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Factors on Memory Retention: Effect to Students' Academic Performance

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Abstract

This paper examined the factors contributory to memory retention affecting the academic performance in Mathematics of Grade 7 students of Kalumbuyan High School, Bayawan City Division for SY 2019–2020. The study made use of the descriptive-correlational research design. The questionnaire covered five areas: motivational practices and experiences, goal setting and accomplishments, personalized learning, teaching strategies and learning activities, and educational resources and learning devices. The respondents of the study were the 160 Grade 7 students. The study utilized percentage, mean, weighted mean, and Spearman's rank correlation coefficient. The salient findings revealed that the extent of students' perception on factors contributory to memory retention were "high" in terms of motivational practices and experiences, goal setting and accomplishments, and personalized learning, while they perceived the use of teaching strategies and learning activities and the utilization of educational resources and learning devices to be "very high". Moreover, the overall academic performance rating of the students in Mathematics is at a fairly satisfactory level. Also, it can be concluded that the extent to which students perceived the factors contributory to memory retention is "very high" and has a moderate and significant relationship to their academic performance in mathematics.

Keywords: Memory retention, Academic performance, Effect, Mathematics

Introduction

Memory retention plays a paramount importance in the academic life of the students. However, students who have a problem in retention may have difficulty in remembering class lectures. They may also have troubles in solving mathematical problems that involve series of steps. In order to solve those problems, they need to access information about math facts from long-term memory while remembering what they have just finished and what they need to do.

Radvansky (2017) defines memory as mental processes which are used to acquire, store, or retrieve information. Its processes are acts of using information in specific ways to make the information available later or to bring that information back into the current stream of processing. According to Wang and Hou (2016), sharing personal memories online facilitates memory retention.

Memory and concentration are being considered as sisters, and in previous researches, it was found out that 10% of students had poor concentration and 46% had average concentration (Lamba et al., 2014, Podila, 2019). Hence, students can hardly memorize without classroom concentration. Even when their concentration is good, it may not be useful without memory. Specifically, enhancing students' motivation in the classroom is an important concern for educators and researchers, due to its relation to students' achievement. The importance of students' memory retention is reflected in the vast amount of related research focusing on the teaching and learning process (Pantziara & Philippou, 2015).

It is in this context that the researcher wants to identify what are the factors that might be contributory to students' memory retention and its effect to academic performance in mathematics. These factors include motivational practices and experiences, goal setting and accomplishments, personalized learning, teaching strategies and learning activities, and educational resources and learning devices.

These factors are being identified through intensive reading of related studies and looking into variables that are effective in other subject areas as well as the one not made mentioned in Mathematics to fill in the gap of existing related literature most especially looking into its effect to students' academic performance. Moreover, these factors

are being considered by the researcher based on her observations and experiences. No previous research was found regarding the relationship between the aforementioned factors and students' academic performance. It is for this reason that the researcher conducted this study for the students to better able to solve mathematical problems and ensure more effective learning by keeping good memory retention skills.

Research Design

The research utilized the descriptive-correlational survey. It is descriptive in the sense that this study gathered information about the factors that are contributory to memory retention aspect and described the nature of the situation. It is also correlational because this study determined the relationship of variables such as extent of students' perception on the contributory factors to memory retention and students' extent of perception and their academic performance.

Research Environment

The study was conducted in Barangay Kalumboyan, Bayawan City. The said barangay is 21 kilometers away from the city. The study would specifically focus on the secondary school of Kalumboyan. Kalumboyan High School is one of the big schools within the Division of Bayawan City. The classrooms are well-ventilated and have basic facilities such as water supply and electrical connection. Moreover, they have laboratories with laboratory equipment and computer laboratory with internet connections.

Research Respondents

The respondents of the study were the Grade 7 students of Kalumboyan High School. Of the 255 total population, only 160 were the representatives. These students were chosen through systematic random sampling wherein every second of the list was part of the respondents.

Research Instruments

The study utilized researcher-made questionnaire which is an amalgamation of the modified standardized questionnaires combined with the researcher's readings from the related literature and studies. The whole questionnaire was presented to three experts in the field of Mathematics for content validity and cross checking if the items are aligned with the specific problems of the study.

A dry run was conducted to ensure item reliability. There were 30 selected students who served as the respondents. Through Cronbach's alpha test, the items were tested for its reliability. This test is considered as the most suitable type for survey research where items were not scored right or wrong and where each item could have different answers (McMillan and Schumacher, 2010). A value of 0.70 is considered acceptable, and higher values of alpha are more desirable. The results were the following: 0.738 for motivational practices and experiences, 0.864 for goal setting and accomplishments, 0.703 for personalized learning, 0.716 for teaching strategies and learning activities, and 0.701 for educational resources and learning devices. This implies that all of these found in the test were considered reliable since 0.70 is the cut-off rating.

Research Procedure

The researcher integrated all the corrections and suggestions of the panel members after the design hearing. A letter of request to conduct the study was sent to the Schools Division Superintendent of Bayawan City and District Supervisor (PSDS) upon the endorsement of the Vice Chancellor for Academic Affairs of Foundation University. Then, the signed and approved request was presented to the school principal and respective advisers as well as subject teachers of the students. During the distribution, the researcher explained to the students the purpose and importance of the research as well as the questionnaire itself. The students who served as the respondents were asked if they are willing to participate in the study and were also informed that the answered questions will not be revealed to anyone and that it will be safely kept for confidentiality. The retrieval of the questionnaires was done right after the students have answered the questions. The results were tallied using MS Excel and Megastat software, analyzed, and interpreted.

Findings

Table 1.1 Extent of Students' Perception on Motivational Practices and Experiences

Indicators	$w\bar{x}$	Verbal Description	Extent of Perception
1. I participate in the given learning activities.	4.42	Strongly Agree	Very High

2.	I answer given tests and accomplish my assignments.	4.33	Strongly Agree	Very High
3.	I enjoy the teaching strategies employed by the teacher.	4.32	Strongly Agree	Very High
4.	I communicate with my peers in collaborative group activities.	4.31	Strongly Agree	Very High
5.	I demonstrate awareness with the lesson objectives.	4.27	Strongly Agree	Very High
6.	I engage myself in class discussion and motivational strategies.	4.13	Agree	High
7.	I solve assigned tasks like word problems.	4.03	Agree	High
8.	I listen to my classmates on the experiences they shared.	4.03	Agree	High
9.	I connect presented concepts to real-life setting.	3.95	Agree	High
10.	I ask questions and clarifications for different concepts.	3.48	Agree	High
Composite		4.13	Agree	High

Legend:	Scale	Verbal Description	Extent of Perception
	4.21–5.00	Strongly Agree	Very High
	3.41–4.20	Agree	High
	2.61–3.40	Moderately Agree	Moderate
	1.81–2.60	Disagree	Low
	1.00–1.80	Strongly Disagree	Very Low

The extent of students' perception in motivational practices and experiences is presented in Table 1.1. As depicted in the table, the extent of students' perception on motivational practices and experiences is high as reflected in the composite mean of 4.13.

Item number 1, "I participate in the given learning activities," obtained the highest weighted mean of 4.42 verbally interpreted as "very high" extent of motivational practices. This means that students foster active participation in given class activities during learning sessions. Similar result also surfaced in the study of Field (2018) which pointed out that students are more likely to engage in learning when they can relate with the activities, procedures, and processes. In affirmation, Curtis (2012) supports this idea, putting emphasis on how instructional practices should take place in important context so that students could share something in the conduct of learning activities demonstrating their ownership of learning in the quest of knowledge.

Meanwhile, items on task assignments accomplished, teaching strategies used, and collaborative group activities implemented obtained the next highest weighted means of 4.33, 4.32, and 4.31, respectively. It could be implied that, of particular importance, teaching strategies, learning activities alongside lesson objectives, and tasks accomplishments have all shown to influence students' engagement. On the other hand, the item which obtained the least weighted mean is item number 10 on asking questions and clarifications on different concepts. It implies that students demonstrate inhibitions in asking teachers or peers for better lesson conceptualization. Teachers are supposed to create a non-threatening atmosphere, where every student is motivated to actively participate and exchange or even challenge others' views. In the words of Field (2018), motivational practices and experiences are important for academic success. This premise also put emphasis on how teachers should consider the practices that support students' experiences and encourage them to be motivated. In general, student motivation served as one of the significant factors playing a vital role for memory retention.

Table 1.2 Extent of Students' Perception on Goal Setting and Accomplishment

Indicators	$w\bar{x}$	Verbal Description	Extent of Perception
1. I participate in the activities needed for the goal accomplishment.	4.31	Strongly Agree	Very High
2. I demonstrate awareness on the things I must achieve and develop.	4.19	Agree	High
3. I review and reflect on the processes for goal achievement.	4.13	Agree	High
4. I utilize strategies and techniques to accomplish the objectives.	4.11	Agree	High

5. I take part in setting the learning goals and objectives.	4.09	Agree	High
6. I use self-evaluation to know that set goals have been accomplished.	4.08	Agree	High
7. I employ in my practices the values I develop.	4.04	Agree	High
8. I monitor the progress I attain in the given lesson.	3.97	Agree	High
9. I establish enhancement activities that paved way for goal manifestation.	3.93	Agree	High
10. I see connection between the goals and its implications.	3.86	Agree	High
Composite	4.07	Agree	High
Legend:	Scale	Verbal Description	Extent of Perception
	4.21–5.00	Strongly Agree	Very High
	3.41–4.20	Agree	High
	2.61–3.40	Moderately Agree	Moderate
	1.81–2.60	Disagree	Low
	1.00–1.80	Strongly Disagree	Very Low

Table 1.2 shows the extent of students' perceptions on goal setting and accomplishment considered as another factor of memory retention. This area has an overall composite mean of 4.07 verbally translated as "high" extent.

Item number 1, "I participate in the activities needed in goal accomplishment," obtained the highest weighted mean of 4.31 interpreted as "very high." This means that students actively take involvement in different activities that could contribute to attain the lessons' goals and objectives. In support, Susak (2016) noted that participation allows students to build knowledge, demonstrate skills, develop confidence, and apply theory into practice. Moreover, items on demonstrating awareness, reflecting on processes, and utilizing teachings strategies and techniques obtained the next highest weighted means of 4.19, 4.13, and 4.11, respectively, all denoting verbal equivalent of "high" extent. This runs parallel to the findings of Abe et al. (2014), Zohud (2015), and Francis (2017) on the conduct of learning activities and the utilization of teaching strategies and techniques to better support inclusionary education as well as enhance student motivation leading to memory retention.

On the other hand, item on seeing connection between the goals and its implications is interpreted as "high" with a weighted mean of 3.86. This signifies the need for students to establish connection between goals and its implications through real-life applications. Hunt (2015) also indicated the importance of setting specific and challenging goals to establish connection between goals and real-world connections.

In general, in the extent of students' perception on goal setting and accomplishment, students agree on the use of learning activities, utilization of teaching strategies, and reflecting on classroom processes among others as essential components playing vital roles for memory retention and paving to higher test scores. In this regard, it has been emphasized how goal setting has the potential to positively impact learning through teachers and students' clear understanding of specific targets (Bray & Mc Claskey, 2015; Dotson, 2016; Curtis, 2017, Comighud, 2019; Comighud & Arevalo, 2020).

Table 1.3 Extent of Students' Perception on Personalized Learning

	Indicators	$w\bar{x}$	Verbal Description	Extent of Perception
1.	I am responsible and in control with my own learning.	4.38	Strongly Agree	Very High
2.	I work well at my own pace in different activities.	4.36	Strongly Agree	Very High
3.	I participate well in hands-on and motivational strategies.	4.35	Strongly Agree	Very High
4.	I demonstrate excitement when the lessons suit my interest.	4.28	Strongly Agree	Very High
5.	I join activities that motivate me well.	4.27	Strongly Agree	Very High
6.	I engage myself in exploration and discoveries.	4.26	Strongly Agree	Very High
7.	I work with activities needed to be individually accomplished.	4.15	Agree	High
8.	I use own techniques in solving set of problems.	3.99	Agree	High

9. I express my views and activities that address my needs.	3.93	Agree	High
10. I make choices depending on my strengths and weaknesses.	3.84	Agree	High
Composite	4.18	Agree	High

Legend:	Scale	Verbal Description	Extent of Perception
	4.21–5.00	Strongly Agree	Very High
	3.41–4.20	Agree	High
	2.61–3.40	Moderately Agree	Moderate
	1.81–2.60	Disagree	Low
	1.00–1.80	Strongly Disagree	Very Low

As indicated in Table 1.3, the extent of students’ perceptions on personalized learning obtains composite mean of 4.18 verbally interpreted as “high.”

Item number 1, “I am responsible and in control with my own learning,” obtained the highest weighted mean of 4.38 verbally interpreted a “very high” extent. This means that students retain information presented better if they are practicing personalized learning. As students demonstrate personalized learning, they are likely to develop mastery through their own choices. In line with this, it is suggested for students to write learning goals of what they already know which serves as action plan that students strive for and realize accomplishments along the way (Fernchild, 2013; Pipkin, 2015; Comighud, 2019).

In addition, the items which obtained the next highest weighted means deal with working well with one’s own pace in different activities, demonstrating excitement when lessons suit one’s interests, and engaging oneself in exploration and discoveries. In support to this, students generally felt autonomous, competent, and related in their personalized learning environments, which contributed to their intrinsic motivation, engagement, and well-being within these settings (Netcoh, 2017) through tailoring to their specific needs and interests (Huchens, 2014).

Also, the shift to personalization encourages educators to be open and flexible, so that learners become more invested in the design of their own learning path (Bray & Mc Claskey, 2015). Personalized learning requires more than a shift in thinking; it requires bringing in modern technology. Hence, developing evidence that student-centered learning promotes higher-order skills like critical thinking and problem solving, there are difficulties insupporting students to successfully complete activities. Further, Grant and Basye (2014) found that personalized learning is an incitement for educators to construct opportunities.

In general, as to the aspect of personalized learning, students are pushed from one content to another and one grade to another in a linear step-by-step process (Zmuda, Ullman, & Curtis, 2015). Our students need to invest in their own learning and passions. This paradigm shift takes the state- and teacher-prescribed educational plan and transfers the actions to the learner. When students take charge of personalizing their own learning, they dictate their pacing for instructional needs and utilize multiple methods and strategies to meet their own learning (Bray & Mc Claskey, 2015; Comighud & Arevalo, 2020).

Table 1.4 Extent of Students’ Perception on Teaching Strategies and Learning Activities

Indicators	$w\bar{x}$	Verbal Description	Extent of Perception
1. My teacher employs strategies that developed learners’ numeracy.	4.49	Strongly Agree	Very High
2. My teacher employs interesting activities that encourage me to participate in the classes.	4.41	Strongly Agree	Very High
3. My teacher applies strategies that develop critical and creative thinking skills.	4.39	Strongly Agree	Very High
4. My teacher encourages me to ask questions and clarifications on the concepts presented.	4.38	Strongly Agree	Very High
5. My teacher uses strategies that enhance learners’ achievement.	4.36	Strongly Agree	Very High
6. My teacher relates the lesson in real-life situations and practices.	4.35	Strongly Agree	Very High

7. My teacher applies knowledge of content within and across curriculum teaching areas.	4.34	Strongly Agree	Very High
8. My teacher assists and supports me to attain development and progress.	4.33	Strongly Agree	Very High
9. My teacher allows me to collaborate with my peers to help me learn better.	4.33	Strongly Agree	Very High
10. My teacher utilizes strategies that promote higher-order thinking abilities.	4.26	Strongly Agree	Very High
Composite	4.36	Strongly Agree	Very High

Legend:	Scale	Verbal Description	Extent of Perception
	4.21–5.00	Strongly Agree	Very High
	3.41–4.20	Agree	High
	2.61–3.40	Moderately Agree	Moderate
	1.81–2.60	Disagree	Low
	1.00–1.80	Strongly Disagree	Very Low

As shown in Table 1.4, the extent of students' perceptions on classroom teaching strategies and learning activities resorted to an overall composite mean of 4.36 which indicated that they strongly agreed with all of the items, thereby translated into "very high" extent in its verbal equivalent.

Further, findings reveal that the use of teaching strategies which involve the development of learners' numeracy as well as critical and creative skills that enhance learners' achievement all contributes to better student engagement and higher memory retention rate. This pertains to the vital element on building strong foundation in strengthening learners' ability. Hence, the findings of this study affirms the recommendations of Angeles (2018) that in this millennial era where individual differences are displayed by the learners, teachers are encouraged to implement varied techniques, methods, and approaches in order to advance student learning through the development of creative and critical thinking skills.

In addition to the previously mentioned, empirical evidence to well-established theory on the multidimensional nature of teaching and student learning has also been taken into consideration (Blazar, 2016). Over the past decade, research has confirmed that teachers have substantial impacts on their students' academic and lifelong success (Chetty, Friedman, & Rockoff, 2014; Jackson, 2012). Recent investigations also have uncovered some characteristics of effective classroom environments, including teachers' organizational skills and interactions with students (Loeb, Cohen, & Wyckoff, 2015; McCaffrey, Miller, & Staiger, 2015).

As to learning activities, the crucial tasks of fostering developmentally sequenced teaching and learning processes encourage teachers to be mindful of effective instructional planning which also includes successfully managing and implementing lessons. In affirmation, Marco-Bujosa and Levy (2016) shared the findings that teachers utilize the curriculum in many different ways for diverse reasons, and manifestations should be made to achieve the learning goals. Also, Kulasegaram and Rangachari (2017) indicated how learning depends on context, the application of developmentally sequenced process decided by the teachers and the learners' interactions in a set framework.

Table 1.5 Extent of Students' Perception on Educational Resources and Learning Devices

Indicators	$w\bar{x}$	Verbal Description	Extent of Perception
1. The school has a library with accessible resources.	4.63	Strongly Agree	Very High
2. The school has laboratory equipment like computers.	4.63	Strongly Agree	Very High
3. The teacher uses books for references.	4.56	Strongly Agree	Very High
4. The teacher utilizes materials like learning workbooks.	4.44	Strongly Agree	Very High
5. The teacher utilizes educational television.	4.44	Strongly Agree	Very High
6. The teacher employs realia to integrate real-life concepts.	4.36	Strongly Agree	Very High
7. The teacher utilizes PowerPoint presentation in the delivery of the lesson.	4.32	Strongly Agree	Very High
8. The school has mathematics subject center.	4.29	Strongly Agree	Very High

9. The teacher uses videos to deepen the concept understanding.	4.27	Strongly Agree	Very High
10. The teacher uses ICT resources to present given mathematical concepts.	4.23	Strongly Agree	Very High
Composite	4.42	Strongly Agree	Very High

Legend:	Scale	Verbal Description	Extent of Perception
	4.21–5.00	Strongly Agree	Very High
	3.41–4.20	Agree	High
	2.61–3.40	Moderately Agree	Moderate
	1.81–2.60	Disagree	Low
	1.00–1.80	Strongly Disagree	Very Low

Table 1.5 indicates the extent of students' perception on educational resources and learning devices. It depicts the extent of students' perceptions on educational resources where an overall composite mean of 4.42 is verbally interpreted as "very high" extent. This means that educational resources have been seen a recent widespread integration into daily life, where access to vast amounts of information is now available with ease. Today's generation of students has grown up with educational resources all around them in an ever-increasing manner. In addition, to create an effective 21st century classroom that meets the needs of the students, a modern teacher must factor student's motivation to learn and the effects technology has on inclusionary education (Francis, 2017). In line with this, updating teaching techniques better support inclusionary education, enhance student motivation, and improve memory retention.

Among the indicators, item on the availability of school library with accessible resources, laboratory equipment with computers, and use of books as references among others obtained the highest weighted means of 4.63, 4.63, and 4.56 all resorted to "very high" extent in their corresponding verbal equivalent. It means that in the modern information era, the wealth of the world's information can be accessed through a variety of educational resources and learning devices. Students have grown up with technology all around them, and teachers must adapt to these new ways of learning. Francis (2017) contends that teachers adapting to these new ways find methods of incorporating and utilizing these new forms of technology in class both in motivational and instructional levels. Hence, students who find themselves supported with ways of which they are used to will be more motivated to learn and feel included.

Moreover, the students of today are surrounded by technology, where access to an adequate collection of information is only a fingertip away. Technology supports the need for divergent learning approaches, helping to create a sense of community as well as a meaningful experience. Appropriate use of technology can serve the regular education classroom by motivating students in all disciplines like mathematics (Liu et al., 2016; Housand & Housand, 2012; Francis, 2013; Francis, 2017).

Table 1.6 Summary Table on the Extent of Students' Perception on Factors Contributory to Memory Retention

Variables Correlated to Students' Academic Performance	$w\bar{x}$	Verbal Description	Extent of Perception
1. Motivational practices and experiences	4.13	Agree	High
2. Goal setting and accomplishment	4.07	Agree	High
3. Personalized learning	4.18	Agree	High
4. Teaching strategies and learning activities	4.36	Strongly Agree	Very High
5. Educational resources and learning devices	4.42	Strongly Agree	Very High
Overall	4.23	Strongly Agree	Very High

Legend:	Scale	Verbal Description	Extent of Perception
	4.21–5.00	Strongly Agree	Very High
	3.41–4.20	Agree	High
	2.61–3.40	Moderately Agree	Moderate
	1.81–2.60	Disagree	Low
	1.00–1.80	Strongly Disagree	Very Low

Table 1.6 displays the extent of students' perceptions on factors contributory to memory retention. Among the given variables, teaching strategies and learning activities as well as educational resources and learning devices obtained the highest weighted means of 4.36 and 4.42, respectively. This shows that the learners strongly agree that teachers' teaching strategies and learning activities as well as educational resources and learning devices greatly influence their ability to recall information. This result conforms to Bray (2012), who emphasized that when students are given the responsibility to take charge of their own learning, the better is the degree of their understanding and mastery of the concepts learned.

Foremost, as to learning activities, literature supports made mention on how recent years have seen an upsurge of interest in learner-centeredness which has marked a paradigm shift in the world of education (Quinonez, 2014). Taking into account, learner characteristics, engaging students in the learning process, and promoting collaboration among students have been brought into the forefront. Keeping in sight the rising popularity of learning, comprehending what it encompasses appear to be of high significance (Ross, 2017; Kosar & Bedir, 2018).

Additionally, Blazer's (2011) ideas on Mathematical discourse in the classroom were used to facilitate students' deeper understanding of the material. Mathematics should have high interest appeal as it offers learners a challenge, the opportunity to choose strategies, pose questions, use logic, and interpret conclusions. As to the use of educational resources, with mathematics becoming more important in the growing technological world, teachers need to focus on how to create school environments that are more Mathematics friendly (Taylor, 2018).

Furthermore, items on motivational practices and experiences, goal setting and accomplishments, and personalized learning are among the indicators which obtained "high" extent of students' perceptions on factors contributory to memory retention. As to motivational practices, Vibulphol (2016) contends that while autonomy controlling strategies were commonly used in these classes, autonomy-support strategies were found only in highly motivated and high-performing classrooms.

With regard to goal setting and accomplishment, Dotson (2016) put emphasis that goal setting should serve as the process of establishing a direction for learning. In view thereof, it is recommended for students to develop a plan of action. Simply writing down a goal does not impact student learning. It is the activities that the student will participate in during the learning process that have the potential to positively influence student achievement. In collaboration with the teacher, the student will need to brainstorm different possibilities beyond core instruction that could increase achievement. Additionally, as student ownership is a critical piece in goal setting, progress monitoring provides a system to ensure that students value and own their learning. And as to personalized learning, Ramos (2015) revealed that the students exposed to the personalized learning environment had more positive perceptions.

Table 2 Performance of the Students in Mathematics

Rating	Verbal Description	Frequency	Percent
90%–100%	Outstanding	5	3.12
85%–89%	Very Satisfactory	14	8.75
80%–84%	Satisfactory	38	23.75
75%–79%	Fairly Satisfactory	103	64.38
Below 75%	Did Not Meet Expectations		
Total		160	100
Average	79.05 (Fairly Satisfactory)		
Sd	4.25		

Table 2 shows the performance of the students in Mathematics where the respondents of the study obtained an average of 79.05 verbally interpreted as fairly satisfactory. A closer look on the data presented would reveal that 5 or 3.12% of the students got outstanding rating and 14 or 8.75% were at very satisfactory level, while 38 or 23.75% garnered satisfactory rating and 103 or 64.38% were at fairly satisfactory level. Based on the findings, it could be inferred that majority of the students are at fairly satisfactory level in their performance in mathematics.

Based on DO No. 8, s. of 2015, the Policy Guidelines on Classroom Assessment for the K to 12 Basic Education Program, classroom assessment is an integral part of curriculum implementation which allows teachers to track and measure learners' progress and to adjust instruction accordingly. Also, based on the current findings, the students obtained a fairly satisfactory verbal equivalent which means that students on average got a rating of 79.05. Hence, teachers and students are encouraged to work together to increase students' academic performance in mathematics considering more factors of memory retention.

Table 3 Relationship between the Profile of the Students and the Extent to which They Perceived the Factors Contributory to Memory Retention

Factors	Comp. Value	p-value	Decision	Remark
1. Motivational practices and experiences				
Age	$r_s = 0.111$	0.161	Do not reject H_{01}	Not significant
Sex	$\chi^2 = 21.07$ Male: $w\bar{x} = 4.08$ Female: $w\bar{x} = 4.57$	0.000	Reject H_{01}	Significant
Income	$r_s = 0.138$	0.082	Do not reject H_{01}	Not significant
2. Goal setting and accomplishments				
Age	$r_s = 0.097$	0.224	Do not reject H_{01}	Not significant
Sex	$\chi^2 = 23.58$ Male: $w\bar{x} = 3.98$ Female: $w\bar{x} = 4.49$	0.000	Reject H_{01}	Significant
Income	$r_s = 0.147$	0.064	Do not reject H_{01}	Not significant
3. Personalized learning				
Age	$r_s = 0.101$	0.206	Do not reject H_{01}	Not significant
Sex	$\chi^2 = 20.30$ Male: $w\bar{x} = 4.14$ Female: $w\bar{x} = 4.61$	0.000	Reject H_{01}	Significant
Income	$r_s = 0.205$	0.009	Reject H_{01}	Significant
4. Classroom teaching strategies and learning activities				
Age	$r_s = 0.145$	0.059	Do not reject H_{01}	Not significant
Sex	$\chi^2 = 7.06$ Male: $w\bar{x} = 4.47$ Female: $w\bar{x} = 4.71$	0.029	Reject H_{01}	Significant
Income	$r_s = 0.123$	0.123	Do not reject H_{01}	Not significant
5. Educational resources and learning devices				
Age	$r_s = 0.081$	0.305	Do not reject H_{01}	Not significant
Sex	$\chi^2 = 3.04$	0.081	Do not reject H_{01}	Not significant
Income	$r_s = 0.007$	0.928	Do not reject H_{01}	Not significant

Level of significance = 0.05

2009)	Legend:	Value of r	Strength of Relationship (Statistical Correlation,
		Between ± 0.50 and ± 1.00	\pm strong relationship
		Between ± 0.30 and ± 0.49	\pm moderate relationship
		Between ± 0.10 and ± 0.29	\pm weak relationship
		Between ± 0.01 and ± 0.09	\pm very weak relationship

Table 3 presents the data on the relationship between the profile of the students and the extent to which they perceived the different factors contributory to memory retention. Their perceptions are based on their participation and what occurred in the classroom.

In terms of age, all p-values are greater than the level of significance (0.05). This finding will not warrant rejection of the null hypothesis. This means that there is no significant relationship between the age of the students and the 5 factors contributory to memory retention. This may imply that regardless of age, students may have the same level of memory retention. The said finding is in consonance to the study of Catinas (2017) revealing no significant relationship between the age of students and factors contributing to memory retention rate. However, it negates the findings of the study of Navarro, Rubio, and Olivares (2015) which states that the differences in the

experiences and maturation of older students involve a relatively better performance in academic settings, which is known as the relative age effect.

Considering the sex of the students, the p-values in the following factors are less than the level of significance (0.05): (a) motivational practices and experiences, (b) goal setting and accomplishments, (c) personalized learning, and (d) classroom teaching strategies and learning activities. This finding allows rejection of the null hypothesis. This means that a relationship exists between the sex of the students and the aforementioned factors. Based on the values of the weighted means, results indicate that female students have higher perceptions on (a) motivational practices and experiences, (b) goal setting and accomplishments, (c) personalized learning, and (d) classroom teaching strategies and learning activities than male students. Since their perceptions are based on their participation or experiences in school, this signifies that female students participate more than male students on activities that are contributory to memory retention.

In support to the findings shown in the table, Becirovic (2017) revealed that in his study, the results demonstrate a statistically significant relationship between sex and motivation where female students are more successful at than male students at each group/grade level. Also, as to goal setting, the findings showed that there is a significant sex difference in students' memory retention rate with female participants recording a higher mean score than males. Moreover, as to personalized learning, the findings run parallel to the results showed where female students used metacognition more than male students in both math and social studies and that male and female students both adopt a domain-general approach to metacognition, meaning they use the same skills to help them learn in both school subjects. It was also found that male and female students are both motivated to learn in math and social studies. Specifically, in math, males and females both believed that they could enhance their abilities through time and effort. These results suggest that female students are more likely than male students to use metacognitive skills to help them learn across school subjects and that male and female students are usually motivated to the same degree, except female students are higher in engagement and ability beliefs than male students (Jenkins, 2018).

With regard to family monthly income, it is only in the area of personalized learning that a relationship exists ($p = 0.009 < \alpha = 0.05$). This means that students with higher family monthly income tend to practice better personalized learning than those with lower family monthly income. This further implies that those students who came from family with high earnings could more likely be provided with basic educational needs and could purchase more supplemental resources working well with their own pace suiting into their interest (Hiuchens, 2014).

Table 4 Relationship between the Extent to which Students Perceived the Factors Contributory to Memory Retention and Their Academic Performance

Variables Correlated to Students' Academic Performance	Comp. r _s	p-value	Decision	Remark
1. Motivational practices and experiences	0.300	0.000	Reject H ₀₂	Significant
2. Goal setting and accomplishments	0.301	0.000	Reject H ₀₂	Significant
3. Personalized learning	0.344	0.000	Reject H ₀₂	Significant
4. Classroom teaching strategies and learning activities	0.317	0.000	Reject H ₀₂	Significant
5. Educational resources	0.021	0.795	Do not reject H ₀₂	Not significant
Overall	0.340	0.000	Reject H₀₂	Significant

Level of significance = 0.05

2009)	Legend:	Value of r	Strength of Relationship (Statistical Correlation,
		Between ± 0.50 and ± 1.00	± strong relationship
		Between ± 0.30 and ± 0.49	± moderate relationship
		Between ± 0.10 and ± 0.29	± weak relationship
		Between ± 0.01 and ± 0.09	± very weak relationship

Table 4 indicates that the following factors are moderately and significantly related to the students' academic performance: (a) motivational practices and experiences, (b) goal setting and accomplishments, (c) personalized learning, and (d) classroom teaching strategies and learning activities (p -values $< \alpha = 0.05$). This implies that the higher the perceptions (based on their participation/experiences) of the students, on the mentioned factors, the better is their academic performance in math.

Foremost, as to motivational practices and experiences, this finding corroborates that of Arulmoly and Arulmoly (2017) who stressed that successful students have significant higher motivation for achievement than unsuccessful students. In similar way, the study reveals how academic achievement is highly correlated with student's motivation which lends a good support to the present findings. Learning mathematics can be arduous but motivation can energize children to invest the effort and utilize the strategies necessary to be successful (Froiland, Oros, Smith, and Hirschert, 2012 ; Comighud & Arevalo, 2020). Many researchers have also revealed that in mathematics education, student motivation plays a key role, and mathematical achievement is related to both intrinsic and extrinsic motivational factors. Also, motivation leads to high self-esteem, indicating a clear predictor of students' academic performance in mathematics. In addition, a study by Güvendir (2013) found that students should have high motivation in order to achieve a high standard of mathematical education. The findings of Phuntsho (2017) also indicated that students' motivation toward learning mathematics was mostly influenced by reinforcements, and a significant difference in the students' motivation toward learning mathematics was also observed that ultimately determined students' academic achievement results.

Secondly, as to goal setting and accomplishment, the finding corroborated with that of Abe et al. (2013) stating that goal-setting intervention was recommended as a strategy to enhance students' academic performance. Moreover, Dotson (2016) noted that goal setting also establishes a direction for learning can increase student motivation and higher academic achievement. In the same manner, Clift (2015) in her study combined two separate activities into a single intervention.

Thirdly, in drawing the relationship between personalized learning and students' academic achievement in mathematics, students' choice is considered to have a similar set of benefits to those associated with personalized learning. In particular, by empowering students to exercise a degree of autonomous decision making, students' choice makes students active participants in their educations, thereby increasing levels of engagement (Hanover Research, 2014). Notably, researchers highlight the fact that such autonomy is generally associated with greater personal well-being and satisfaction in educational environments, as well as in terms of academic performance. Studies have found that students given a degree of choice about their learning showed improvement on standardized tests (Wolf, 2010; Patrick et al. 2013, Hanover Research, 2014). Moreover, the results of the study of Sereno (2018) confirmed previous findings which had indicated the use of personalized learning practices which also supported previous research which indicate that high-quality teacher professional development supports teachers' implementation of personalized learning practices leading to higher students' academic achievement

Fourthly, in teaching strategies and its relationship with students' academic performance in mathematics, Blazar (2016) contends that teachers through the teaching strategies they used in classroom processes have large effects on a range of students' attitudes and behaviors in addition to their academic performance. These teacher effect estimates have moderate to strong predictive validity. Further, student outcomes are predicted by teaching practices most proximal to these measures (e.g., between teachers' math errors and students' math achievement and between teachers' classroom organization and students' behavior in class) all leading to increase memory retention. Hence, over the past decade, research has confirmed that teachers have substantial impacts on their students' academic and lifelong success (Chetty, Friedman, & Rockoff, 2014; Jackson, 2012). Recent investigations also have uncovered some characteristics of effective classroom environments, including teachers' organizational skills and interactions with students (Loeb, Cohen, & Wyckoff, 2015; McCaffrey, Miller, & Staiger, 2013).

In addition, having good strategies of reinforcement can attract the attention and boost the interest of the students in learning. Hence, it is important that teacher must make instruction interesting using various strategies and materials. That way, it will make the learning of mathematics not only interesting but also engaging and motivating and investigative and adventurous. Also, in the study of Clift (2015), the results provide statistical evidence in support of the inclusion of teaching strategies and learning activities into instructional routines to improve academic achievement. Further, it has been indicated that expanding mathematics practice for enrichment on a computer and setting different goals for individual student had a positive impact on student achievement.

Finally, as to the relationship between educational resources and the students' academic achievement, it is regarded that students of today are surrounded by technology, where access to a vast collection of information is only a fingertip away. Many in the field of pedagogy state that technology integration is helpful, meaningful, and necessary for a school to function successfully. Appropriate use of educational resources and learning devices can serve the

regular education classroom by motivating students (Housand&Housand, 2012; Francis, 2013; Liu, 2016; Francis, 2017).

Generally, the students' perception on the different factors is very high, and their overall academic performance is in fairly satisfactory level. It implies that students with higher perceptions on the different factors tend to obtain better academic performance than those students with lower perceptions. Students' perception is based on their participation or experiences, and having high perception indicates better engagement to the lesson. Hence, this results to better academic performance.

On the other hand, there are some other factors that could contribute to their academic performance. It could be the subject itself as some students claimed that mathematics is difficult (complex), scary, and not enjoyable to learn (Hayati & Ulya, 2019).

Conclusions

Based on the findings of the study, the following conclusions are hereby drawn:

1. The extent of students' perception on factors contributory to memory retention is "high" in terms of (a) motivational practices and experiences, (b) goal setting and accomplishment, and (c) personalized learning. Likewise, it is "very high" in terms of (a) teaching strategies and learning activities and (b) educational resources and learning devices.
2. The academic performance of the students is in the fairly satisfactory level.
3. There is a significant relationship between the following:
 - (a) Sex of the students and the following factors contributory to memory retention: (i) motivational practices and experiences, (ii) goal setting and accomplishment, (iii) personalized learning, and (iv) teaching strategies and learning devices. The results are in favor of the female students.
 - (b) Family monthly income of the students and personalized learning in favor of the higher income.
4. There is a significant and moderate relationship between the following factors and students' academic performance: (a) motivational practices and experiences, (b) goal setting and accomplishment, (c) personalized learning, and (d) teaching strategies and learning activities.

In general, it can be concluded that the extent to which students perceived the factors contributory to memory retention is "very high" and has a moderate and significant relationship to the academic performance in mathematics.

Recommendations

In light of the conclusions drawn, the researcher arrived to the following recommendations:

1. Teachers are encouraged to increase the use of motivational strategies, goal setting practices, personalized learning techniques, teaching strategies, learning activities, and educational resources in the conduct of teaching-learning process to facilitate instructional process and enhance learners' achievement.
2. The utilization of motivational practices and experiences, goal setting and accomplishments, personalized learning, teaching strategies and learning activities, as well as educational resources and learning devices may be strengthened in the delivery of classroom instruction to increase memory retention.
3. The results of this study may be further incorporated in peer professional discussions like Learning Action Cell (LAC) sessions to develop awareness among teacher-educators and incorporate its practice in classroom instruction.
4. For the future researchers, similar studies may be conducted to a wider scope using increased samples or an entire population to promote generalizability of the results. It is also advised to utilize qualitative data collection and examine more variables for a much more comprehensive output.

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Appendix

Questionnaire

Factors on Memory Retention: Effect to Students' Academic Performance in Mathematics

This questionnaire aims to identify the factors which are contributory to memory retention affecting students' academic performance in mathematics. Kindly answer the following questions honestly. It is assured that the information you share will be treated with utmost confidentiality observing the ethical standards of research. Thank you so much for your time and cooperation.

Part I:

Name: _____

Age: _____ Family Monthly Income: _____

Gender: Male Female

Part II:

Direction: 1. Read each statement. Please respond truthfully as you can.

2. Place a check mark (/) on the column of your choice. Be guided by the following scale.

Verbal Description	Scale	Explanations
Strongly Agree (SA)	4.21–5.00	The feeling/behavior is felt/manifested by the students 81%–100% of the time.
Agree (A)	3.41–4.20	The feeling/behavior is felt/manifested by the students 61%–80% of the time.
Moderately Agree (MA)	2.61–3.40	The feeling/behavior is felt/manifested by the students 41%–60% of the time.
Disagree (D)	1.81–2.60	The feeling/behavior is felt/manifested by the students 76%–100% of the time.
Strongly Disagree (SD)	1.00–1.80	The feeling/behavior is felt/manifested by the student's 76%–100% of the time.

	Strongly Agree (5)	Agree (4)	Moderately Agree (3)	Disagree (2)	Strongly Disagree (1)
Motivational Practices and Experiences					
1. I demonstrate awareness with the lesson objectives.					
2. I enjoy the teaching strategies employed by the teacher.					
3. I engage myself in class discussion and motivational strategies.					
4. I participate in the given learning activities.					
5. I ask questions and clarifications for different concepts.					
6. I solve assigned tasks like word problems.					
7. I communicate with my peers in collaborative group activities.					
8. I listen to my classmates on the experiences they shared.					
9. I connect presented concepts to real-life setting.					
10. I answer given tests and accomplish my assignments.					
Goal Setting and Accomplishments					
1. I take part in setting the learning goals and objectives.					
2. I utilize strategies and techniques to accomplish the objectives.					
3. I participate in the activities needed for the goal accomplishment.					
4. I review and reflect on the processes for goal achievement.					
5. I monitor the progress I attain in the given lesson.					
6. I demonstrate awareness on the things I must achieve and develop.					
7. I establish enhancement activities that paved way for goal manifestation.					
8. I see connection between the goals and its implications.					
9. I employ in my practices the values I develop.					
10. I use self-evaluation to know that set goals have been accomplished.					
Personalized Learning					
1. I am responsible and in control with my own learning.					
2. I demonstrate excitement when the lessons suit my interest.					
3. I make choices depending on my strengths and weaknesses.					

4. I work with activities needed to be individually accomplished.					
5. I use own techniques in solving set of problems.					
6. I join activities that motivate me well.					
7. I express my views and activities that address my needs.					
8. I work well at my own pace in different activities					
9. I engage myself in exploration and discoveries.					
10. I participate well in hands-on and motivational strategies.					
Teaching Strategies and Learning Activities					
1. My teacher applies knowledge of content within and across curriculum teaching areas.					
2. My teacher applies strategies that develop critical and creative thinking skills.					
3. My teacher utilizes strategies that promote higher-order thinking abilities.					
4. My teacher uses strategies that enhance learners' achievement.					
5. My teacher employs strategies that developed learners' numeracy.					
6. My teacher employs interesting activities that encourage me to participate in the classes.					
7. My teacher assists and supports me to attain development and progress.					
8. My teacher encourages me to ask questions and clarifications on the concepts presented.					
9. My teacher allows me to collaborate with my peers to help me learn better.					
10. My teacher relates the lesson in real-life situations and practices.					
Educational Resources and Learning Devices					
1. The school has a library with accessible resources.					
2. The school has laboratory equipment like computers.					
3. The school has mathematics subject center.					
4. The teacher uses books for references.					
5. The teacher utilizes materials like learning workbooks.					
6. The teacher employs realia to integrate real-life concepts.					
7. The teacher utilizes PowerPoint presentation in the delivery of the lesson.					
8. The teacher uses videos to deepen the concept understanding.					
9. The teacher utilizes educational television.					

10. The teacher uses ICT resources to present given mathematical concepts.					
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Part III. What is the academic performance of the student as depicted in his/her Mathematics grade average?

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