Learners Attitude and Academic Success Towards Science

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ABSTRACT

Aim. COVID-19 disrupted education, leading to new learning methods. Other factors like attitude are overlooked but can aid effective learning. This paper explores two major variables: the learners' learning attitude and academic performance in science. The study analysed students' learning attitude, academic performance, and relationships in a blended learning setting for science.

Method. The study used a mixed-methods design, with both quantitative and qualitative phases. Participants were in a blended learning program.

Results. Learning can happen in a blended learning modality, with the learners' mean grade of 87.03 (Very Satisfactory). Learners have a favourable learning attitude towards science (3.49; moderate attitude). The highest aspect of the learning attitude of learners in the blended learning modality is affective (3.72; high attitude), followed by cognitive (3.62; moderate attitude) and behavioural (3.15; moderate attitude). Furthermore, there was a positive correlation, $r(78) = .48$, $p < 0.01$, between the LLATS and SAP of the learners in blended learning.

Conclusion. Learning can effectively take place in a blended learning modality. Learners exhibit a positive attitude towards science learning in a blended learning environment, with affective attitudes ranking the highest, followed by cognitive and behavioural attitudes. This can be attributed to the teachers' efforts in providing ample

opportunities for the development of both affective and cognitive aspects of attitude. However, the pandemic has presented limitations in cultivating positive behaviour attitude. Learners persevered through challenges, thanks to dedicated teachers fostering positivity and academic growth.
Keywords: science education, distance learning, science academic performance, attitude, blended learning

Introduction

United Nations Educational, Scientific and Cultural Organization (UNESCO, 2023) records that about 1.5 billion children's and young people's education has been impacted by the Coronavirus disease or COVID-19. Similarly, the educational landscape of the Philippines has greatly changed because of an unprecedented pandemic affecting about 26,950,258 learners (UNESCO, 2023). Many schools are forced to shift from face-to-face or onsite learning to other modalities like modular, online, hybrid, hyflex, and blended. With this change, teachers and the curriculum had to adapt in order to remain effective and relevant. More recently, several countries, including the Philippines, eased the movement restrictions. Thanks to increased vaccination rates, the number of people getting infected with COVID-19 has decreased. This provided a silver lining and a chance to conduct limited onsite learning. Moreover, face-to-face or onsite learning still remains more favoured than online learning (Nambiar, 2020). Sukiman Sukiman et al. (2021) found that while online learning is effective, onsite learning is still imperative. Nimarpreet Kaur et al. (2020) further contend that while online learning can support the learning process, it cannot replace steady and established conventional learning. However, the pandemic remains, which is still limiting our movements and physical interactions and pushing educational institutions to conduct a mix of online and onsite learning called blended learning.

The rapid transformation of international industries in technology, communication, agriculture, and medicine has greatly increased the need for and importance of science (Amir et al., 2017). Science literacy opens many opportunities and is closely related to the economic development of a given society (Mao et al., 2021). Science can help learners be more critical problem-solvers. Due to school closures caused by the pandemic affected our country's already declining quality of science education (Villegas, 2021). A study presented at the annual American Educational Research Association conference found that learners were struggling to learn science during the pandemic (Sparks, 2021).

People's opinions and emotional states are driven by their general tendencies, known as attitudes (Zeidan & Jayosi, 2015). Attitudes are complicated mental processes that manifest in behaviour (Shah et al., 2013). They are pivotal factors that David Krech et al. (1962 as cited in Shah et al., 2013), measured in terms of affective, behavioural,

and cognitive factors. Hence, it is the feelings, behaviour, and way of thinking towards something. Jeannette Musengimana et al. (2021) argued that attitudes may be changed. Furthermore, Icek Ajzen and Nicole Gilbert Cote (2008) agree that attitudes, as opposed to being innate, are learned. Some studies (Mao et al., 2021; Shah et al., 2013) show that attitudes towards science impact learners' achievement. With an increase in learners' attitudes towards scientific learning, their science achievement improves. However, on the contrary, a Three-way Meta-Analysis study conducted by Peipei Mao et al. (2021), citing Leonie Rennie and Keith Punch (1991), Paul Gardner (1995), and Tanisha Brooks (2011), reported either less or no correlation between attitudes and students' achievement in science. As demographic variations increase, the relationship between the two changes (Brooks, 2011). Hence, it is important to ascertain the relationship between attitude towards science and science performance in the context of the Philippines and a learning modality other than the conventional one. After all, learners with a more positive attitude towards science are more likely to show science-related attitudes and are more likely to choose science-related careers (Akkuş, 2019; George, 2006; Shah & Mahmood, 2013).

The institution in which the participants are enrolled has adopted the blended learning modality for teaching Science. The learners attend onsite classes for two days and online classes for three days. Online classes are divided into two synchronous online classes and one asynchronous online class. During onsite days, teachers provide students with interactive and practical hands-on laboratory activities to maximise contact time with students and make learning more meaningful and collaborative. On the other hand, synchronous online allows the teachers to process the activities given during asynchronous online. The teachers deepen the understanding of the content, correct misconceptions, ask relevant probing questions of the learners and give further instructions for the next onsite days.

Several contradictions in the findings concerning the previous research have not been addressed, as there is a dearth in the number of studies conducted on learning attitudes towards science and science performance among learners in the blended learning modality. The researchers identified this as an apparent evidence gap. Thus, this study aims to determine the learners' attitudes towards science in a blended learning modality. Moreover, it also explores the relationship between attitude towards science and the science performance of learners in a blended learning modality. The results and findings may be used to develop distance learning programmes and provide interventions to make distant learning modalities more effective in delivering education when conventional learning is impossible. The pandemic has made us learn the hard way that, just like us humans, learning modalities and teaching methods are not immune to such events (Verde & Valero, 2021).

Review of Related Literature

Attitude and Attitude towards Science

People's opinions and emotional states are driven by their general tendencies, known as attitudes (Zeidan & Jayosi, 2015). These perspectives arise from human needs and manifest in individuals' cognitive processes (Wheeler et al., 1974; Zeidan & Jayosi, 2015). The phrase "attitudes towards science" is being used to describe a broad, pervasive, favourable, or unfavourable attitude towards science (Abbas et al., 2019; Anastasi, 1968; Thomas et al., 1985; Zeidan & Jayosi, 2015). Moreover, studies (Akkuş, 2019; George, 2006; Shah & Mahmood, 2013) show that a more positive scientific attitude can boost students' motivation and interest in science and increase science-related careers. A more favourable attitude toward science allows learners to sustain learning in science and positively correlates with science performance (Pell & Jarvis, 2001; Shah et al., 2013).

However, on the contrary, some studies in science (Brooks, 2011 as cited in Mao et al. 2021; Gardner, 1995; Rennie & Punch, 1991) in their Three-way Meta-Analysis study, reported that there was very little or no correlation between attitudes and students' achievement in science. Zubair Ahmad Shah et al. (2013) cited several studies focused on the extent to which the attitude towards science is influenced by variations in demographic characteristics and how such variations can enhance the attitude. Additionally, studies on this matter have been done purely through conventional or onsite learning.

Studies (Berg, 2005; Dalgety & Coll, 2003) reported that developing a positive attitude is pivotal to learning chemistry among high school students. Students' attitudes and interest levels could influence their decision to pursue a science-related career (Abulude, 2009; Al-Najdi, 2012). The level of learners' critical thinking skills, data analysis, asking HOTS questions, and application of learning in a real-world context is positively correlated with their level of attitude (Magallanes, 2016). Amel L. Magallanes (2016) cites Quek Choon Lang et al.'s (2015) study, which found that secondary students in Singapore with a positive attitude towards Chemistry perform better in the classroom. Maria Tavita Q. Lumintac (2014) found that students' dislike for physics impacts their academic performance.

Several studies have shown a relationship between blended learning and students' attitudes towards learning Science. However, most of these studies are conducted at a tertiary-level school. As Clement C. Chen and Keith T. Jones (2007) mentioned, the blended learning strategy has been proven to benefit student achievement. Studies by Nisreen Saleh Khader Khader (2016) and Iga Setia Utami (2017) suggest that blended learning enhances science academic performance more effectively than traditional learning. In Najeh Rajeh Alsalhi et al. (2019), the results show a significant relationship between attitudes and blended learning modalities. It shows that attitudes were positively related to when teachers utilised blended learning in teaching Science.

Aspects of Attitude: Affective, Behavioural, and Cognitive (ABC)

Attitude can be generally defined as a complex psychological summary of a certain object manifested in favourable or unfavourable traits (Ajzen, 2001). The way a person acts or behaves towards an object, event, or environment shows his or her attitude. It is characterised by three components: Affective, Behavioural, and Cognitive (Jain, 2014).

Affective refers to the learners' feelings towards an attitude object (Jain, 2014). This may involve their self-confidence, anxiety about the subject, and enjoyment of the subject (Mazana et al., 2019). Pieces of literature (Ajzen, 1989; Jain, 2014; Krech et al., 1962; Shah et al., 2013) suggest that attitude has an affective component.

The second component of the ABC theory revolves around behaviour. Behaviour plays an important role in the teaching and learning processes of students. With the shift in learning modalities due to the global pandemic, students' behaviour is also affected. Students will undergo several adjustments due to the change in learning modalities. Additionally, students' attitudes and behaviour in a blended learning modality can be evident through their study habits. According to Leovigildo Lito D. Mallillin et al. (2021), most online class students exhibit a lazy attitude and apathetic behaviour, affecting their learning.

Cognitive refers to the constructed thoughts of an individual about a certain object. In a study by Martin Fishbein and Ajzen (1975), the cognitive component refers to a person's understanding of an object, specifically the relationship between that object and its attributes.

Research Methodology

Research Design

With the nature of this research problem and its objectives, a mixed method design was utilised, specifically an explanatory sequential mixed method. Hence, after the quantitative data collection and analysis, it was followed by a qualitative phase to strengthen and give a deeper explanation, thereby supporting the study's quantitative nature (Creswell & Plano Clark, 2018).

The study utilised a cross-sectional, one-time correlational design in its quantitative nature. Subsequently, this paper was followed by a qualitative phase. The formulation of the qualitative questions was based on the analysed quantitative data to ensure alignment and ascertain that the qualitative data that was gathered supported and explained the quantitative results.

Participants

The respondents of this study are learners from a private institution. Specifically, grade 8 learners who had their blended class in the school year 2022-2023. The researchers utilised random sampling in determining the number of samples dependent on the survey's participation turnout. The total number of respondents who participated in the study was 80, equivalent to 30.53% of the target population, with 31 males and 49 females.

Instruments

Survey Questionnaire

To determine the level of learning attitude towards science, the researchers developed a 5-point Likert scale with statements that measured their affective, behavioural, and cognitive aspects of learning attitude.

The description of the mean of the scores was based on the descriptors used by *Afif Hafez* Zeidan and *Majdi Rashed* Jayosi (2014), as shown in Table 1.

Table 1

Learning Attitude Toward Science Scale (LATSS) Descriptor

Score	Interpretation
2.32 below	Low Attitude (L)
2.33 – 3.67	Moderate Attitude (M)
3.68 above	High Attitude (H)

Source. Adopted by the authors from Zeidan and Jayosi (2014).

The science academic performance of the learners was measured in quarter grades composed of written works, performance tasks, and quarter exams. In order to describe the science academic performance of the learners, the researcher utilised the academic performance scale provided by the Department of Education (DepEd Order No. 8, Series of 2015). The questionnaire was designed to be completed in less than 15 minutes.

Table 2

Academic Performance Scale

Grades	Interpretation
75% below	Did Not Meet Expectations (F)
75% - 79%	Fairly Satisfactory (FS)
80% - 84%	Satisfactory (S)
85% - 89%	Very Satisfactory (VS)
90% above	Outstanding (O)

Source. Adopted by the authors from *DepEd Order No. 8, Series of 2015* (Department of Education, 2015).

Focus Group Discussion (FGD) Protocol

In relation to research questions 1, 2, and 4, which require qualitative data, the researchers utilised a Focused Group Discussion (FGD) protocol to attain the data. The first part of the protocol consisted of some preliminary questions to establish rapport. The second part included details on the students' learning attitudes and academic performance. Note that the FGD questions to answer research questions 1 and 2 depend on the quantitative results from the LATSS. Hence, the researchers formulated the questions after the LATSS was administered and the data was analysed. For research question 4, the general experiences of participants have been explored, specifically, the challenges experienced, opportunities to develop positive learning attitudes toward science, and opportunities to enhance their academic performance in a science subject.

Validity and Reliability

For the purpose of ensuring the quality of survey items and their validity, the instrument was validated by a panel of experts composed of two (2) members who have thorough background knowledge in relation to the context of the study, as well as in the field of research. In the validation process, these experts were given a copy of the survey questionnaire to provide feedback regarding the contents covered in the questionnaire. Moreover, the research instrument was pilot-tested on 20 respondents with similar characteristics to the target respondents Using IBM SPSS Statistics 25, the researchers calculated a Cronbach's Alpha of 0.923. No item was removed from the instrument.

Data Collection

The researchers wrote a letter to the principal regarding the study and its nature. After its approval, the researchers identified the sections from which the participants would come. The population of blended learning learners was determined, and a sample was taken.

The researcher initially implemented the quantitative phase of the study. The quantitative phase began by stating the quantitative questions and determining the approach.

One hundred fifty (150) respondents were identified, which comprised 75 males and 75 females. However, only 80 participants agreed to participate in the study, which was comprised of 31 males and 49 females. The level of learning attitude was collected using the instrument prepared by the researchers. On the other hand, the level of science academic performance was determined using the average grades for the first and second quarters. The respondents were given time to complete the questionnaire, and their grades were directly gathered from the Registrar of the school. After collecting

quantitative data, the researcher proceeded with data analysis using the mean scores, standard deviation, and Pearson *r*.

The results of the quantitative phase led to the formulation of qualitative interview questions. The researchers then stated the qualitative questions and implemented the qualitative phase of the study. The respondents for the qualitative phase were the same respondents as from the quantitative phase of the study. However, only 12 of the 80 were randomly selected for this phase; they were comprised of three males and nine females. A focused group discussion was conducted for one hour in one of the school's offices. The researchers then employed the FGD protocol and began with the interview.

Data Analysis

To answer questions 1 and 2, the quantitative data was analysed using descriptive and inferential statistics. For descriptive statistics, the researchers utilised the mean and standard deviation. To answer question 3, inferential statistics were employed in this study. This study specifically used Pearson r. The researchers employed Pearson r to ascertain the significant relationship between attitude towards science and science performance. To answer question 4, the qualitative data was analysed using thematic analysis by Virginia Braun and Victoria Clarke (2006), which followed a six-step process: a) familiarising the data; b) generating initial codes; c) searching for themes; d) reviewing themes; e) defining themes; f) writing up (Maguire & Delahunt, 2017).

The quantitative data was analysed, and specific questions were developed to address the qualitative part of the research study. The researcher employed an FGD and gathered twelve (12) respondents from the sample respondents in the quantitative phase of the study. More specific interview questions for the attainment of research question 4 (four) were followed after the analysis of the quantitative data that answered questions one (1), two (2), and three (3). The researchers followed the step-by-step guide to thematic analysis of Braun and Clarke (2006).

Results and Discussion

The Level of Science Academic Performance of Learners in Blended Learning Modality

The data shows that the learners' science academic performance in blended learning is 87.03 *(Very Satisfactory)*. Hence, learning can happen in a blended mode.

The Level of Learners' Learning Attitude Towards Science in Blended Learning Modality

The data show that the learners' attitude towards science in blended learning has a mean score of 3.49 (moderate attitude). Moreover, the aspect of attitude towards science for which learners gained the highest mean score is affective, with a mean score of 3.72 (high attitude), followed by the cognitive aspect, which has a mean score of 3.62 (moderate attitude), and lastly, the behavioural aspect, which gained the lowest mean score of 3.15 (moderate attitude)

Figure 1

Mean Score of the Aspects of Learners' Attitude Toward Science

Source. Own research.

Table 3

Analysis of Variance of the Three Attitude Types

Score					
	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Between Groups	14.617	2	7.308	20.432	.000
Within Groups	84.771	237	.358		
Total	99.388	239			

Source. Own research and analysed using IBM SPSS (Version 25).

Table 4

Post-hoc analysis of the three attitude types

Dependent Variable: Score							
	(I) Attitude	**(J) Attitude**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
						Lower Bound	**Upper Bound**
Tukey HSD	Affective	Behaviour	.56792*	.09456	.000	.3449	.7909
		Cognitive	.10462	.09456	.511	-.1184	.3276
	Behaviour	Affective	-.56792*	.09456	.000	-.7909	-.3449
		Cognitive	-.46330*	.09456	.000	-.6863	-.2403
	Cognitive	Affective	-.10462	.09456	.511	-.3276	.1184
		Behaviour	.46330*	.09456	.000	.2403	.6863

Dependent Variable: Score							
	(I) Attitude	(J) Attitude	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Scheffe	Affective	Behaviour	.56792*	.09456	.000	.3350	.8009
		Cognitive	.10462	.09456	.543	-.1283	.3376
	Behaviour	Affective	-.56792*	.09456	.000	-.8009	-.3350
		Cognitive	-.46330*	.09456	.000	-.6962	-.2304
	Cognitive	Affective	-.10462	.09456	.543	-.3376	.1283
		Behaviour	.46330*	.09456	.000	.2304	.6962

Note. *. The mean difference is significant at the 0.05 level.

Source. Own research and analysed using IBM SPSS (Version 25).

Interestingly, the results revealed that there is a significant difference between affective and behaviour attitudes. Similarly, there is also a significant difference between the cognitive and behaviour attitudes of the learners. However, there is no significant difference between the affective and cognitive attitudes of the learners.

Despite the movement restrictions and fewer onsite interactions, the learners' have a favourable attitude towards science in a blended learning modality across aspects of attitude, with affective being the highest. The structure of the blended learning modality utilised by the school effectively maintains a favourable science-learning attitude among learners. A positive disposition among teachers also encourages the learners to have a favourable affective attitude towards science. Teachers are also very welcoming towards learners' struggles and allow them to ask questions about things that they do not understand and find hard. Teachers guide the learners through their struggles and learning. Additionally, teachers utilise activities that fit with the context of the learners, and at the same time, they are interesting and fun as they are allowed to utilise scientific tools. A learner expressed, "It gives me joy when using scientific tools." In spite of the movement restrictions and limited onsite classes, teachers also utilised the onsite days to conduct meaningful laboratory experiments. This has allowed learners to understand and construct their own knowledge (Tobin, 1990) and maintain their cognitive attitude at a favourable level. However, in light of the results, the limitations in movement and interaction have somehow affected the learners' behaviour and attitude. Furthermore, the teachers provided the learners with more opportunities to develop both the affective and cognitive aspects of attitude; on the contrary, teachers provided fewer opportunities for learners to develop the behavioural aspect of attitude. This has been the case since the pandemic inflicted a lot of limitations on physical activity.

The Affective Aspect of Attitude

In the affective aspect of Learners' Learning Attitude Toward Science (LLATS), the highest affective attitude statement is "I enjoy the laboratory activities given by our science teacher, which has a mean score of 4.16 (high attitude), followed by the affective attitude statement "I find science interesting, with a mean score of 4.15 (high attitude). The third highest affective attitude statement is "Science is a very important subject to me, which has a mean score of 4.09 (high attitude). The lowest affective attitude statement is "I enjoy having science conversations, which has a mean score of 3.10 (moderate attitude), as shown in Table 5.

Table 5

Mean and Standard Deviation of the Affective Aspect of LLATS

Statements	M	SD	Interpretation
Science is a very important subject to me.	4.09	0.83	High
Science is something that I enjoy very much in a blended learning class.	3.43	0.84	Moderate
I like communicating with our science teacher.	3.90	0.91	High
I enjoy the activities given by our science teacher in a blended learning class.	3.66	0.81	Moderate
I like our science lesson.	3.75	0.89	High
I enjoy the laboratory activities given by our science teacher.	4.16	0.86	High
I find science interesting.	4.15	0.94	High
I find happiness during science discussion in a blended learning class.	3.45	0.90	Moderate
I enjoy watching movies that are science related.	3.51	1.07	Moderate
I enjoy having science conversation.	3.10	1.04	Moderate
Average:	3.72	0.59	High

Source. Own research.

The learners find the laboratory activities enjoyable, boosting their interest and making it an important subject. Learners find science conversations interesting, and their interest in science is more specific to those they understand and find significant to them.

A learner expressed, "I feel happy about the laboratory activities because they are fun and easy." This helps the learners construct their own knowledge (Tobin, 1990). They find it fun because they are able to collaborate with their friends. As a learner expressed, "We get to collaborate with our friends with our classmates, and we get to ask each other, How do we do this, or how can we do this very effectively for our group? I think that's what makes it fun because you get to talk to them compared to when we were online." Hands-on activities are central to science learning (Wisanti et al., 2021). Additionally, the classroom environment heavily influences attitude (George, 2000; Talton & Simpson, 1987 as cited in Musengimana et al., 2021). However, while learners

find the laboratory enjoyable, they face a challenge in understanding the instructions. A learner said, "The instructions on the worksheets are not enough for me to understand." This is also because there are no visual pictures or representations of the said activity. A proper pre-laboratory must be made for learners to understand the instruction before doing the activity. If learners do not understand what they will do, it affects their attitude toward their task. A positive attitude will allow learners to continue with the task; however, a negative attitude will hinder learners from doing their task in the activity, leading to a lack of interest and less participation. A more positive scientific attitude can boost students' motivation and interest in science (Akkuş, 2019; George, 2006; Shah & Mahmood, 2011).

Learners also find science interesting and important. Incorporating learning into daily life and experiences and allowing learners to do so through action and reflection makes their learning more significant and allows them to understand that everything they do has a scientific explanation to a certain degree as a learner expressed "every lesson that was taught successfully connected our understanding of the importance of science in our lives."

However, learners rarely engage in science conversation, as they sometimes find it boring and not a topic to discuss. As a learner expressed, "It depends on the topic that the teacher is talking about because sometimes suddenly, I find it interesting, but there are times that it is not really interesting." They usually start science conversations only during science class, in which the teacher gives them the opportunity to talk about the topic they are learning because they are cautious that if they talk about science outside the class, the other party may not like it, as a learner also expressed, "because I think a person might not like the topic."

The Behaviour Aspect of Attitude

In the behaviour aspect of LLATS, the highest behaviour attitude statement is "I always make sure that I finish all science activities on time in a blended learning class, which has a mean score of 3.75 (high attitude). The behaviour attitude statement follows this: "We have enough time to interact with our science teacher in a blended learning class, which has a mean score of 3.64 (moderate attitude). Lastly, the third highest behaviour attitude statement is "I can focus during our science class in a blended learning class, which has a mean score of 3.50, which translates to (moderate attitude. The lowest behaviour attitude statement is "I write a journal about what I learned in science during the day, which has a mean score of 1.98 (low attitude), as shown in Table 6.

Table 6

Mean and Standard Deviation of the Behavior Aspect of LLATS

Statements	M	SD	Interpretation
We are given enough time to process what we have learned during the science discussion in a blended learning class.	3.39	0.79	Moderate
I am active during science discussions in a blended learning class.	3.36	0.86	Moderate
We have enough time to interact with our science teacher much in a blended learning class.	3.64	0.73	Moderate
I can focus during our science class in a blended learning class.	3.50	0.86	Moderate
I look forward to our science class every day in a blended learning class.	3.44	0.90	Moderate
I always jot down notes during science discussions.	3.15	1.14	Moderate
I am always eager to participate in science discussions in a blended learning class.	3.29	0.96	Moderate
I participate in science discussions in a blended learning class.	3.40	0.91	Moderate
I write a journal about what I learned in science during the day.	1.98	0.78	Moderate
I always make sure that I finish all science activities on time in a blended learning class.	3.75	0.95	High
I consult our science teacher even after science class.	2.85	1.03	Moderate
I often start science conversation with other people.	2.20	1.01	Moderate
I follow a regular schedule to review our science lesson.	3.28	1.06	Moderate
Average:	3.15	0.59	Moderate

Source. Own research.

Unfortunately, the limitations in movement and interaction have somehow affected the behaviour and attitude of the learners. Although it remains fairly favourable, it is also notable that among the given aspects of attitude under study, behaviour is the lowest. Hence, the promotion of behavioural activities to increase positive attitudes is necessary. Although learners make sure that they finish all science activities on time because they are pressured and required to submit on time, one learner expressed that they do not want activities to pile up. Additionally, they are given enough time to interact with their science teacher. Hence, learners have enough time to finish their activities, and the teachers can interact with them. Furthermore, learners stay focused on a blended learning modality despite the many distractions. It is also noted that learners are no longer interested in writing journals of what they have learned, as learners expressed, "I am not fond of it. And I cannot express my feelings so much" and "I am not that good at expressing myself, especially in writing.". Teachers should give learners opportunities to write journals and reflection papers regarding what they have learned. These activities should also be interesting and done at the right times. Learners' behaviour and attitudes reflect the future, possible direction, and significance of new normal classes in learning and the implications it has for increasing interaction and communication (Mallillin et al., 2021). Furthermore, learners also expressed that they have too many things and activities to accomplish and would rather focus on what is important and due.

The Cognitive Aspect of Attitude

In the cognitive aspect of LLATS, the highest cognitive attitude statement is "I consider science as an important subject to the development of a country, which has a mean score of 4.31 (high attitude), followed by the cognitive attitude statement "I can relate old science lessons to the new science lessons" which has a mean score of 3.96 (high attitude), and lastly, the cognitive attitude statement "I can relate my existing knowledge to our science lessons" which has a mean score of 3.81 (high attitude). The lowest cognitive attitude statement is "I can easily answer the question of our science teacher" which has a mean score of 2.99 (moderate attitude), as shown below.

Table 7

Mean and Standard Deviation of the Cognitive aspect of LLATS

Statements	M	SD	Interpretation
I consider science as an important subject to the development of a country.	4.31	0.82	High
I can relate my existing knowledge to our science lessons.	3.81	0.89	High
I can relate my existing experience to our science lessons.	3.71	0.89	High
I can relate old science lessons to the new science lessons.	3.96	0.91	High
I understand the science lesson taught by the science teacher in a blended learning class.	3.80	0.88	High
I can explain our science lesson in my own words.	3.19	1.07	Moderate
I can relate what I have learned in science to my everyday experience.	3.46	0.90	Moderate
During science lessons, I can easily understand what the teacher is pointing out.	3.36	0.89	Moderate
I can easily answer the question of our science teacher.	2.99	0.85	Moderate
I can learn our science lesson by just doing our science activities in a blended learning class.	3.34	0.94	Moderate
I understand science lesson easily in a blended learning modality when the teacher uses organizational charts and graphical presentations.	3.68	0.90	High
I understand science lesson easily in a blended learning modality when the teacher uses web tools such as wizer, padlet, quizizz, etc.	3.66	1.11	Moderate
I understand science lesson easily in a blended learning modality when the teacher uses audio-visual presentation to support discussion.	3.73	1.03	High
AVERAGE:	3.62	0.61	Moderate

Source. Own research.

Table 5 posits that learners find science important to their lives and the development of our country. This results from incorporating science lessons into everyday life and

their applications to daily routines. AdZU follows a paradigm that encourages learners to incorporate learning into their environment and experiences. Teachers provide opportunities for students to reflect upon the importance of their topic to real life, as learners expressed, “When we answer an exam, what’s the role of science or why is it important in our lives? Reflect how it’s relevant”. Additionally, a learner expressed, “I think we were able to connect matter and how it is important for our environment.”

Learners also relate their previous learning to new learning; hence, the teachers’ curriculum is aligned and the lessons being taught are related. Learners also relate their prior knowledge to new knowledge. Therefore, using the learners’ context before teaching has also enhanced their cognitive attitude. After all, the cognitive component of an attitude refers to a person’s understanding of an object, specifically the relationship between that object and its attributes (Fishbein & Ajzen, 1975). However, learners find it hard to answer the teachers’ questions. This results from the pressure to answer the question and the intimidation felt at the time. Nevertheless, teachers provide the learners with enough time to think about the question and rephrase it in a more understandable manner and language.

The Relationship Between Learners’ Learning Attitude Towards Science and Science Academic Performance

Based on the analysis for normality made using IBM SPSS (Version 25), the data is normal (see Appendix I); hence, the researchers proceeded with the use of Pearson’s Correlation to determine the relationship between Learners’ Learning Attitude Towards Science and Science Academic Performance. The Pearson’s Correlation test shows that there is a positive correlation, $r(78) = .48$, $p < 0.01$, between the Learners’ Learning Attitude Toward Science (LLATS) and Science Academic Performance (SAP) of the learners in blended learning.

Table 8

Parametric Test for Correlation

		LLATS	**SAP**
LLATS	Pearson Correlation	1	.480**
	Sig. (2-tailed)		.000
	N	80	80
SAP	Pearson Correlation	.480**	1
	Sig. (2-tailed)	.000	
	N	80	80

Note. **. Correlation is significant at the 0.01 level (2-tailed).

Source. Own research and analysed using IBM SPSS (Version 25).

Hence, if the LLATS increases, the SAP of the learners also increases. This result is similar to studies by Shah et al. (2013) and Mao et al. (2021), which also show that attitude towards science impacts learners' achievement. With an increase in the learners' attitude towards scientific learning, their science achievement improves. Learners with a low attitude towards science may no longer pursue studying the lessons or topics they find challenging and hard to learn (Phuong & Dung, 2022). A more favourable attitude towards science allows learners to sustain learning in science (Pell & Jarvis, 2001; Shah et al., 2013).

Learners' Learning Experiences in Blended Learning Modality

The challenges that learners face cross affective, behavioural, and cognitive boundaries. In affective learning, the learners faced challenges in terms of lack of interest due to not-interesting activities, as a learner expressed, "Because I do not have the interest", "Sometimes because I don't like the activity", and "Sometimes I get more frustrated for a group activity". This lack of interest has resulted in learners having a lot of distractions during the online set-up and being overwhelmed by the number of activities they have to submit in a day. Lack of time has also affected the learner's affective learning, specifically, interest in science. Additionally, learners find difficulty submitting requirements and understanding scientific words as one of the learners expressed, "For example, some of my exams like there are deep words, I have to analyse what is the meaning of that word". Furthermore, learners also struggle to express their thoughts and understand instructions given by the teachers as one of the learners mentioned, "So I will figure it out because sometimes the instructions on the worksheets there's not enough for me to understand". Instead of doing the task, since they do not understand it, it led to individual learners not anymore participating in activities as a learner expressed, "Most of my group mates sometimes they don't really have interest in answering". This lack of interest led to several repercussions in learning.

To meet the learners' challenges, the science teachers gave them opportunities to develop their attitudes. To increase the learners' interest, the teachers provided more laboratory activities that allowed the learners to utilise scientific tools. One of the learners emphasised this: "We get the experience of, like, doing experiments such as using scientific tools. That makes me feel that I am a little scientist." Additionally, the teachers promoted peer interactions and scientific conversations inside the classroom by giving interesting topics. Furthermore, to help learners with difficulty understanding instructions and topics, teachers guide them by elaborating and clarifying the instructions and topics being discussed. The teacher also allowed the learners to ask questions and gave them enough time to process what they learned

or needed to do. This was affirmed during the FGD, as one of the learners stated, "Yes, she gives us time to think." Additionally, teachers changed the instructions into a more understandable construct and allowed learners to research independently. Teachers also employ strategies that are entertaining and interesting. To make learning more meaningful, teachers connect their topics to the real-life experiences of the learners. The school's Ignatian pedagogical paradigm also provides opportunities for the learners to reflect upon their learning, act, and connect it to their daily experiences and endeavours. It is noticeable in Table 6 that the teachers provided more opportunities to develop the cognitive attitude of the learners, which is followed by the affective attitude. However, there are fewer opportunities provided by teachers for learners to develop behavioural attitudes. The great number of challenges learners face in their behavioural learning and the few opportunities to develop behavioural attitudes have taken a toll on the level of behavioural attitude that the learners have toward science learning. Teachers also provided learners with opportunities to enhance their academic performance by boosting academic success through grading and feedback, motivating students to provide results on time, and encouraging them to finish the task completely to receive full credit.

Table 9

Learners' Challenges, Opportunities to Improve Attitude and Performance in Science

	Affective	**Behaviour**	**Cognitive**
Challenges	1.3 Lack of interest 1.5 Not interesting activity 1.10 Pressured to answer the question.	1.6 Lots of requirements in other subjects 1.7 Unresponsive groupmates/lack of communication 1.8 Lack of time 1.12 Easily distracted in an online set-up. 1.14 Less interaction with classmates/peers 1.15 Difficulty of submitting hard copies of assignments during online-onsite class	1.1 Difficulty in understanding the instructions/ questions given in the worksheet. 1.2 No visual representations of the procedures given in the experiment. 1.4 Difficulty of understanding the subject matter 1.9 Difficulty in expressing their thoughts through journal writing. 1.11 Weak internet connectivity 1.13 Difficulty in understanding scientific words

	Affective	Behaviour	Cognitive
Opportunities to improve Attitudes	2.1 Conduct of enjoyable and interesting hands-on laboratory activities 2.7 Learning through scientific conversations with other people 2.10 Peer-interactions 2.12 Interesting topic	2.6 Teacher guides the students in the class. 2.9 Teacher gives time to process the activity/question. 2.13 Teacher elaborates and clarifies the topic being discussed	2.2 Easy to understand instructions. 2.3 Doing research on their own. 2.4 Learn new scientific concepts after doing hands-on laboratory experiments. 2.5 Processing of the activity/topic being discussed. 2.8 Real-life connections to the topics being discussed. 2.11 Teacher's teaching strategy in delivering the content.
Opportunities to Improve Science Academic Performance	3.2 Motivate students to provide results on time. 3.3 Encouraged to finish the task completely to receive full credit.	3.1 Emphasize boosting academic success through grading and feedback.	

Source. Own research.

Conclusion

Upon analysing the gathered data, the researchers draw the following conclusions:

- Learning can effectively take place in a blended learning modality, although there is room for improvement in its structure;
- Learners exhibit a positive attitude towards science learning in a blended learning environment, with affective attitudes ranking the highest, followed by cognitive and behavioural attitudes. This can be attributed to the teachers' efforts in providing ample opportunities for the development of both affective and cognitive aspects of attitude. However, challenges arise in fostering a positive behavioural attitude due to the limitations imposed by the pandemic.

Lastly, despite facing several challenges during the blended learning modality, learners were able to persevere and continue their learning journey. This is primarily attributed to the teachers' dedication to offering opportunities to cultivate a positive attitude and enhance academic performance.

Recommendations

Based on the findings and discussions, the researchers offer the following recommendations:

- To improve teaching strategies, teachers should participate in seminars and workshops focused on enhancing their art of questioning and crafting meaningful science activities;
- To enhance reading comprehension among learners. Moreover, simplify worksheet instructions and make them more accessible to learners;
- Encourage more opportunities for reflection among learners;
- Foster engagement by involving learners in relevant scientific conversations and current science issues;
- Reduce the number of activities given to learners per day, focusing on meaningful activities aligned with the lesson objectives.

Furthermore, the researchers recommend conducting further research in the following areas:

- Replicating the study in a post-pandemic school year to assess any changes in the effectiveness of blended learning;
- Extending the study to other subject areas and using a larger sample to explore the impact of blended learning in various educational contexts.

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Appendix A

Table A1

Normality of Data

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
LLATS	.078	80	.200*	.978	80	.184
SAP	.076	80	.200*	.974	80	.101

Note.*. This is a lower bound of the true significance; a. Lilliefors Significance Correction; Alpha = 0.05.

Source. Own research and analysed using IBM SPSS (Version 25).