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Assessing Differences on Students' Attributes in Mathematics Based on Their Learning Sessions

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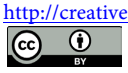

Abstract

This research investigated the differences on students' attributes in mathematics such as their attitudes, self-efficacy, learning environment, and math performance based on their learning sessions. The descriptive comparative research design was employed using a three-set survey questionnaire to assess the attitudes, self-efficacy, and learning environment while the average of the students' First and Second Quarter grades in Math was used to assess their academic performance. There were 204 respondents who were selected using stratified random sampling with their learning session as the stratum. Data were treated using descriptive and inferential statistics. Results revealed that the students had positive attitudes towards Math, had moderately positive self-efficacy and considered learning environment as influential to their learning while they had fair math performance. When grouped by their learning sessions, findings showed no significant difference on the students' attitudes, self-efficacy, and learning environment but there is a significant difference on their math performance. Hence, school administrators and teachers are encouraged to design programs that would minimize the gap of student's math performance based on their learning sessions.

Keywords

Attitudes, Learning Environment, Learning Session, Performance in Math, Self-Efficacy

1. Introduction

Mathematics, of all the subjects in the elementary, secondary and tertiary levels,

is the widely recognized mother of all learning where other subject matter's concepts are derived from, in both the arts and sciences (Gamit, Antolin, & Gabriel, 2017; Mazana, Montero, & Casmir, 2019). Consequently, it is safe to assume though, that Mathematics has been a subject of ill-repute in more ways than one. Many factors add to this contention as a general impression when they hear the word "Math". It is not at all surprising to have that off-putting notion as an initial response. This negativity is presumably known to be environment-related, such as, but are not limited to one's teacher, parents, classmates, peers or the school in general, if not any other underlying experiences and reasons affecting ones attitude towards Math as a subject matter (Mata, Monteiro, & Peixoto, 2012).

In all walks of life, whether in the office, in school, in presentations, in business dealings, in completing tasks, grocery errands, and chores, or even just coming home after work, whatever one's day-to-day routine is, one makes use of reasoning, patterns, measurement, structure, classification, combinations and relationships to mention but a few, all of which sets into application, deliberately or inadvertently, one's Mathematical skill set. Most individuals feel they were not able to learn much from Mathematics but consequently though, each one has gained a significant skill or two unaware of their potential to maximize their skill sets in their day-to-day transactions (Abramovich, Grinshpan, & Milligan, 2019). Thus far, in spite of modern day advancements and teaching-learning techniques, children are still inclined not to give much effort to learning Mathematics when they do not find importance on the subject (Li & Schoenfeld, 2019).

The performance in Mathematics continues to be a problem for many countries. For example, in TIMSS 2011 report, achievement in Mathematics for sixth-grade students fell at or below low international benchmarks (Mullis et al., 2011). While many other developed countries continue to dominate international rankings in the 2015 Trends in International Mathematics and Science Study (TIMSS), a study the Organization for Economic Cooperation and Development (OECD) finds United Kingdom, a developed country with high-income economy, lagging dramatically behind. British school children are failing to improve even though the country spends more on education than the international average.

In the 2003 Trends in International Mathematics and Science Study (TIMSS), the Philippines participated its second and latest participation thus far, is far from desirable: of the 38 participating countries, the country placed 34th in Mathematics (Mullis, Martin, & Foy, 2005). This dismal record is alarming and has triggered an overwhelming concern about the quality of education in the country. This is no different case from that of United Kingdom as the Philippine national government has now too been allocating more funds in its education system yet students are still continually underperforming. The large number of students in the Philippines who are enrolling in high school has been a problem every year because it leads to classroom shortage. Thus, the Department of Edu-

cation implemented two learning sessions for the high school students to maximize classroom usage. The two sessions are the day and night sessions where students have the liberty to choose what learning sessions they want to enroll.

However, it has been observed for the past years of implementation that students who enroll in the night sessions have less focus towards their academic activities than those who enroll in the day sessions. Some subjects particularly Mathematics has to be taken seriously by students in order to cope up the lessons. Oftentimes, teachers need to give reinforcement activities to their math lessons so that students can practice the learned skills outside the classroom (Fitriati, Fatmala, & Anjaniputra, 2020). Notably, teachers struggle to emphasize the importance of complying the school tasks to the students who enroll in night classes because they seemed to be relaxed in school (García-Moya, Moreno, & Brooks, 2019). Students who enroll in these classes oftentimes resort to going to internet cafes, hanging out with friends, going to malls, and other entertainment activities at night. Hence, these students oftentimes skip classes and go home late. Consequently, they will no longer have time to comply the tasks that should be done at home (Peteros et al., 2021). On the other hand, students who enroll in the day sessions were observed to be more compliant with the school tasks and exhibit positive attitudes towards learning (Mazana, Montero, & Casmir, 2019). Such differences are common observations of teachers who encounter students enrolling in the day and night sessions. If these observations have impact on student's learning then it is imperative that the perceived gap between the students' attributes who enroll in these learning sessions maybe explored so that these issues can be resolved by the concerned stakeholders.

Thus, it is in this context that the researchers aimed to determine if there are differences on the students' attributes in mathematics such as their attitudes, self-efficacy, learning environment, and math performance based on their learning sessions. The researchers intend to scrutinize and explore into the experiences of Grade 7 students in the identified schools. This study aimed to contribute to the body of literature by considering this group of students with reference to the unique characteristics of students in sub-urban government-run secondary schools.

2. Literature Review

Presented here is a survey of literature and relevant studies about attitude, self-efficacy, learning environment and academic performance of students and a necessity of proposing solutions for teaching students with reference to their unique characteristics being in sub-urban government-run secondary schools.

Many studies discovered that there is a connection between the attitudes and mathematics achievement. Attitudes are ones' belief and feelings towards something that may influence ones' responses on situations (Ariola, 2009). Attitudes are defined as ones positive or negative feelings towards something (Aiken, 2000; Yee, 2010). In this case, the students' emotion is significant in developing the at-

titudes particularly in responding to situations that the students have encountered while learning mathematics. Situations that bring enjoyment to students will influence their positive beliefs. Otherwise, negative beliefs will develop (Hayat et al., 2020).

Brahier (2009) cited that students learn mathematics which can exceed the concepts, principles and its applications in life which includes the development of the attitudes towards the subject and realizing mathematics as an influential tool for looking at situations. Disposition is not only about attitudes but also ones tendency to act positively. The assessment of students' mathematical disposition should seek information about their 1) confidence in using Mathematics to solve problems, to communicate ideas, and to reason; 2) flexibility in exploring Mathematical ideas and trying alternative methods in solving problems; 3) willingness to persevere in Mathematical tasks; 4) interest, curiosity, and inventiveness in doing Mathematics; 5) inclination to monitor and reflect on their own thinking and performance; 6) valuing of the application of Mathematics to situations arising in other disciplines and everyday experiences; 7) appreciation of the role of Mathematics in our culture and its value as a tool and as a language. These dispositions develop in students most effectively when teachers model the dispositions. Teachers who are enthusiastic about topics they are presenting are likely to instill the same interest in their students. Ask students who "like Math" where this feeling came from, and you'll often find that one teacher at a particular grade level got them excited about Math, and that excitement impacted their attitudes for the rest of their lives. Unfortunately, the same situation can be and often is true for those who dislike mathematics or even fear it.

In general, the affective domain in mathematics education is described by attitude, belief and emotion while knowledge and thinking are contents and processes of human memory. However, mathematics education is concerned on the attitudes because it is considered as unstable and a general matter as a belief (Sanchal & Sharma, 2017). In attitudes toward Mathematics, the affective component predominates. It is manifested in interest, satisfaction, and curiosity, or, on the contrary, in rejection, denial, frustration, evidence of Mathematics tasks, positive interest and attitudes toward Mathematics seem to decline with age especially during secondary education (Blanco, Barona, & Carrasco, 2013).

Self-efficacy refers to the extent on the students' belief on his capability to do the task in the class. If the student has failed previously in his mathematics class and is given a problem that is even difficult the student will have the tendency to think that he cannot perform the task and will immediately give up because of the belief that he cannot be successful due to the lack of his ability (Brahier, 2009). Students with low self-efficacy has the tendency to avoid the tasks provided by the teachers particularly those challenging ones while students with high self-efficacy enthusiastically accept these tasks. More likely students with high self-efficacy exert more effort on learning tasks than those with low self-efficacy (Schunk & Pajares, 2009).

Brophy (2010) stated that people having achievements in life with self-efficacy

consider that they can carry out what are needed in the situation while people who lack this will not be certain if they can achieve their goals in life. Students with high self-efficacy have high math grades and having perceived math as an easy subject (Usher, 2009). Research studies have shown that individuals tend to choose tasks that are neither impossibly difficult nor overly simple—within their comfort zone. As a point of reference, one study found that a study must be successful about 70 percent of the time to consider tasks to be challenging enough to be interesting but not so difficult that they appear impossible to complete. This is very significant for classroom instruction planning because students will not be motivated if the tasks are easy and they feel that doing the task is a waste of time and they could refuse to do the task or give up if it seems difficult. Thus, the role of the teacher is to choose activities that challenges and build the students' self-efficacy in the later part of the school year (Brahier, 2009).

The learning environment has been one of the many contexts in which development is expected to occur. Designing the learning environment has been the focus of every teacher. Although the concept of a learning environment includes the classroom, the meaning is greater than what is expected because learning environment is everywhere. Many of what individuals learn and teach; they learn and teach first in the classroom. Teachers set the atmosphere inside the classroom. A friendly and welcoming classroom will make students feel at ease while learning which can be achieved when the teacher is equipped with enough knowledge on the appropriate pedagogical strategies based on the learning situations (Anastasios, 2020). Though, the most significant learning occurs outside the classroom. Settings like the playground as well as the home forms part of the learning environment. The classroom is an arena where there is information exchange. To make it more effective and productive—one that generates more student participation and learning—it should be designed effectively in order to achieve its objectives (Aquino, 2009). Environmental factors such as parental support and class session may also influence the individual learning process because if the parents do not follow up learners' daily assignments and practice mathematical concepts, the acquired learning is just rote learning (Gafoor & Kurukkan, 2015).

Despite applying different strategies and techniques, still the problem of low performance emerges. One of the reasons why learners performed poorly in Mathematics is their attitude towards the subject (Alpacion et al., 2014). Several studies proved that their attitude had strong relationship with their academic performance (Parker et al., 2013; Mazana, Montero, & Casmir, 2019; Hayat et al., 2020). Peteros et al. (2019) found that students have neutral attitude in terms of self-confidence, very positive attitude in terms of the value of math, positive attitude in terms of enjoyment and motivation in mathematics while they had fairly satisfactory performance in the subject. Moreover, the four components were found to have significant relationship with the students' academic achievement. Moreover, Mazana et al. (2019) found that students have positive attitudes

towards mathematics but observed a decline as the move towards the higher levels of education. Moreover, there was a significant relationship between the students' attitude and their performance in math. Hence, it was recommended that relevant improvement in the teaching-learning practices may be applied to promote enjoyment in learning mathematics and better performance in the subject.

Learners' attitudes towards Mathematics should be given attention in teaching the subject if one is serious in advancing the performance of the students. This can only be developed in the presence of a healthy environment (Tran, 2012). Aside from environment, teachers' attitudes and beliefs, teaching styles and parental attitudes were identified as explanation factors that account for the student's attitudes towards mathematics (Asante, 2012). Hence, a positive learning environment would lead to a positive attitudes towards mathematics and result to an improved performance (Tran, 2012).

On the other hand, self-efficacy in Mathematics was also seen as strong factor. Several studies revealed the strong relationship between self-efficacy and Mathematics performance (Pampaka et al., 2011; Fast et al., 2010). Self-efficacy in Mathematics is strongly related to the students' attitudes towards the subject. The former also showed significant effect on the tertiary entrance ranks (Vukovic et al., 2013). Bassi et al. (2007) noted that students with high self-efficacy had higher academic goals, more diligent in performing assignments, and have the tendency to relate learning tasks with favorable experiences than those with low self-efficacy. Prat-Sala and Redford (2010) found out that students with high self-efficacy for reading and writing tend to adopt a deep, strategy-oriented approach to studying with their low-self-efficacy counterparts were more likely to take a surface approach.

Most research studies have the impression that high self-efficacy is better. However, this observation needs to be validated further. Koh (2006) investigated the self-efficacy of college students while learning technology skills found that high technology efficacy students were more at ease and successful, as well as more resilient in the face of frustrations, than low self-efficacy students. Nonetheless, this high self-efficacy of the students overrated their knowledge, demonstrating overconfidence that would result to defending their wrong concepts of things. In other sense, researchers have observed that extremely high self-efficacy can build complacency, resulting to relaxing from the constant efforts that lead them to achieve more. However, it is not established yet that self-efficacy causes the performance of the students (Bandura & Locke, 2003; Vancouver & Kendel, 2006).

A lot of studies have been conducted exploring the attitudes, self-efficacy, learning environment, and academic performance of the students in mathematics. Different findings were observed based on these investigations. However, there was no study that focused on comparing these student's attributes based on the learning sessions that students enroll. Conducting investigation on the

gap of the present literature can provide a better understanding on the interplay of these variables when taken into the other aspect which could possibly explain the existing status of the student's attributes.

In this regard, the researchers fervently decide to conduct this study to add significant knowledge to the literature on the differences of these three variables based on learning sessions that affect learning experiences. Expectations are that this study will make a significant contribution to the existing body of research in children's mathematics education. It is hoped to bring clarity to degree to which interplay of attitude, self-efficacy and learning environment are involved in different aspects of their children's mathematics education, and whether these variables have differences when students are enrolled in different learning sessions.

3. Materials and Methods

Descriptive comparative research design was employed in this study to explore the attitude, self-efficacy, learning environment, academic performance of the students in math utilizing the data that were gathered through a survey questionnaire. Comparative research is a type of research design which aims to compare two groups in order to make inference about the similarities and differences between these groups (Richardson, 2018). There were 204 Grade 7 students who participated from the four public national high schools in District 5 of Cebu City South District, Cebu City, Philippines. This study focused on the Grade 7 students because they are beginners in the high school system and at the considerably crucial stage of their education. These learners are also at the transition stage from childhood to puberty and it is imperative to be more acquainted about their attitudes, self-efficacies and learning environments this early part of their respective high school experiences. Stratified random sampling using ratio and proportion was used to determine the number of respondents in every stratum in gathering the data. Stratified random sampling is a probability sampling that involves dividing a population into smaller groups based on their common characteristics known as strata (Hayes, 2021). The determination of the sample size was done in such manner since it is relevant to the total population through Slovin's formula. The respondents were grouped in terms of the learning session they enrolled. There were 101 respondents who were enrolled in the day session while there were 103 respondents for the evening session.

The researchers used three sets of survey questionnaire in determining the needed information of the study. Part I elicited information on the attitudes of the respondents which is a modified questionnaire from the "Attitudes Towards Mathematics" by Nicolaidou and Philippou (2003). It has 10 indicators. The respondents were asked to rate how they think, act, and value mathematics on a five-point scale, namely: 5—strongly agree, 4—agree, 3—undecided, 2—disagree, 1—strongly disagree. Part II used the modified questionnaire entitled "Self-efficacy Towards Learning Mathematics" by Nicolaidou and Philippou (2003). It has 10 indicators. The respondents were asked to rate on how they

perceive their effectiveness towards learning mathematics on a five-point scale, namely: 5—strongly agree, 4—agree, 3—undecided, 2—disagree, 1—strongly disagree. Part III used the modified questionnaire entitled "Learning Environment Influence towards Learning Mathematics" by Mutai (2010). It has 10 indicators. The respondents were asked to rate on how their learning environment has influenced towards learning mathematics on a five-point scale, namely: 5—strongly agree, 4—agree, 3—undecided, 2—disagree, 1—strongly disagree. The researchers asked the assistance of the respondents' adviser to retrieve their grades for the First and Second Quarter. The average the respondents' grades for these quarters were used to assess their academic performance.

4. Results and Discussion

This section presents the level of students' attributes as to their attitudes, self-efficacy and learning environment of the students, their academic performance in Math, and the test of the hypotheses for these variables.

Table 1 presents the level of attitudes of the respondents towards Mathematics. Attitude towards Mathematics plays a critical role in the teaching-learning processes of mathematical concepts. Attitude towards Mathematics vary. It is either positive or negative and to a certain degree.

It can be gleaned in the table that the respondents had a positive attitude towards Mathematics with a weighted mean of 3.73. Students may find Mathematics a difficult subject yet they felt the need to study the subject because they can use the skills developed in this subject in the future. Thus, they try to develop a positive attitude towards the subject so that they will be motivated to learn more about the subject. On the other side, students might have a positive attitude towards the subject because the lessons they learn are not yet too advanced

Table 1. Attitudes of the students towards mathematics.

S/N	Indicators	WM	Description
1	I am interested in Mathematics	3.84	Positive
2	Mathematics is an interesting subject	3.92	Positive
3	I need to study Mathematics	4.25	Very Positive
4	Mathematics thrills me! It's my favorite subject!	3.38	Moderately Positive
5	I am happy when answering questions in Mathematics	3.45	Positive
6	I like school Mathematics	3.42	Positive
7	I am comfortable with mathematics	3.48	Positive
8	Mathematics is useful for anyone's life	4.41	Very Positive
9	I enjoy the struggle to solve a mathematical problem	3.67	Positive
10	I like problem-solving in Mathematics	3.45	Positive
	Aggregate Weighted Mean	**3.73**	**Positive**

Legend: 4.21 - 5.00 Very Positive, 3.41 - 4.20 Positive, 2.61 - 3.40 Moderately Positive, 1.81 - 2.60 Less Positive, 1.00 - 1.80 Negative.

and abstract that they can still relate the topics to real-life situations because at this level only the basic concepts in Math are introduced to them. Students may have a positive attitude towards the subject yet they encounter difficulties in understanding the lessons in Math because Math is a complex subject. Secondary students were aware that mathematics is important in their lives which contributed their willingness to learn well and the attitudes acquired from their past experiences can affect their learning towards the subject (Mutai, 2010).

Table 2 shows the level of self-efficacy of the students in learning Mathematics. In constant and continuous efforts of improving students' academic performance in Mathematics; educational psychologists, curriculum developers, administrators, educators, and all other stakeholders have continued to search for variables that could be given emphasis in favor of academic gains due to student's disposition and poor performance in the subject.

In general, the students had a moderately positive self-efficacy in learning Mathematics with a weighted mean of 3.07. When students are able to help others in answering Math problems in school, their feelings are boosted that they already understand their lessons in Math. They are motivated to learn more so that they can act as somebody whom their peers can depend on when their classmates have difficulties in the subject. Students who are motivated find it interesting to solve difficult problems in Math because they will be able to share to others how they were able to find solutions to problems that others were not able to solve. Most of them engaged in independent learning in order to enrich their

Table 2. Self-efficacy of the students in learning mathematics.

S/N	Indicators	WM	Description
1	I am one of the best students in Mathematics	2.50	Less Positive
2	I believe that I have a lot of strengths in Mathematics	3.22	Moderately Positive
3	Compared to other students, I am a smart student in Mathematics	2.49	Less Positive
4	Mathematics is one of my strengths	3.21	Moderately Positive
5	I usually can help my classmates, when they ask me for help in problem-solving	3.52	Positive
6	I can usually solve any mathematical problem	3.12	Moderately Positive
7	I feel sure about myself in solving Mathematical problems	2.93	Moderately Positive
8	When I start answering a mathematical question, I usually feel that I would manage to give a solution	3.23	Moderately Positive
9	I can easily understand Mathematical problems	3.22	Moderately Positive
10	I am capable of making good grades in Math	3.26	Moderately Positive
	Aggregate Weighted Mean	**3.07**	**Moderately Positive**

Legend: 4.21 - 5.00 Very Positive, 3.41 - 4.20 Positive, 2.61 - 3.40 Moderately Positive, 1.81 - 2.60 Less Positive, 1.00 - 1.80 Negative.

knowledge in Math by exploring topics that are beyond the scope of their lessons. In such case, they could feel that they are self-efficient in learning the subject. Students use their grades as basis for assessing how well they perform in mathematics (Ramírez, 2005). Students with high self-efficacy exerted more effort in performing the activities than those with low self-efficacy. Furthermore, students with high self-efficacy had higher academic goals extend their time working with their assignments, and relate their learning tasks with their favorable experiences than those with low self-efficacy (Bassi et al., 2007).

Table 3 shows the level of influence of the learning environment of the students in learning Mathematics. Generally, the students perceived that the learning environment is influential to them in learning Mathematics with an average weighted of 3.60. In the life of the students, the teacher is very influential towards their learning because teachers facilitate the learning of the students. When teachers are ineffective in facilitating the learning of the students, their performance would be affected. Students oftentimes look up to the teachers as the source of their knowledge that they can always depend when they encounter difficulties in learning.

Dispositions develop in students most effectively when teachers model the dispositions. Teachers who are enthusiastic about topics they are presenting are likely to instill the same interest in their students. Ask students who "like Math"

Table 3. Learning environment of the students.

S/N	Indicators	WM	Description
1	I like my Mathematics teacher.	4.43	Very Influential
2	I think that our teacher makes learning Mathematics easier.	4.26	Very Influential
3	I like to go to the board and share my answers in Math class	3.21	Moderately Influential
4	I like to participate in classroom discussions about Mathematics	3.53	Influential
5	My friends like to learn Mathematics	3.78	Influential
6	I do a lot of Mathematics exercises with a friend	3.24	Moderately Influential
7	My parents encourage me to perform well in Mathematics	3.67	Influential
8	My siblings encourage me to perform well in Mathematics	3.36	Moderately Influential
9	I would love to join a Math club in school	3.13	Moderately Influential
10	I like to participate in Math activities inside the school.	3.39	Moderately Influential
	Aggregate Weighted Mean	**3.60**	**Influential**

Legend: 4.21 - 5.00 Very Influential, 3.41 - 4.20 Influential, 2.61 - 3.40 Moderately Influential, 1.81 - 2.60 Slightly Influential, 1.00 - 1.80 Not Influential.

where this feeling came from, and you'll often find that one teacher at a particular grade level got them excited about Math, and that excitement impacted their attitudes for the rest of their lives. Unfortunately, the same situation can be and often is true for those who dislike mathematics or even fear it (Brahier, 2009). Peers and family members may also influence students' performance because if students cannot get the support from their teachers they will find an alternative confidant in their struggles to learn. Students may base their self-evaluation on Mathematics performance on feedback from parents, teachers, and peers regarding their mathematics abilities (Usher, 2009).

Table 4 exhibits the performance in Math of the students. It revealed that there were 77 or 38 percent of the students whose grades are from 75 to 79 which means that they had a poor performance in Mathematics. There were 58 or 28 percent whose grades are from 85 to 89 which means that they had an average performance in Mathematics while 36 or 18 percent of the students had grades from 80 to 84 which means that they had a fair performance in Mathematics.

Twenty-seven or 13 percent of the students had grades from 90 to 94 which means that they had an above average performance in Mathematics while only six (6) or 3 percent of the students had grades from 95 to 100 which means that they had an excellent performance in Mathematics. Most of the students had poor performance in Math which could be due to their less interest and attitude towards the subject. When students are not interested to learn, it may result to a poor performance. Several studies proved that learners' attitude had strong relationship with their academic performance (Parker et al., 2013). On the other hand, self-efficacy in Mathematics was also seen as strong factor of the students' academic performance (Fast et al., 2010; Pampaka et al., 2011; Peteros et al., 2021). Self-efficacy in Mathematics is strongly related to the learners' attitudes towards the subject. Student's attitudes towards Mathematics should be given attention in teaching the subject if one is serious in advancing the performance of the students. This can only be developed in the presence of a healthy environment (Tran, 2012).

Table 5 shows the test on significant differences of the students' attributes based on their learning sessions using two-tailed test for z-test. As to the statistical

Table 4. Performance of the students in math.

Level	Range of Scores	*f*	%
Excellent	95 - 100	6	2.94
Above Average	90 - 94	27	13.24
Average	85 - 89	58	28.43
Fair	80 - 84	36	17.65
Poor	75 - 79	77	37.75
Total		**204**	**100.00**
Average			83.31

Table 5. Significant differences on the students' attributes based on their learning sessions.

Attributes	Source of Difference	Mean	Std. Dev	*p*-value	$Z_{statistics}$	Decision	Result
Attitudes	Day	4.73	1.41	0.197	−1.29	Do not reject Ho	Not Significant
	Night	4.99	1.38				
Self-Efficacy	Day	3.95	1.18	0.514	−0.65	Do not reject Ho	Not Significant
	Night	4.04	0.87				
Learning Environment	Day	4.57	1.43	0.193	−1.30	Do not reject Ho	Not Significant
	Night	4.81	1.31				
Academic Performance in Math	Day	85.49	6.74	0.000	6.66**	Reject Ho	Significant
	Night	80.05	4.72				

**significant at $p < 0.01$ (two-tailed); Critical z-value = ±1.96.

results on the test of differences on students' attributes based in their learning sessions such the attitudes (z = −1.29, $p = 0.197$), self-efficacy (z = −0.65, $p = 0.514$), learning environment (z = −1.30, $p = 0.193$), academic performance (z = 6.66, $p = 0.000$), it is revealed that the three attributes such as the students' attitudes, self-efficacy, and learning environment do not differ among students who enrolled in the two learning sessions. However, the students' academic performance in Mathematics revealed that there is a significant difference on the students' academic performance when grouped according to their learning sessions.

In general, the perceptions of the students from the two learning sessions towards the aforementioned attributes except their performance do not differ. Students may have different schedules in learning Math but it does not affect their attitudes towards the subject. Similarly, the self-efficacy of the students is not affected by their learning sessions. Lastly, the perception of the students towards the influence of their learning environment is not affected by their learning sessions. Attitudes and self-efficacy are innate characteristics of individuals which are not easily affected by the external factors that may affect them. The perception of the students towards the influence of their learning environment is not changed though their learning sessions are different because they enjoy the same facilities and the people that surround them (Ahmed et al., 2018). Students may have different learning sessions towards their classes in Math yet these do not change the attitudes of the learners towards the subject since attitudes can be affected by the students' past experiences with the subject (Mazana et al., 2019). Good experiences of students towards the subject result to positive attitudes while the experiences had opposite results (Hofstein & Mamlok-Naaman, 2011; Jabali, 2018). Students' perception on their self-efficacy towards learning Math is not affected by their learning session because acquiring such schedule is the student's choice, thus, the student feels comfortable with it. That is why when students evaluate themselves on how they perform in the subject, their learning session is not considered. Furthermore, students' perception towards their learning

environment is not affected by their learning session because the facilities and the people that they mingle in school are the same regardless of the time schedule that they are in school. Interestingly, there is a difference in the performance of the students when grouped by their learning sessions. This means that students from day sessions have better performance in math than students from the night sessions. This affirms the teachers' observations that students from the day sessions are more focused with their studies than the students from the night sessions. In addition, there are more distractions when studying at night because there are establishments that open different entertainment activities that could tempt the students to skip their classes.

In general, the students have positive attitudes towards mathematics (Mean = 3.73), have moderately positive self-efficacy (Mean = 3.07), considered the learning environment as influential (Mean = 3.60), and average performance in Mathematics (Mean = 83.31). Moreover, student's attributes are not affected by their learning sessions except for their academic performance in mathematics which exhibits a highly significant difference confirming that students in the day sessions perform better than their counterparts.

5. Conclusion

Based on the findings, evidence shows that students from the day sessions perform better than the night sessions. Although they do not differ in their attitudes, self-efficacy, and the learning environment, the difference in their academic performance is a breakthrough in this study because this can provide a clear idea that students in the day sessions acquire more learning than the students in the night sessions. It is found out in this study that learning session brings significant effect on students' performance in math and could reinforce their learning success when students took advantage of this. Moreover, students have to be given enough freedom to choose in which learning session they enroll in school in order not to compromise their comfort in learning. School administrators and teachers may design programs that would address the gap between the performance of the students enrolling in different learning sessions.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Abramovich, S., Grinshpan, A. Z., & Milligan, D. L. (2019). Teaching Mathematics through Concept Motivation and Action Learning. *Education Research International, 2019,* Article ID: 3745406. https://doi.org/10.1155/2019/3745406

Ahmed, Y., Taha, M. H., Alneel, S., & Gaffar, A. M. (2018). Students' Perception of the Learning Environment and Its Relation to Their Study Year and Performance in Sudan. *International Journal of Medical Education, 9,* 145-150. https://doi.org/10.5116/ijme.5af0.1fee

Aiken, L. R. (2000). *Psychological Testing and Assessment* (10th ed.). Allyn and Bacon.

Alpacion, N. J. D., Camañan, C. T., Gregorio, A. J. L., Panlaan, J. M. R., & Tudy, R. A. (2014). Attitude, Self-Efficacy and Students' Academic Performance in Mathematics. *IAMURE International Journal of Social Sciences, 12,* 21-34. https://ejournals.ph/article.php?id=2368

Anastasios, R. (2020) Study of the Learning Climate and the Feedback That Students Draw in the Mathematics Class. *Open Access Library Journal, 7,* e7029. https://doi.org/10.4236/oalib.1107029

Aquino, A. M. (2009). *Facilitating Human Learning*. Rex Book Store.

Ariola, M. M. (2009). *General Psychology with Drug Education*. Katha Publishing Co., Inc.

Asante, K. O. (2012). Secondary Students' Attitudes towards Mathematics. *IFE PsychologIA, 20,* 121-133. https://hdl.handle.net/10520/EJC38916

Bandura, A., & Locke, E. A. (2003). Negative Self-Efficacy and Goal Effects Revisited. *Journal of Applied Psychology, 88,* 87-99. https://doi.org/10.1037/0021-9010.88.1.87

Bassi, M., Steca, P., Fave, A. D., & Caprara, G. V. (2007). Academic Self-Efficacy Beliefs and Quality of Experience in Learning. *Journal of Youth and Adolescence, 36,* 301-312. https://doi.org/10.1007/s10964-006-9069-y

Blanco, L. J., Barona, E. G., & Carrasco, A. C. (2013). Cognition and Affect in Mathematics Problem Solving with Prospective Teachers. *The Mathematics Enthusiast, 10,* 335-364. https://doi.org/10.54870/1551-3440.1270

Brahier, D. J. (2009). *Teaching Secondary and Middle School Mathematics* (3rd ed.). Bowling Green University, Pearson Merrill Prentice Hall.

Brophy, J. (2010). *Motivating Students to Learn* (3rd ed.). The McGraw-Hill Companies, Inc.

Fast, L. A., Lewis, J. L., Bryant, M. J., Bocian, K. A., Cardullo, R. A., Rettig, M., & Hammond, K. A. (2010). Does Math Self-Efficacy Mediate the Effect of the Perceived Classroom Environment on Standardized Math Test Performance? *Journal of Educational Psychology, 102,* 729-740. https://doi.org/10.1037/a0018863

Fitriati, S. W., Fatmala, D., & Anjaniputra, A. G. (2020). Teachers' Classroom Instruction Reinforcement Strategies in English Language Class. *Journal of Education and Learning (EduLearn), 14,* 599-608. https://doi.org/10.11591/edulearn.v14i4.16414

Gafoor, K. A., & Kurukkan, A. (2015). *Why High School Students Feel Mathematics Difficult? An Exploration of Affective Beliefs*. https://files.eric.ed.gov/fulltext/ED560266.pdf

Gamit, A. D., Antolin, J. A., & Gabriel, A. G. (2017). The Effects of Cooperative Learning in Enhancing the Performance Level of Grade-10 Mathematics Students in Talavera National High School in the Philippines. *Journal of Applied Mathematics and Physics, 5,* 2386-2401. https://doi.org/10.4236/jamp.2017.512195

García-Moya, I, Moreno, C., & Brooks, F. M. (2019). The "Balancing Acts" of Building Positive Relationships with Students: Secondary School Teachers' Perspectives in England and Spain. *Teaching and Teacher Education, 86,* Article ID: 102883. https://doi.org/10.1016/j.tate.2019.102883

Hayat, A. A., Shateri, K., Amini, M., & Shokrpour N. (2020). Relationships between Academic Self-Efficacy, Learning-Related Emotions, and Metacognitive Learning Strategies with Academic Performance in Medical Students: A Structural Equation Model. *BMC Medical Education, 20,* Article No. 76. https://doi.org/10.1186/s12909-020-01995-9

Hayes, A. (2021, October 4). *Stratified Random Sampling*.

https://www.investopedia.com/terms/stratified_random_sampling.asp

Hofstein, A., & Mamlok-Naaman, R. (2011). High-School Students' Attitudes toward and Interest in Learning Chemistry. *Educación Química, 22,* 90-102. https://doi.org/10.1016/S0187-893X(18)30121-6

Jabali, O. (2018). Students' Attitudes towards EFL University Writing: A Case Study at An-Najah National University, Palestine. *Heliyon, 4,* e00896. https://doi.org/10.1016/j.heliyon.2018.e00896

Koh, J. H. L. (2006). Motivating Students of Mixed Efficacy Profiles in Technology Skills Classes: A Case Study. *Instructional Science, 34,* 423-449. https://doi.org/10.1007/s11251-006-0001-3 https://link.springer.com/article/10.1007/s11251-006-0001-3

Li, Y., & Schoenfeld, A. H. (2019). Problematizing Teaching and Learning Mathematics as "Given" in STEM Education. *International Journal of STEM Education, 6,* Article No. 44. https://doi.org/10.1186/s40594-019-0197-9

Mata, M. L., Monteiro, V., & Peixoto, F. (2012). Attitudes towards Mathematics: Effects of Individual, Motivational, and Social Support Factors. *Child Development Research, 2012,* Article ID: 876028. https://doi.org/10.1155/2012/876028

Mazana, M. Y., Montero, C. S., & Casmir, R. O. (2019). Investigating Students' Attitude towards Learning Mathematics. *International Electronic Journal of Mathematics Education, 14,* 207-231. https://doi.org/10.29333/iejme/3997

Mullis, I. V.S., Martin, M. O., & Foy, P. (2005). *IEA's TIMSS 2003 International Report on Achievement in the Mathematics Cognitive Domains*. International Association for the Evaluation of Educational Achievement. http://timssandpirls.bc.edu/PDF/t03_download/T03MCOGDRPT.pdf

Mullis, I. V.S., Martin, M. O., Foy, P., & Arora, A. (2011). *TIMSS 2011 International Results in Mathematics*. https://timssandpirls.bc.edu/timss2011/downloads/t11_ir_mathematics_fullbook.pdf

Mutai, J. K. (2010). *Attitudes towards Learning and Performance in Mathematics among Selected Students in Secondary Schools in Bureti District, Kenya*. Kenyatta University. https://ir-library.ku.ac.ke/bitstream/handle/123456789/609/JACKSON%20KIPRONOH.pdf?sequence=

Nicolaidou, M., & Philippou, G. (2003). *Attitudes towards Mathematics, Self Efficacy and Achievement in Problem-Solving*. University of Cyprus. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.494.2271&rep=rep1&type=pdf

Pampaka, M., Kleanthous, I., Hutcheson, G. D., & Wake, G. (2011). Measuring Mathematics Self-Efficacy as a Learning Outcome. *Research in Mathematics Education, 13,* 169-190. https://doi.org/10.1080/14794802.2011.585828

Parker, P. D., Marsh, H. W., Ciarrochi, J., Marshall, S., & Abduljabbar, A. S. (2013). Juxtaposing Math Self-Eicacy and Self-Concept as Predictors of Longterm Achievement Outcomes. *Educational Psychology, 34,* 29-48. https://doi.org/10.1080/01443410.2013.797339

Peteros, E. D., Cañabano, J. T., Sanchez, D. T., Peconcillo Jr., L. B., Capuno, R. G., Manguilimotan, R. P., Padillo, G. G., Espina, R. C., Pinili, L. C., & Capuno, J. F. C. (2021). Understanding the Effects of Time Management and Self-Efficacy on Math Performance among High School Students Working Part-Time in Cebu, Philippines. *Information Technology in Industry, 9,* 1077-1085. https://doi.org/10.17762/itii.v9i2.455

Peteros, E., Columna, D., Etcuban, J., Almerino Jr., P., & Almerino, J. G. (2019). Attitude and Academic Achievement of High School Students in Mathematics under the Condi-

tional Cash Transfer Program. *International Electronic Journal of Mathematics Education, 14,* 583-597. https://doi.org/10.29333/iejme/5770

Prat-Sala, M., & Redford, P. (2010). The Interplay between Motivation, Self-Efficacy, and Approaches to Studying. *British Journal of Educational Psychology, 80,* 283-305. https://doi.org/10.1348/000709909X480563

Ramírez, M. J. (2005). Attitudes toward Mathematics and Academic Performance among Chilean 8th Graders. *Estudios Pedagógicos, 31,* 97-112. https://doi.org/10.4067/S0718-07052005000100006 https://www.redalyc.org/pdf/1735/173514128006.pdf

Richardson, H. (2018). *Characteristics of a Comparative Research*. https://classroom.synonym.com/characteristics-comparative-research-design-8274567.html

Sanchal, A., & Sharma, S. (2017). Students' Attitudes towards Learning Mathematics: Impact of Teaching in a Sporting Context. *Teachers and Curriculum, 17,* 89-99. https://doi.org/10.15663/tandc.v17i1.151 https://files.eric.ed.gov/fulltext/EJ1149612.pdf

Schunk, D. H., & Pajares, F. (2009). Self-Efficacy Theory. In K. R. Wentzel, & A. Wigfield (Eds.), *Handbook of Motivation at School* (pp. 35-53). Routledge.

Tran, V. D. (2012). Predicting the Attitudes and Self-Esteem of the Grade 9th Lower Secondary School Students towards Mathematics from Their Perceptions of the Classroom Learning Environment. *World Journal of Education, 2,* 34-44. https://doi.org/10.5430/wje.v2n4p34

Usher, E. (2009). Sources of Middle School Students' Self-Efficacy in Mathematics. A Qualitative Investigation. *American Educational Research Journal, 46,* 275-314. https://doi.org/10.3102/0002831208324517 https://motivation.uky.edu/files/2013/08/Usher_2009.pdf

Vancouver, J., & Kendel, L. (2006). When Self-Efficacy Negatively Relates to Motivation and Performance in a Learning Context. *Journal of Applied Psychology, 91,* 1146-1153. https://doi.org/10.1037/0021-9010.91.5.1146

Vukovic, R. K., Kieffer, M. J., Bailey, S. P., & Harari, R. R. (2013). Mathematics Anxiety in Young Children: Concurrent and Longitudinal Associations with Mathematical Performance. *Contemporary Educational Psychology, 38,* 1-10. https://doi.org/10.1016/j.cedpsych.2012.09.001

Yee, L. S. (2010). Mathematics Attitudes and Achievement of Junior College Students in Singapore. In G. Merrilyn, G. Vince, & D. Shelley (Eds.), *Proceedings of the 33rd Annual Meeting of the Mathematics Education Research Group of Australasia* (pp. 681-689). Mathematics Education Research Group of Australasia. https://files.eric.ed.gov/fulltext/ED521019.pdf