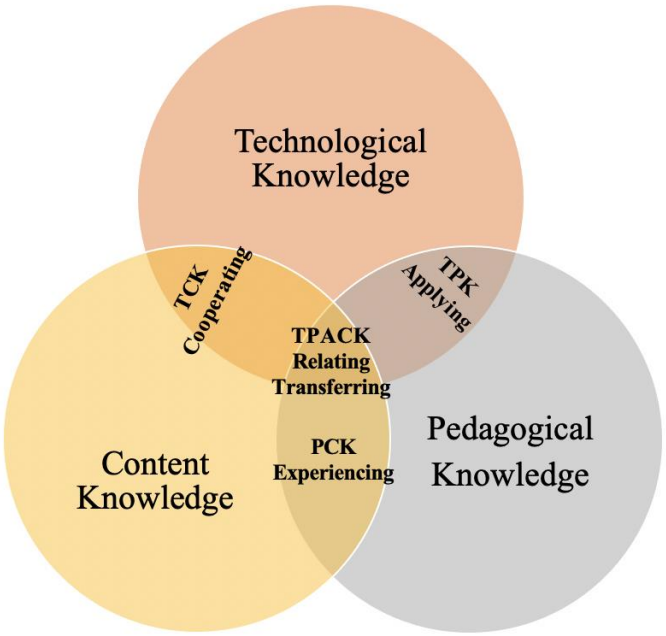

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FIGURE 1
TPACK-REACT UNIFICATION FRAMEWOR

METHODS

For this study, the researchers utilized an Educational Action Research (EAR) which uses a combination of 1-group pretest-posttest design and a posttest-only design to evaluate the impact of the intervention. This was used to established the cause-and-effect relationship among the variables under investigation to make causal inferences regarding the effectiveness of the unification of TPACK and REACT in the key areas of learning outcomes, motivation towards science, and scientific attitude. The 14 selected student participants in 8th grade were pretested and post-tested via a survey questionnaire to determine the level of their motivation towards science and their scientific attitude. The learning plan reflecting the unification of TPACK and REACT was administered through online teaching as part of the intervention where the same teacher taught for 5 instructional weeks. The inter-rater was used to determine the consistency of the scores of the students through a 4-point rating scale rubric to evaluate the Performance Task to assess learning outcomes

Research Participants

The participants of the study were grade 8 Science students of Bagumbong Highschool in the Division of Caloocan for the school year 2020-2021. There were 14 students selected purposively who completed the required criteria namely (a) attended continuously the 5-week online classes; (b) responded to the pre and post-survey questionnaires (c) answered the science motivation questionnaire before the start of 1st day of online classes and after the last day of online classes, and (d) made the individual performance task which is the essay. Among the enrollees in the school, 14 students volunteered to participate in the research and assessed of having equated average learning level based on their performance in Science during the previous grading. The students used primarily tablets provided by the Division office to access the virtual lessons.

Ethical Concerns

The students were informed by their teacher about the implementation of this research. Student participation was made voluntary. They were oriented appropriately with the consent of their parents in written form. The school Principal was also consulted to which approval was also sought. This paper was endorsed to the Schools Division Office of Caloocan as a standard protocol for research in a public school.

Data Instruments and Gathering Technique

There were three instruments used to collect data. The performance rubrics were used to measure the student attainment outcome. It contains 5 criteria of attainment namely applying, analyzing, understanding, cohesiveness, and coherence. Each criterion is measured using four levels of performance rating such as exceeding expectations, meeting expectations, approaching expectations, and not met expectations. Each level is awarded 4, 3, 2, and 1 point respectively. Furthermore, the researchers' data are orchestrated through the use of google forms and social media. Google forms were used for collecting responses to the pre and post-survey and the science motivation questionnaire. Facebook messenger was used for the

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submission of the individual performance task.

Research Procedure

The research procedures went through three phases namely - pre-experimental phase, experimental phase, and post-experimental phase. The pre-experimental phase involved the construction of the TPACK-REACT lesson plan; the validation of the teacher made lesson plan by the research team members; the preparation of the PowerPoint presentation for online classes; and the administration of the pre-survey to measure the scientific attitude and motivation of the students before the lesson is conducted.

The lesson was delivered during the experimental phase for 5 consecutive weeks. One session per week and 2 hours per session. This is the prescribed delivery of online distance learning at the school where the experiment was conducted. Students at this phase used the available self-learning module provided by the Division office of the DepEd. Lessons delivered includes lessons on variations of life, energy pyramid, Mendelian Principles of Inheritance, Biogeochemical cycles and Cell Division.

In the post-experimental phase, the post-survey and science motivation questionnaires were administered. Along with this is the giving and completion of the assigned performance task by the students' participants. The outputs were reviewed and scored by the teacher including three other assigned teachers to ensure the validity of the markings.

RESULTS AND DISCUSSION

This part presents the data that demonstrate the impact of the integration of REACT to the TPACK framework on the attainment, attitude, and motivation of the students. The presentation herein is in the same order as the research questions.

The scores obtained by the students from the raters are tabulated in the succeeding table. The Table 1 shows the scores obtained by the students in each performance criterion. Among the four criteria, cohesiveness and coherence of their thoughts were scored high with 2.86 and 2.81 mean respectively. Both criteria obtained a description of meeting the expectation. Most of the ideas of the output of the students are clear and cohesive and have a clear progression.

TABLE 1
ATTAINMENT OF THE LEARNING OUTCOME

Student	Applying	Analyzing	Understanding	Cohesiveness	Coherence	Mean
1	2.17	3.00	2.17	3.00	2.83	2.63
2	3.00	2.83	2.50	2.83	3.16	2.87
3	2.00	1.50	1.83	3.00	3.00	2.27
4	2.83	2.33	2.50	2.83	2.33	2.57
5	2.50	2.67	2.00	3.00	3.16	2.67
6	1.83	1.67	2.50	3.00	3.00	2.40
7	3.83	3.17	3.17	3.83	3.66	3.53
8	2.50	2.33	2.17	2.33	2.33	2.33
9	2.00	2.50	3.00	3.17	3.00	2.73
10	3.00	2.50	3.67	2.83	2.66	2.93
11	1.83	1.83	2.00	2.33	2.33	2.07
12	2.67	2.33	3.00	2.50	2.66	2.63
13	1.67	2.00	2.00	2.33	2.16	2.03
14	2.50	3.67	2.33	3.00	3.00	2.90

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Mean	2.45	2.45	2.49	2.86	2.81	2.61
Interpretation	Approaching Expectation	Approaching Expectation	Approaching Expectation	Met Expectation	Met Expectation	Met Expectation

The applying and analyzing skills obtained were both scored at 2.45 with an interpretation of "*approaching expectation*". Though understanding was slightly higher than the two with a rating of 2.49, it is interpreted the same way as the other two. This means that the students applied two comparisons between mitosis and meiosis and the role in the cell division cycle related to plant and animal breeding. There were some whose explanations on the significance of meiosis were incorrect or with some lapses. Lastly, the task done tells that students had low precision in predicting the phenotypic expressions of traits using simple patterns of inheritance concerning plant and animal breeding. A deeper look at the data shows that there were 64% of the student-participants met the expectations while the rest obtained low ratings which affect the top-performing students when their attainment is viewed as a whole.

Triangulating this data with the data on attitude and motivation which are presented in the succeeding table tells interesting findings. There was a slight increase in motivation as evidenced by a positive growth of 0.33 between pre and post-survey shown in Table 2. Among the 25 statements to describe the level of motivation, statement 21 that states "My career will involve science" obtained the highest growth with +1 as their difference. A difference of 0.57 was observed in the statements involving relevance of Science to their lives, having a good job, the use of the skills in Science in problem-solving skills for their future career, and the benefits of Science in their future career. Interestingly, there was a negative difference obtained in the statement about their curiosity in the discovery of Science however the value obtained is very low to account for an arbitrary difference.

TABLE 2
STUDENT'S MOTIVATION TOWARDS SCIENCE (GLYNN ET AL., 2011)

Statements	**Mean**		
	Pre Survey	**Post Survey**	**Difference**
The science I learn is relevant to my life.	2.93	3.50	0.57
I like to do better than other students in science class.	3.14	3.14	0.00
Learning science is interesting.	3.71	3.79	0.08
Getting a good science grade is important to me.	3.71	3.93	0.22
I put enough effort into learning science.	3.57	3.79	0.22
I use strategies to learn science well.	3.14	3.50	0.36
Learning science will help me get a good job.	3.00	3.57	0.57
I must get an "outstanding" grade in science.	3.57	3.86	0.29
I am confident I will do well on science tests.	3.14	3.14	0.00
Knowing science will give me a career advantage	3.07	3.57	0.50
I spend a lot of time learning science.	3.21	3.71	0.50
Learning science makes my life more meaningful.	3.57	3.79	0.22
Understanding science will benefit me in my career.	3.00	3.57	0.57
I am confident I will do well on science labs and projects.	3.07	3.21	0.14

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I believe I can master science knowledge and skills.	2.79	3.50	0.71
I prepare well for science tests and labs.	3.21	3.50	0.29
I am curious about discoveries in science.	3.79	3.71	-0.08
I believe I can earn a grade of "*Outstanding*" in science.	3.36	3.79	0.43
I enjoy learning science.	3.71	3.86	0.15
I think about the grade I will get in science.	3.29	3.64	0.35
I am sure I can understand science.	3.36	3.57	0.21
I study hard to learn science.	3.71	3.79	0.08
My career will involve science.	2.43	3.43	1.00
Scoring high on science tests and labs matters to me.	3.50	3.71	0.21
I will use science problem-solving skills in my career.	2.86	3.43	0.57
Overall Weighted Mean	3.27	3.60	0.33
Adjectival Rating	Always	Always	

Considering the positive change in the motivation as a function of the TPACK-REACT unification in a virtual space, their attitude and enjoyment in Science remain the same. This can be evidenced by the data of Scientific attitude and enjoyment presented in Tables 3 and 4. The average obtained between the pre and post-survey does not show a big difference having 4.50 in the presurvey for scientific attitude to 4.56 in the post-survey results. There were agreements in the results between the correlated statements in the two surveys.

TABLE 3
IMPACT OF THE TPACK-REACT ON THE SCIENTIFIC ATTITUDE

Statement	Pre-Survey		Statement	Post-Survey	
	Mean	Description		Mean	Description
I find it boring to hear about new ideas.	4.64	Disagree	I enjoy reading about things that disagree with my previous ideas.	4.07	Agree
In science experiments, I like to use new methods which I have not used before.	4.29	Agree	I dislike repeating experiments to check that I get the same results.	3.64	Not sure
I am unwilling to change my ideas when evidence shows that the ideas are poor.	3.86	Not Sure	I am curious about the world in which we live.	4.86	Agree
In science experiments, I report unexpected results as well as expected ones.	4.14	Agree	Finding out about new things is unimportant.	4.21	Disagree
I dislike other peoples' opinions.	4.36	Disagree	I like to listen to people whose opinions are different from mine.	4.57	Agree
General Average	4.26			4.27	

The data on Science enjoyment shown in Table 4 also gives the same pattern as that of the scientific attitude having a negligible difference of 0.01 between the pre and post-survey. Same as that of the statements in the Scientific attitude, both pre and post-survey on

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enjoyment are correlated except that the students were not sure whether students are getting enjoyment from repeating the experiments.

TABLE 4
A MEASURE OF SCIENCE ENJOYMENT AS A FUNCTION OF THE TPACK-REACT

Statement	Pre-Survey		Statement	Post-Survey	
	Mean	Description		Mean	Description
Science lessons are a waste of time.	4.29	Disagree	Science lessons are fun.	4.79	Agree
I really enjoy going to science lessons.	4.57	Agree	I dislike science lessons	4.71	Agree
The material covered in science lessons is uninteresting.	4.21	Disagree	School should have more science lessons each week.	4.00	Agree
I look forward to science lessons.	4.57	Agree	Science lessons bore me.	4.57	Disagree
I would enjoy school more if there were no science lessons.	4.86	Disagree	Science is one of the most interesting school subjects.	4.71	Agree
Average	4.50		Average	4.56	

With the presentation of the analysis above, the researchers identify the following insights that may have a bearing on the instructional policy at the school level. These findings were based on the 14 student participants who participated in this study and cannot be generalized to the entire population of the students in the same grade level.

1. There is a 65% attainment rating as a function of TPACK-REACT delivery in a Virtual space. The unification of TPACK and REACT has the potential to affect learning outcomes by providing the students with learning experiences, especially on online distance learning. Ultimately, the assessment of students learning outcomes using TPACK and REACT with the directions given to the students were done through online sessions and aided the students throughout the teaching-learning process can provide information that will help educators in an online teaching engagement by giving the students a holistic approach through the various experiences related to the subject matter. REACT is a type of teaching method that encourages student participation in the classroom (Kaya & Gul, 2021). As a result, student participation was promoted, which had a positive impact on the students' performance. Similarly, the REACT technique encourages students to become more actively involved and interested in learning so that they can recall and interpret information more easily (Miftahul et al., 2020). According to Argaw et al. (2016), using a variety of approaches during the teaching process necessitates implying a variety of teaching strategies, such as learning in context, projects, instruction, and web-based, which may indicate in matching internalized students' learning styles and increasing their motivation to learn science and their achievement grades.
2. TPACK-REACT delivery provided a positive change in the scientific attitude of the students. This implies that the application of TPACK-REACT as a strategy in teaching science can improve the motivation level of students. This research backs up Turner and Patrick's (2008) argument, which was mentioned by Spandana et al. (2020), that students must be interested and motivated to learn before they can learn. Being effective at this leads to a desire to learn more. Learners acquire the conceptual understandings demanded of them if they are cognitively engaged in classroom activities. As a result, motivating students requires using an effective strategy to engage them in studying. Video may be a useful educational medium for both teaching and learning science. In addition, achievement in science courses is related to students' motivation level (Chan & Norlizah, 2017). Further, in the findings of Spandana et al. (2020) during the post-test, the total of Students' Motivation towards Science Learning (SMTSL) increased to 87.38 percent from 73.28 percent. The intervention, which consisted of instructing students with video lessons and testing them with quizzes before and after viewing video lessons, was credited with this rise.

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3. There is a potential to keep the positive attitude and enjoyment in Science learning through TPACK-REACT. A positive attitude tells the ability to comprehend the concepts of Science and can embrace their importance in their daily life and career (Astalini et al., 2020). Furthermore, the enjoyment of the students in science provided an emotional expression that is linked to motivation (Manasia, 2015).

CONCLUSION AND RECOMMENDATIONS

In the light of the data gathered in this research to substantiate the impact of TPACK-REACT in the virtual space, the research found its potential to assure attainment at a 65% level. This is brought by the increase of motivation and sustain their positive attitude and enjoyment. The use of TPACK-REACT in a virtual space provided students to interact with the students, teachers, content, and system engagingly. This research encourages Principals to allow their teachers to plan and experiment with the use of TPACK-REACT in a more consistent manner whenever there is an opportunity to provide online distance learning with their students. A longer period of experimentation be done in the use of the TRACK-REACT to confirm the level of attainment. Subject leaders should ensure that activities under TPACK-REACT should promote positive interactions among the four categories such as the student, teacher, content, and system and a good alignment of the teaching and learning activities with the goals and targets in each step of REACT.

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