

Math appreciation: Exploring the antidote for Math anxiety

Nilda V. San Miguel^a, Elymar A. Pascual^b

elymarpascual@rocketmail.com

^aDepartment of Education, Lumban District, Laguna, Philippines, 4014

^bDepartment of Education, Nagcarlan District, Laguna, Philippines, 4002

Abstract

Much has been said and studied about Math anxiety providing hindrance to learners on achieving academic proficiency, and Math appreciation is seen to be the antidote in this case. It is the sum of the affirmative attitude of learners in dealing with Math-related concepts, the way they embrace cooperative learning in class, their positive response to challenges, and the way they apply into practical life the numeracy skills they learned in the four corners of the classroom. This study is focused on the mixed quantitative and qualitative exploration of the introduction of Math appreciation in the Department of Education, District of Lumban, Laguna. With nine participating elementary schools, 60 respondents in an online survey, and 9 participants in a focused group discussion, issues connected to Math appreciation were investigated. Sources of Math boredom, interventions applied, role of Math appreciation in learners' performance, support of school and community, and a look into the education system were the main parts of the qualitative investigation. On the quantitative part, Mathematics mean percentage score (MPS) of school years 2020-2021 and 2021-2022 were seen to have significant difference. Learners significantly perform better when Math appreciation was in context with teaching and learning process. Five themes were developed in this study: (1) Sources of Math Boredom: Lack on the Part of the Learners and Education System, (2) Intervention to Raise Math Appreciation: Hook them in Games, Engaging Activities and Peer Assistance, (3) Math Appreciation Role in Learners' Performance: Inner Motivation from Classroom to Everyday Life, (4) Math Appreciation Sustenance: The Support of the School and Community to each other will Pave Way for One Direction, and (5) The Education System and Math Appreciation: Focus on Learners and Teaching with Retention Emphasized. Recommendations to Math teachers and coordinators, district and division high officials, and to education curriculum developer were laid down at the end of the study.

Keywords: Mathematics; Math appreciation; Math anxiety; teachers; learners; education; intervention; school; community

1. Introduction and Rationale

Mathematics and Science continues to be two of the disciplines that are considered essential gauge when international academic standing is to be assessed. Just three years ago, 2019, the Trends in International Mathematics and Science Study (TIIMS) conducted assessment to grade 4 pupils and it was reported that out of 58 countries, Philippines is the lowest in Math and Science. Rappler Philippines (2020) reported that "Filipinos lagged behind other countries" and it is despite of the fact that the Philippine education has invested a lot for quality delivery of knowledge this time of pandemic.

Can it be because of the attitude of learners, or is it because of the lack of training of teachers so as to implement proper approach, strategies, methods and interventions that will elicit good academic performance for Filipino youth, both in the public and in the private institution? With the change of the department

leadership comes, most of the times, the change in education curriculum. Philippines has already tried the National Secondary Education Curriculum (NSEC) with the homeroom guidance program as one of its salient features. It was changed to Basic Education Curriculum (BEC) with its revised homeroom guidance program. The Revised Basic Education Curriculum (RBEC) comes with the turn of another Department of Education Secretary and it's strength is in the addition of time in teaching Mathematics and Science – the one hour becoming 1.5 and 2 respectively. After the RBEC, it was returned to BEC, and in the year 2013, Republic Act 10533, otherwise known as the Enhanced Basic Education Act of 2013 with its K to 12 Program. The present Department of Education is heard of having the revisitation of the program to assess its effectiveness, now that the first batch has already finished a four-year course in college.

Singling out Mathematics in this discussion, several studies have already been conducted that point out that Math appreciation of learners has connection to academic performance. This connection was mediated by the intervention that was initiated by teachers so that learners will have higher level of Math appreciation. Nevertheless, such studies were not able to specify sources of Math boredom, or to higher extent, Math anxiety. Does Math appreciation always depend on the intervention that can be introduced by the teacher, or the learners, the family and the community also have their own contribution so as to have the world of Math be inculcated in them? This study was thus conducted to investigate sources of Math boredom, ways to raise Math appreciation, and strategies to sustain interest among learners.

2. Literature Review

Different disciplines or areas of study elicits different academic motivation, according to the study made by Andrei, Izabela and Valentina (2014). Math and sciences have an appeal to those who loves logic, problem solving, investigation and those that require exploration. On the other hand, humanities and social sciences create appreciation to learners who loves history, progression, unfolding of scenarios and details in terms of names and places.

When knowledge and learning are made personalized and was made as if coming originally from the learners, then information retention is heightened. This means not restricting the thinking process of the learners but does not necessarily condescend the teacher's exercise of authority in control and management of the class (Smith, 2004).

Mathematics appreciation of learners has something to do with the competence and attitude of the teacher. When the teacher exhibits care of the learners and mastery of the subject matter, walls are being broken down not only with the subject itself but also between disciplines that has connection with Mathematics. And with the positive attitude of learners gained from a competent and caring teacher, the built foundations of learners are become useful in acquiring Mathematical skills, both in the old normal, new normal, and now normal of education (Balmaceda, 2020).

When teachers allow learners to communicate how they understand their tasks, they feel their ideas are valued and they are respected. This respect will form in them positive self-concepts in Mathematics. Upon having holistic view in Mathematics, learners' intrinsic motivation to succeed in Mathematics is sustained. Their disposition towards the subject is being turned in an affirmative sense for them to proceed. This in turn will help them develop self-efficacy and mathematical autonomy, helping them to be independent seeker of knowledge. Enjoyment is at its best when they do Mathematics exercises as they develop ownership of ideas. They are soon to be seen being engaged in mathematical reasoning, and will ultimately be led to acquisition of conceptual understanding (Mueller, Yankelewitz and Maher, 2011).

Positive attitudes towards Mathematics turns out to be a cycle, according to the investigation made by Kislenko, Grevholm and Agder (n.d.). If a student has a positive attitude towards Mathematics, and is combined with proper approach delivered by the teacher in dealing with concepts and skills, it will lead to the

motivation of the students to learn more, which will yield high performance in Mathematics. This will create a wonderful experience for the learners as they achieve good academic standing. And this experience will lead to, again, positive attitude towards the subject.

Guvendir (n.d.) in his study about students' extrinsic and intrinsic motivation level and the Mathematics achievement revealed that students' Mathematics interest, self-efficacy, perceptions of Mathematics, frequency of Mathematics exams, and teachers' interest in students at schools are significantly related to Mathematics achievement. Through the examination of the effect size, it was also found out that intrinsic motivational variables have stronger relationship to achievement than the extrinsic motivational variables. Nevertheless, the study claimed that both intrinsic and extrinsic motivational variables have significant relationship with Mathematics achievement.

The National Association for the Education of Young Children (2002) proposes four actions that would sustain Mathematics appreciation among students: (1) Create more effective early childhood teacher preparation and continuing professional development. (2) Use collaborative processes to develop well aligned systems of appropriate high-quality standards, curriculum, and assessment, (3) Design institutional structures and policies that support teachers' ongoing learning, teamwork, and planning, and (4) Provide the resources necessary to overcome the barriers to young children's mathematical proficiency at the classroom, community, institutional, and system-wide levels.

With the use of an intervention called Math-Island, the study made by Yeh, et. al. (2019) revealed that when interest in Mathematics is high, learners do perform well in solving word problems. This is true even for low achieving learners who have been exposed to Math-Island. Their performance is significantly higher than those students who have not been exposed to the intervention. And when the interest in Mathematics of those who have been exposed to the intervention was measured, it was also revealed that both low achieving and high achieving students maintained high level of interest to the subject and to the system compared to those have been exposed with the intervention.

Lin, Tseng and Chiang (2017) made use of both ANCOVA and MANCOVA in treating the difference between the experimental (using Moodle learning platform) and control group (using the conventional blended learning). It was found out that that experimental group have better output than the control group, and that the experimental group gained also better attitude in studying Mathematics. Furthermore, male students and high-ability students are more motivated in the blended learning environment than other sex group and varied ability groups. Those who have been soaked with the Moodle learning platform provided positive feedback after experiencing the blended learning.

Leonard (2012) found three variables that are directly and indirectly influencing mathematics learning achievement, and they are level of appreciation, positive thinking ability and self-concepts.

Teachers' use of different approaches, and the way he changes it depending on the needs, interest, learning style, experience, strength and weaknesses of the learners has something to do with their motivation for learning Mathematics. That is what Waage (2009) found out in the study entitled "Motivation for Learning Mathematics in Terms of Needs and Goals".

According to Fehr (1952), in his article entitle "Teaching for Appreciation of Mathematics"

"It may be conceded that one can enjoy and appreciate that which is explained by, or which is the outcome of applied mathematics, without actually knowing the mathematics... The appreciation of mathematics comes when we seek it and use it as a means of explaining our environment, explaining design, and so on. It is also a search for and extension of abstract logical structures as satisfying mental creations."

The study of Abramovich, Grinshpan and Milligan (2019) may summarize all the contents of the readings that was previously mentions. They found out that by repeatedly utilizing concept motivation and action learning at all levels of Mathematics education, learners has a great potential to improve in their

performance.

All the above-mentioned readings shed light into the development of this study, particularly on the aspect of Math appreciation and academic performance of learners.

2.1. Research Questions

This study explored on the sources of Math boredom, ways to awaken Math appreciation among learners, and pointers to be considered to sustain Math awareness to different key stages of learning.

Specifically, it sought to answer the following qualitative questions:

1. What are some possible sources of Math boredom among learners?
2. What interventions do teachers implemented so as to raise Math appreciation among their learners?
3. How does the academic performance before the intervention and after the intervention compare with each other?
4. What is the role of Math appreciation to the performance of learners in Mathematics?
5. What can be done by the school and community for learners' Math appreciation to be sustained as learners advance from one grade level or key stage to a higher one?
6. As to the educational system, what changes and development can be done to secure high level of Math appreciation in the next generations to come?

2.2. Scope and Limitation

The Department of Education, Lumban Districts, is one of the smaller units of the DepEd Division of Laguna that would like to investigate on Math appreciation among learners. Even during pandemic, DepEd Lumban has never ceased to monitor numeracy level on learners under key stages 1 and 2, specifically grades 1 to 6. The data and findings that resulted from this study reflects the scenario, culture, approaches and system in the DepEd Lumban with regards to Math appreciation among learners. The district has 23 public elementary schools, not counting the private institutions that offer key stages 1 and 2. The result of the exploration is a representation of the scenario for the school year 2021-2022.

3. Research Methodology

3.1. Sampling

Out of 150 teachers from 9 schools, there were 45 teachers who responded in an online survey containing the qualitative questions. And from these 45 teachers, 8 purposively chosen to be part of the focused group discussion in order to clarify their answers, allow them explain their answers in an online survey question, and encourage them to share deeper insights on the topic under study.

3.2. Data Collection

There were two ways in which data were collected. First was the online survey through Google form. Elementary teachers in DepEd Lumban were enjoined to answer qualitative questions contained in the online form. Participants were instructed to provide answers in at least two sentences so as to provide clear picture of their answers. After this online survey, participants were purposively selected for them to be part of the focused-group discussion, moderated by the authors. Note taking were done to encode salient responses from the participants. Audio recording, through the permission of the participants, were also done so as to back up

the note-taking.

3.3. Ethical Issues

To ensure proper treatment of the participants and of the data as well, the following actions were taken:

1. Indorsement from the Public Schools District Supervisor of DepEd Lumban that signifies her permission to conduct the study in the district, and to ask guidance and advice as well in coming up with a comprehensive study.
2. Voluntary participation was the approach as the Google form was distributed to elementary teachers and they are free to choose whether to participate or not.
3. Information obtained using Google Form was kept secured, not divulging personal information from the participants, but only the responses to qualitative questions.
4. Informed consent was secured from the selected participants of focused group discussion so as to gain their commitment in being part of the study.
5. Noted and recorded responses were not also divulged in terms of the personal data of the participants, but only the qualitative data obtained from the focused group discussion.

3.4. Plan for Data Analysis

Qualitative data gathered from online survey were harvested, sorted as to question item, and were treated with Word Cloud Generator. Words that are frequently appearing were analyzed as to their connection to ideas and their association with other words. Clarification of the thoughts and ideas were checked across or against the transcription from the focused group discussion. Word Clouds were generated in connection to frequently appearing words from the responses obtained to every questions. With the Word Clouds and the responses from the focused group discussion, themes were developed that represent patterns of thoughts and ideas regarding the topic being investigated.

4. Discussion of Results

4.1. Sources of Math Boredom among Learners

Table 1. Most frequent words appearing in the qualitative response on sources of Math boredom among learners

Word	Frequency
pupils	19
Lack	18
subject	16
interest	15
Learners	14
students	14
boredom	13
understand	10
lesson	10
problem	10

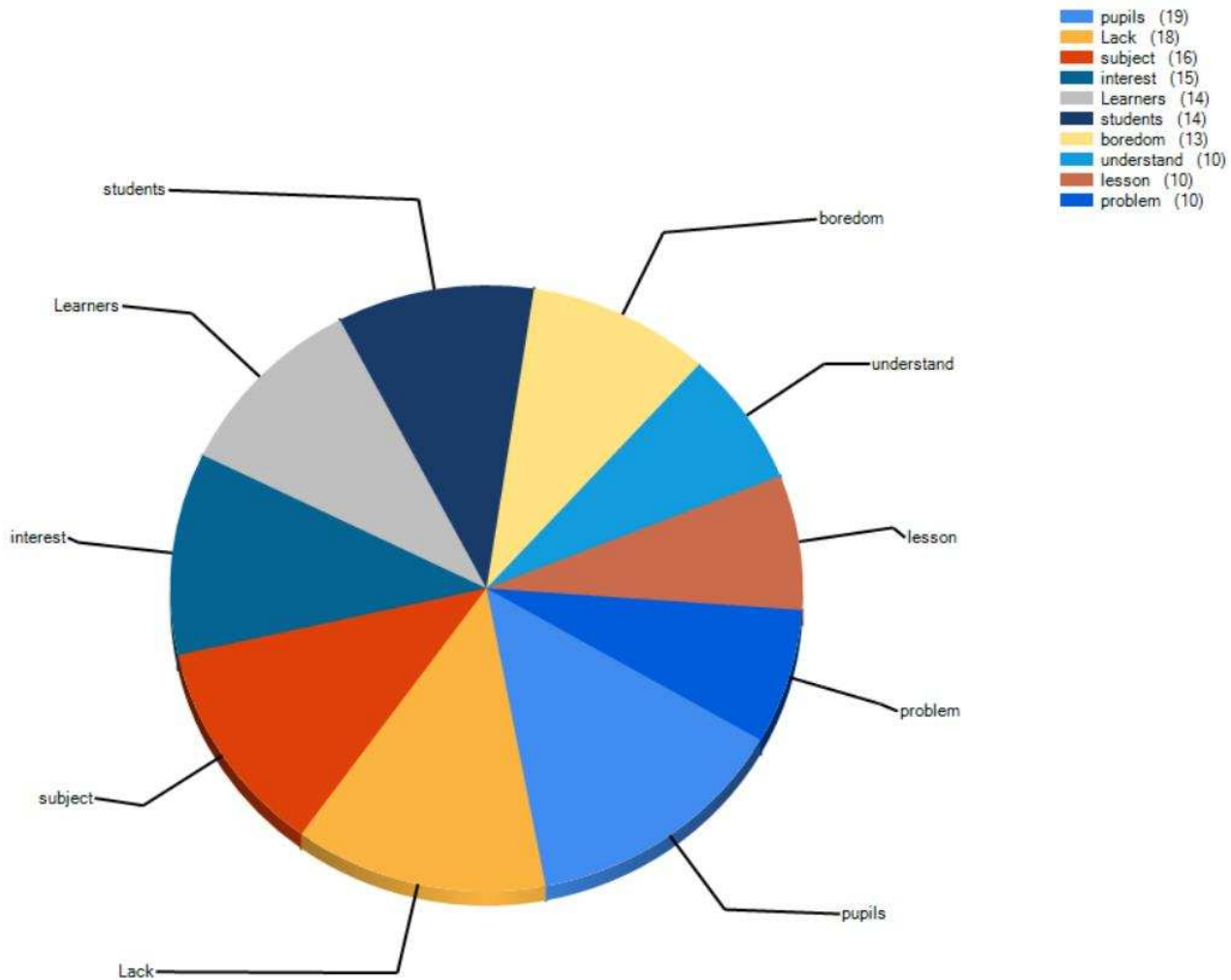


Fig. 1. Pie-chart word cloud of most frequent words appearing in the qualitative response on sources of Math boredom among learners

Sixty elementary Math teachers were able to respond to the online survey on the inculcation of Math appreciation in teaching. The table and pie-chart word cloud above shows the frequently appearing words in the participants' response to the first qualitative question, "What are some possible sources of Math boredom among learners?". The word "lack" is the key in discovering the source of boredom of the learners in Math subject. Several responses where the word "lack" was used were the following:

1. Lack of facility or connectivity
2. Lack of interest
3. Lack of understanding the lesson
4. Lack of understanding of unfamiliar words like wage (contextualization)
5. Lack of materials

6. Lack of engaging activities
7. Lack of basic knowledge on fundamental operations

Aside from these insufficiencies, two other factors were mentioned prevalently in the participants' responses: problems are too challenging or too easy, and students' laziness and dependence on others. These two represents the teacher and student factors in having boredom in Math subject.

With these findings, the resulting theme is this:

Sources of Math Boredom:
Lack on the Part of the Learners and
Education System

4.2. Interventions to Raise Math Appreciation

Table 2. Most frequent words appearing in the qualitative response on interventions to raise Math appreciation

Word	Frequency
learners	15
Games	14
teaching	10
Learning	10
activities	10
pupils	9
Peer	8
Lesson	8
Make	8
Intervention	8

The table and pie-chart word cloud associated highlights the frequently appearing words to the response of 60 elementary teachers to the qualitative question "What interventions do teachers implemented so as to raise Math appreciation among their learners?". With these 10 frequently appearing words, the five interventions that the elementary Math teachers are implementing to raise Math appreciation this school year 2021-2022 were the following:

1. Games – Other terms equivalent to this that also appear in the responses are game-based learning and recreational activities.
 2. Activities – Participants specified this by writing "differentiated", "engaging", "interactive", and "modified activities for least learned competencies".
 3. Peer assistance or peer tutoring – Learners are able to move on their own pace and understanding if assisted by peers.
 4. Accessible materials – Example of this is videoclip. Several respondents mentioned about Project LUMVAN (Localized Undertaking through Mobile Video Attachment in New-Normal) which is one of the continuous improvement projects of DepEd Lumban District.
 5. Cooperative and experiential learning – When learners are exposed to what is happening to the real world, and they themselves are involved in the process, they Math appreciation is likely to be raised.
- Other interventions that participants mentioned are the following:
- Use of pictures and real objects or manipulatives
 - Drills and exercises

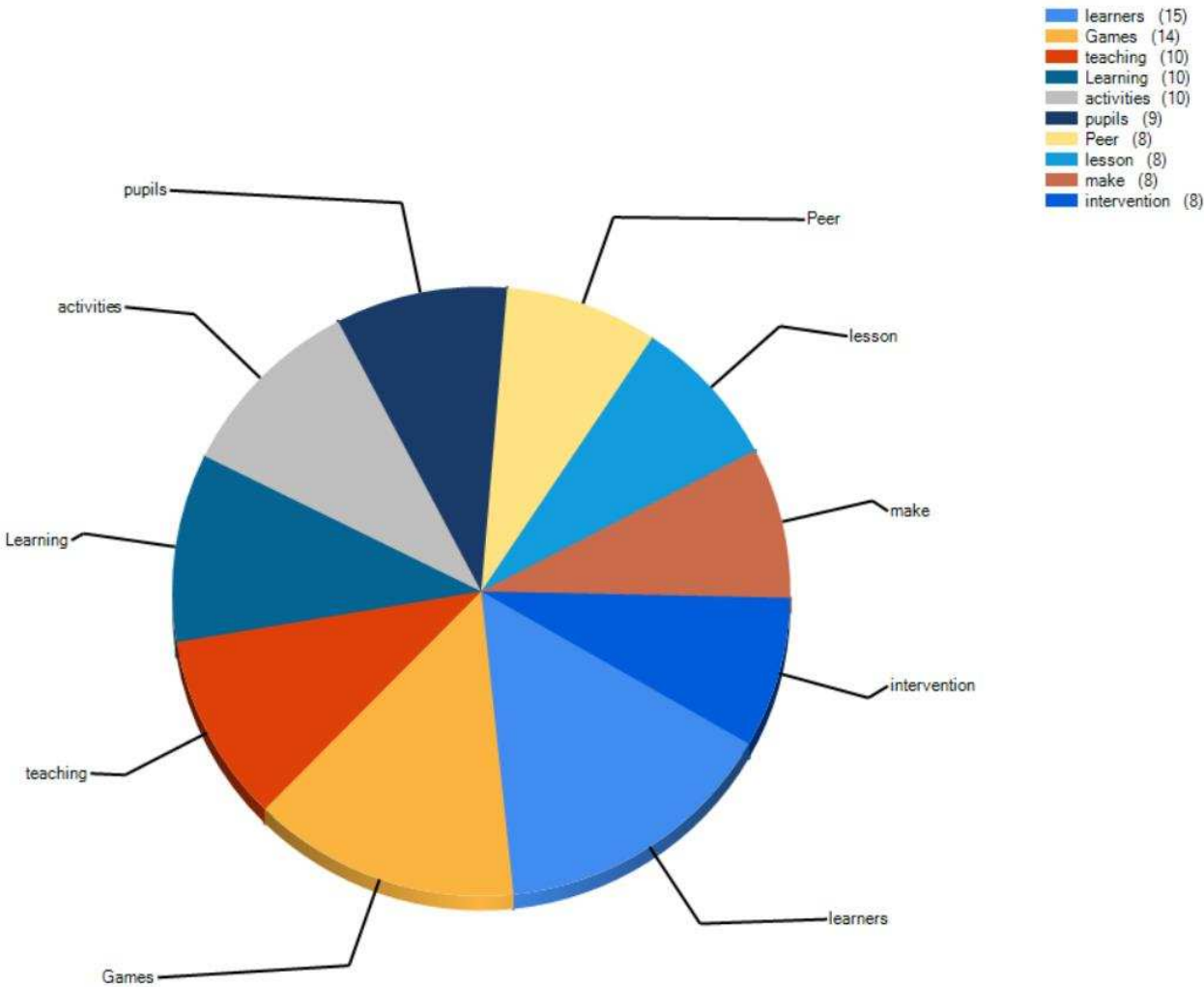


Fig. 2. Pie-chart word cloud of most frequent words appearing in the qualitative response on interventions to raise Math appreciation

With the findings mentioned above, the resulting theme is thus formed:

Intervention to Raise Math Appreciation:
Hook them in Games, Engaging Activities
and Peer Assistance

4.3. Mean Level of Learners' Academic Performance when Learners' Math Appreciation is not Yet Considered

Table 3. Mean level of learners' academic performance in terms of MPS when Math appreciation is not yet considered

SCHOOL	Math MPS 2020-2021
Balubad ES	65.97
Caliraya ES	72.60
Concepcion	70.03
Lewin ES	67.96
Lumban CES	73.19
Maytalang 1 ES	71.59
Maytalang 2 ES	64.61
Sto. Niño ES	78.75
Wawa ES	72.50
Mean	70.80
SD	4.27

The table above shows the mean level of Math academic performance of learners in terms of mean percentage score (MPS) from the nine elementary schools in DepEd Lumban District, during the school year when learners' Math appreciation was not yet being given consideration. The average MPS of the nine schools is 70.80, signifying moving to mastery level. The standard deviation of 4.27 signifies heterogeneity and can be attributed to different factors such as school culture, teacher factors, student factors, and even family support.

4.4. Mean Level of Learners' Academic Performance when Learners' Math Appreciation is already being Considered

Table 4. Mean level of learners' academic performance in terms of MPS when Math appreciation is considered

SCHOOL	Math MPS 2021-2022
Balubad ES	71.68
Caliraya ES	81.41
Concepcion	73.82
Lewin ES	81.52
Lumban CES	78.86
Maytalang 1 ES	71.88
Maytalang 2 ES	69.56
Sto. Niño ES	80.61
Wawa ES	70.68
Mean	75.56
SD	4.97

The table above shows the mean level of Math academic performance of learners in terms of mean percentage score (MPS) from the nine schools in DepEd Lumban District during the school year when Math

appreciation is already being considered. The average MPS from the nine schools is 75.56, interpreted as moving to mastery level, and noticeably 4.76 points higher than the previous school year. The standard deviation which is 4.97 still connotes heterogeneity but 0.70 points lower than the previous school year, signifying better performance because of lower variability.

4.5. Difference in the Academic Performance with and without Learners' Math Appreciation Consideration

Table 5. T-test result (dependent samples) of academic performance with and without learners' Math appreciation consideration

Teaching Strategy	Mean	SD	t-value	t-crit	p-value	Decision
Learners' Math Appreciation not Yet Considered	70.80	4.27	3.112499	2.306	0.01439	Significant
Learners' Math Appreciation already being Considered	75.56	3.97				

alpha = 0.05

The table above highlights the difference of Math academic performance of learners in terms of MPS without and with the consideration of learners' Math appreciation. Using t-test for dependent samples, it can be seen that the computed t-value is 3.112499 is higher than the critical value 2.306. This leads to the decision that there is a significant difference between the academic performance of learners with and without the consideration of learners' Math appreciation. This is supported by the p-value 0.01439 which is lower than the alpha value 0.05. With 95% level of confidence, it can be said that there is enough evidence to claim that there is a significant difference in the MPS of learners with and without the consideration of Math appreciation, that is, learners perform better (MPS of 75.56) when learners' Math appreciation is in mind than when learners' Math appreciation is not being considered (MPS of 70.80).

The findings in this study are in consonance with the findings of the study made by Abramovich, Grinshpan and Milligan (2019) as they found out that repeatedly utilizing concept motivation and action learning at all levels of Mathematics education, learners has a great potential to improve in their performance.

4.6. Role of Math Appreciation to Learners' Performance

Table 6. Most frequent words appearing in the qualitative response on role of Math appreciation to learners' performance

Word	Frequency
learners	24
Mathematics	18
subject	17
learning	15
appreciation	14

role	13
learn	13
appreciate	11
understand	10
life	10

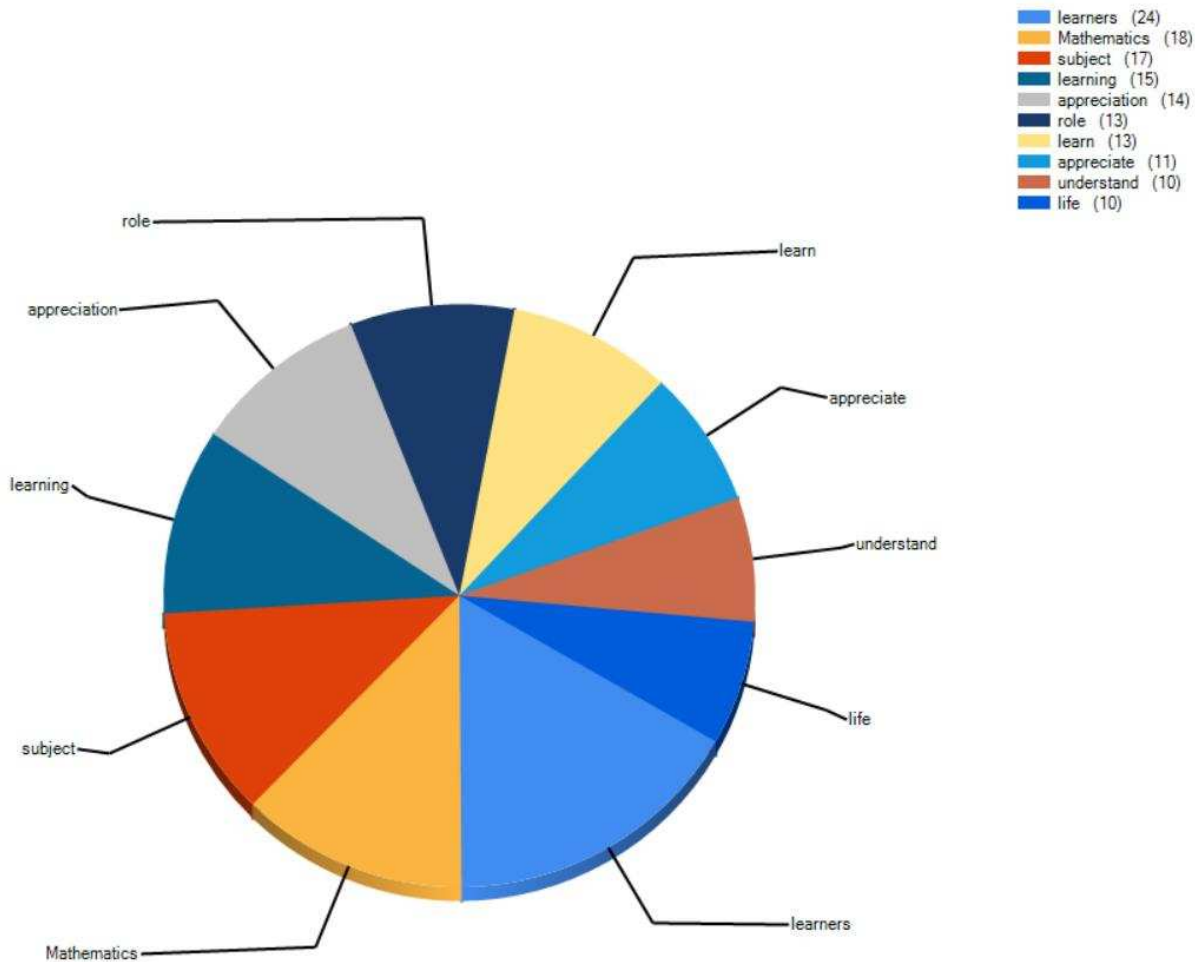


Fig. 3. Pie-chart word cloud of most frequent words appearing in the response on role of Math appreciation to learners' performance

The table and pie-chart word cloud above highlights the frequently appearing words to the response of 60 elementary teachers to the qualitative question "What is the role of Math appreciation to the performance of learners in Mathematics?" Connecting the frequently appearing words and verifying their appearance in the response of the participants, the following salient role of Math appreciation are the following:

1. A driving force for learning – No addition motivation is needed for learners to focus if they are interested about the subject.
2. Change of perception in Mathematics – Math anxiety and Math boredom arises, for one reason, because of student factor. With proper mindset, learners don't need to be afraid of this subject.
3. Building confidence and other positive attitudes – When learners have a positive outlook of the subject, they tend to be patient, respectful of teachers and others as well.
4. Nurturing problem solving and critical thinking skills – As learners start to appreciate the nature of Math subject, their enjoyment will turn into enhancement of problem solving and critical thinking skills.
5. Acquisition of ability needed for everyday life – Aside from their everyday life having Math being applied in their individual tasks, they are also to become an effective workforce in our country, workforce who faces challenges in a positive way.

With the foregoing discussion of findings, the resulting theme is thus framed:

Math Appreciation Role in Learners' Performance:
 Inner Motivation from Classroom to Everyday Life

4.7. Role of School and Community for Math Appreciation Sustenance

Table 7. Most frequent words appearing in the qualitative response on role of school and community for Math appreciation sustenance

Word	Frequency
learners	21
school	20
family	18
community	16
support	15
learning	13
activities	12
Mathematics	12
one	11
subject	9

The table and pie-chart word associated highlights the frequently appearing words to the response of 60 elementary teachers to the qualitative question "What can be done by the school and community for learners' Math appreciation to be sustained as learners advance from one grade level or key stage to a higher one?" Looking into the top 10 frequently appearing words and validating them from the responses of the participants, it can be seen that thoughts can be connected by 1 key word, and that is "support". Support from school and community should be evident Math appreciation among learners. When seen from ideas from the respondents, the following are the salient ones:

1. Support of school – The top suggestion is remedial class. While others mentioned provision of interesting, contextualized learning activities, formulation of clubs or programs catering to different numeracy levels and putting signages in school about Math.

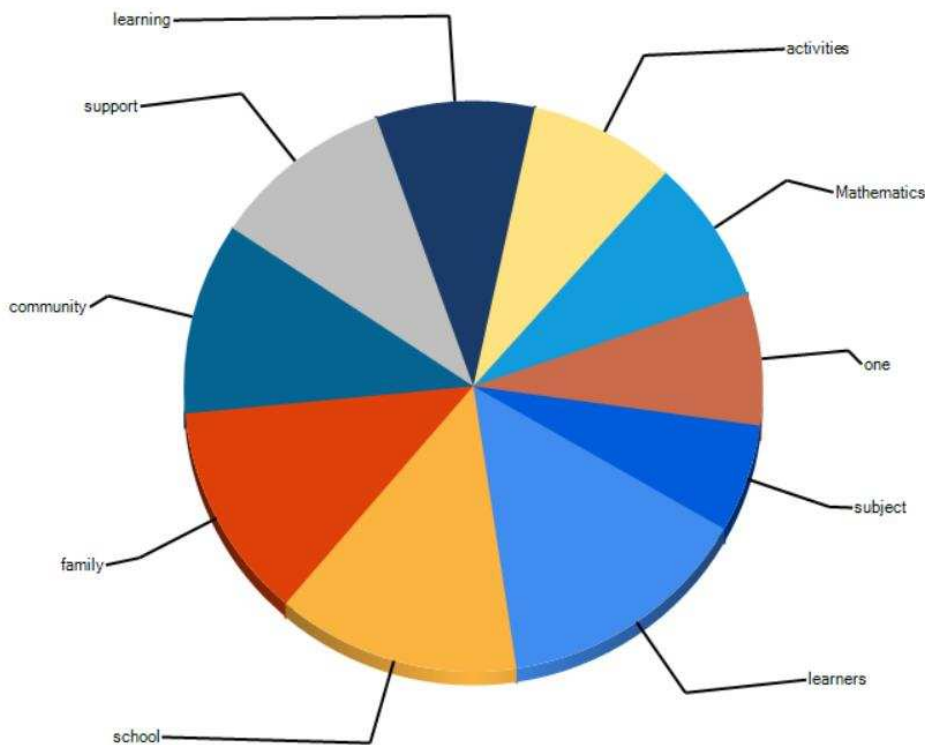
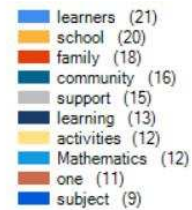


Fig. 4. Pie-chart word cloud of most frequent words in the response on role of school & community for Math appreciation sustenance

2. Support of community – A sample project mentioned in the responses is the “Numbers on Wheels” which is an initiative of teachers supported by the local government, a project of delivering Math instructional/supplemental materials to households. Other participants mentioned community Math camp or Quiz Bee spearheaded by the school with the collaboration of community officials. Other community support appeals to the basic institution, the family/parents, that they be as teacher-extension at home, teaching and assisting learners on their task.

The school and the community should one in sustaining Math appreciation among learners because this will not only lead them in having good academic standing, but also in having promising effective workforce in our country who valiantly face challenges for our nation’s growth.

Having said thus, the resulting theme is presented below:

Math Appreciation Sustenance:
 The Support of the School and Community to each other will
 Pave Way for One Direction

4.8. The Educational System and Math Appreciation

Table 8. Most frequent words appearing in the qualitative response on the educational system and Math appreciation

Word	Frequency
learners	17
learning	14
teaching	12
students	11
Educational	10
system	10
Mathematics	10
subject	9
teach	9
appreciation	9

The table and pie-chart word cloud connected highlights the frequently appearing words to the response of 60 elementary teachers to the qualitative question “As to the educational system, what changes and development can be done to secure high level of Math appreciation in the next generations to come?” It can be noticed that the top 4 in the list pertains to learners and teaching-and-learning. This shows the voice of the participants in that, the educational system should focus on the learners and the teaching-and-learning process.

To capsulize the responses of the 60 participants on this subject, here is the summary:

1. Focus on learners and learning, not on adding too many competencies – This will help learners retain what is really necessary, and have other competencies be dealt with in the next level.
2. Focus on teaching, not on adding too many clerical works – Teachers are bombarded with many forms to be filled-up, having their energy drained in those tasks, thereby making them already haggard when they face their learners to receive the expected quality teaching.
3. Focus on basic arithmetic on key stage 1 – The four basic operations are the foundation of other competencies, and failure to have mastery on them will produce detrimental effect when the learner reached junior high school, senior high school, and even tertiary education.
4. Focus on learners having academic problem, not on already academically inclined – Those with academic excellence are being highlighted on national or international quiz contest, but those who are lagging behind are too many compared to those who are at the limelight.
5. Focus on Mathematics by lessening subject areas – Other areas can be integrated other subjects, providing ample time for Mathematics to be studied.
6. Revisit spiral curriculum; learners’ progress little by little but with retention is suggested – Though there is a good view of the spiral system, it fails to leave a strong impact to many 21st century learners. They are not having mastery of one competency, and therefore, not having the success for the next competency that they need to learn.

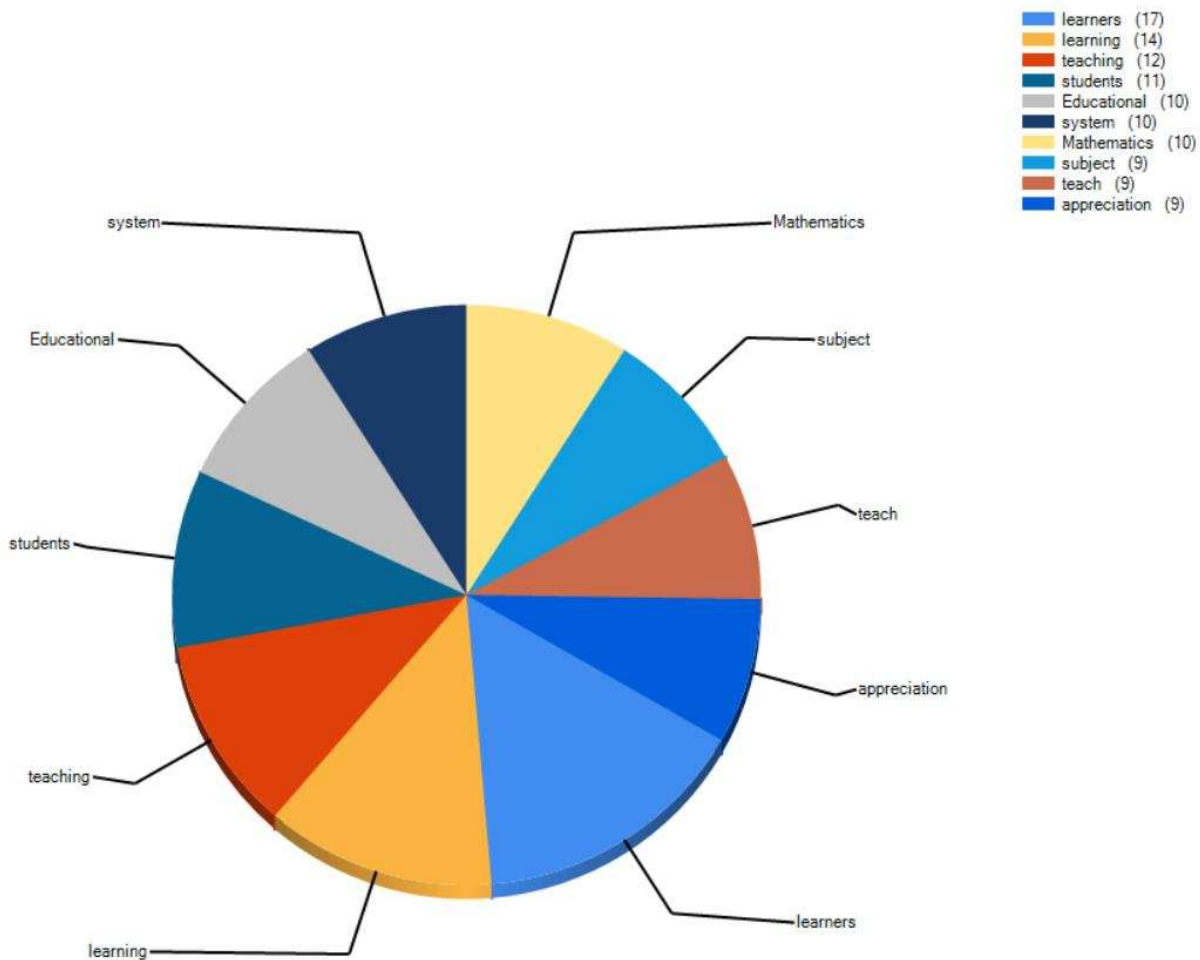


Fig. 5. Pie-chart word cloud of most frequent words appearing in the qualitative response on educational system and Math appreciation

7. Provision of additional seminars that will deal on the use of technology-based teaching, and seminars on effective delivery of the basics – The system tends to give emphasis more on the upward move of the stages of learning, neglecting the very foundation. There needs to be an additional seminar or training for those teaching the foundation. This does not mean that the blame is on them who are at the grass root of educational system, rather, it is just a call for additional reinforcement for them because they have a vital role in developing the young minds of Filipino youth.

With the aforementioned discussion, the theme for this section is now here laid down:

The Education System and Math Appreciation:
 Focus on Learners and Teaching with Retention Emphasized

5. Recommendations

With the foregoing discussion of the findings that resulted out of the study's exploration, the following recommendations are thus laid down here:

1. **Math teachers** should expose the students to different types of real-life Math application, so that they can understand the various aspect of Math in everyday life. They should make an effort to connect math concepts to the real world. Students are more likely to understand and appreciate math if they can see how it is used in everyday life.
2. **Math coordinators** should initiate projects like "Make Math Fun with Hands-On Projects". The goal of this was to take a Math game and make it more interesting for students by adding a hands-on element to it.
3. **Department of Education higher officials** should review the spiral curriculum if it is serving the purpose of having the learners attain high numeracy skills. Looking into the data of the previous school years can be the basis of evaluation, and through them, action plan can be drafted so as to remediate in this time of blended learning.
4. **Curriculum developers** should design activities in which students will be given more opportunity to investigate mathematical concepts in the real world. Through this, learners will be more likely to engage in and retain the lessons.

5.1. Reflection

Math plays an important role in students' performance, both in the classroom and in everyday life. Love of math and a strong inner motivation are essential for success. However, many students struggle with math anxiety and lack of confidence. It is widely accepted that math is a critical subject for students to learn. What is often neglected is the importance of appreciation for the role math plays in our lives. Math appreciation is the understanding and enjoyment of the beauty and power of mathematics. It is the ability to see the world around us and the universe itself in a mathematical way. Math appreciation is a way of looking at the world that can be enjoyed by anyone, regardless of whether they are good at math or not.

In line with this, the Lumban District teachers will continue to raise the level of math appreciation because it eases math anxiety and students come to love math. Classroom teachers in Lumban District want to know more about effective mathematics so they will be able to teach math in a way that will let their students develop a deep understanding and mastery of math. Additionally, teachers in the said district plan to continue working hard to make sure that their students have a positive attitude towards math. The district has many initiatives in place to improve math instruction and make it more engaging for students. The district understands that the education system is an important factor in mathematical appreciation. A focus on learners and teaching with retention emphasized can help to create a love for mathematics. The ability to see the beauty and usefulness of math is essential for enjoyment and success in the subject.

Acknowledgment

The authors wish to extend grateful appreciation of the following teachers who have been part of the focused group discussion towards the development of the themes in this study:

- Grethel L. Abad – Lumban Central Elementary School
- Reyca G. Legisma – Wawa Elementary School
- Armielyn A. de Guzman – Sto. Niño Elementary School
- Alice B. Gaza – Maytalang II Elementary School

- Baby Maricar D. de Chavez – Maytalang I Elementary School
- Emelinda B. Santiago – Caliraya Elementary School
- Marivic C. Aquino – Concepcion Elementary School
- Ma. Hazel L. Rana – Balubad Elementary School
- Rose Ann S. Bagayan – Lewin Elementary School

References

- Abramovich, S., Grinshpan, A. Z. and Milligan, D. L. (2019). Teaching Mathematics through concept motivation and action learning. *Education Research International*. Scribb. <https://www.hindawi.com/journals/edri/2019/3745406/>
- Andrei, C., Izabela, V. P. and Valentina Z. (2014). Comparative study between study tracks: math and sciences or humanities, regarding academic motivation and learning strategies in the 9th grade students. *Procedia - Social and Behavioral Sciences*. Volume 128, pp. 432 – 437.
- Balmaceda, J. M. P. (2020). The continuing value and relevance of mathematics appreciation courses. *Proceedings of the 1st International Conference on Mathematics and Mathematics Education (ICMMED)*. Volume 550
- Fehr, H. F. (1952). Teaching for appreciation of Mathematics. Presented before the Mathematics Section of the Central Association of Science and Mathematics Teachers, Cleveland, Ohio. Scribb. <https://doi.org/10.1111/j.1949-8594.1952.tb06806.x>
- Guvendir, M. (n.d.). Students' extrinsic and intrinsic motivation level and its relationship with their Mathematics achievement.
- Kislenko, K., Grevholm, B. and Agder, M. L. (n.d.). "Mathematics is important but boring": Students' beliefs and attitudes towards Mathematics. *The Research Council of Norway*.
- Leonard. (2012, December 30). Level of appreciation, self-concept and positive thinking on Mathematics learning achievement. *The International Journal of Social Sciences*. Vol. 6, No. 1
- Lin, Y., Tseng, C. and Chiang, P. (2017). The effect of blended learning in Mathematics course. *EURASIA Journal of Mathematics Science and Technology Education*. ISSN 1305-8223 (online) 1305-8215 (print). Volume 13, Issue 3, pp. 741-770. Scribb. <https://doi.10.12973/eurasia.2017.00641a>
- Mueller, M. Yankelewitz, D. and Maher, C. (2011). Sense making as motivation in doing Mathematics: Results from two studies. *The Mathematics Educator*. Vol. 20, No. 2, 33–43.
- National Association for the Education of Young Children. (2002). *Early childhood Mathematics: Promoting good beginnings*
- Smith, M. R. (2004, fall semester). Math anxiety: Causes, effects, and preventative measures. A Senior Thesis submitted in partial fulfillment of the requirements for graduation in the Honors Program Liberty University.
- Waege, K. (2009). Motivation for learning Mathematics in terms of needs and goals. *Proceedings of CERME 6*. January 28 – February 1, 2009. Lyon France.
- Yeh, C. Y. C., Cheng, H. N. H., Chen, Z., Liao, C. C. Y. and Chan, T. (2019). Enhancing achievement and interest in mathematics learning through Math-Island. *Research and Practice in Technology Enhanced Learning*. Volume 14, Issue 5. <https://doi.org/10.1186/s41039-019-0100-9>