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Predictive Analysis on Students' Academic Performance in Mathematics

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Abstract

This research aimed to determine the predictors of academic performance in mathematics of Grade 10 students using descriptive correlational design. The respondents were 435 Grade 10 students from the three identified public high schools in Lapu-Lapu City and Liloan, Cebu, Philippines. A survey questionnaire was used to describe student-related factors,

teacher-related factors, and environment-related factors while the First Quarter Grades were used to measure students' academic performance in mathematics. Data gathered were treated statistically using frequency count, percentage, weighted mean, and multiple regression. The results showed that most of the respondents were 14 to 15 years old and were female; most of the parents were high school graduates and had a combined family monthly income of 10,000 pesos and below. The respondents had satisfactory performance. Also, teaching skills and instructional materials used by the teacher are significant predictors of academic performance in mathematics. However, the students' interest, study habits, teacher's personality, school environment and home environment of the students were not significant predictors of the mathematics performance of the students. It was concluded that the teacher-related factors as to teaching skills and instructional materials used can predict the academic performance of the students. The researchers recommended that the proposed intervention plan could be utilized and monitored.

Keywords: Challenge Teaching Mathematics, Student-related Factors, Teacher-related Factors, Environment-related Factors, Mathematics Performance, descriptive correlational, Cebu, Philippines

1. Introduction

1.1 Rationale of the Study

In most countries, mathematics is one of the fundamental core subjects in primary and secondary education that plays an important role in fostering students' critical, logical, problem-solving, arithmetic and logical reasoning, and higher-level thinking. It is the science of magnitude and numbers that is very useful in all areas. It is one of the most important subjects in any discipline with varying effects on every facet of human existence. However, students have different perceptions of mathematics. Even today, most people believe that mathematics is all about calculation and computation as tools for understanding mathematical concepts producing solutions to complex real-world problem making life easier and establish that mathematical abilities are not only necessary for academic success but also for working effectively in everyday life. Likewise, many researchers considered mathematics to be the queen of all sciences because scientific, technological, and social breakthroughs are emphasized by the language of numbers.

In the Philippines, observations especially among junior high school students, show that they excel at acquiring knowledge but perform considerably low in lessons requiring higher order thinking skills. For decades and across grade levels, students' academic performance in mathematics has shown a gap in achievement based on numerous studies and reports which has been alarming even with the massive investment in education. In particular, retention and simple recall are some of the basic concerns that needs to be addressed. How students learn and how their achievement in these areas can be measured are a priority concern of policymakers and educators worldwide. Undeniably, most of these students are unprepared to learn mathematics. Additionally, according to recent results from the National Achievement Test, most schools and institutions did not make it to the passing rate set by the National Educational Testing and Research Center (NETRC).

Banking on this general perspective of student performance in mathematics, researchers have succeeded in determining the different factors that significantly influence students' performance in mathematics. The study is carried out to examine and assess the identified factors affecting the mathematics performance of the Grade 10 students in three (3) identified public high schools. The result can use as fundamentals for implementing curriculum and strategies that are best suited to the teachers' and learners' needs. It could also serve as a guide in designing a plan on how to facilitate students meeting learning outcomes, competencies, and school expectations.

1.2 Theoretical Background

This study is anchored on Bloom's Theory of School Learning and Bronfenbrenner's Ecological Systems Theory. In addition, the legal bases that support this study are DepEd Order No. 034.S.2022, entitled "School Calendar and Activities for the School Year 2022-2023," and the "No Child Left Behind Act of 2010." These theories and legal bases help the researchers determine the identified factors that may affect the mathematics performance of Grade 10 students.

The Theory of School Learning as described by Bloom (1976) explains two types of prerequisites to learning: cognitive and affective entry characteristics of the learner. Cognitive entry characteristics refer to the intellectual abilities, knowledge, and skills a learner brings to a learning situation. (Cherry, 2023) On the other hand, affective entry characteristics refer to the learner's attitudes, motivations, and values that influence their engagement with the learning task (The Peak Performance Center, 2023). Bloom maintained that both the cognitive (related to the ability to learn specific content) and affective (related to the persistence in learning) entry characteristics are important in determining the success of learning.

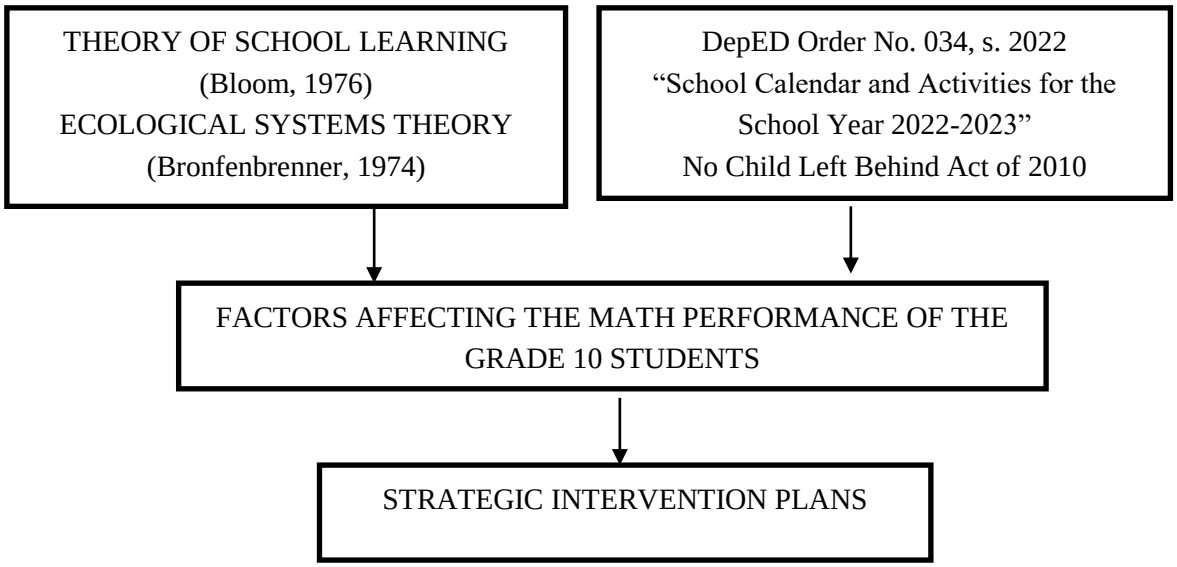

Figure 1. Theoretical – conceptual framework

The focus of cognitive entry characteristics is the distinctive requirements for mastering individual learning activities, including verbal and reading comprehension. The affective entry characteristics also include features broadly applicable to life in general and less task-specific traits like attitudes toward education and self-image as a learner. The structure of the learning task, in addition to the learning goal, influences the cognitive and behavioral beginning of the activity as they serve to activate and control learning processes to facilitate successful learning (Richter, 2012). The objectives of the lessons can be modified to some extent without changing the essential learning outcome to fit the characteristics of various learner groups and meet their needs (Stanford University, Accessed 2023). For example, the utilization of cues (Professional Learning Board, 2023), reinforcements (Costa, 2023); feedback (Yang et al., 2021); correlatives (Pappas, 2015), as well as participation (Reeson, 2009), or the degree of overt and covert engagement of students in the learning activity, all reflect in the quality of instructions provided by the teacher which falls under the teacher-related factors. Cues, verbal or non-verbal, can help students understand what's asked of them and what to do next. (Classroom Management Techniques: Using Cues, 2023) Reinforcements, such as praise or rewards, can encourage students to continue learning and

performing well. (Costa, 2023) Effective use of positive and constructive feedback helps students improve their academic achievement by understanding their strengths and weaknesses (Yang et al., 2021; Stenger, 2014) Correlatives, linking new information to prior knowledge, can help students better understand and retain new concepts (Pappas, 2015). Students actively participating in the learning process are more likely to retain information and apply it to new situations (Reeson, 2009). Affective outcomes are less related to achieving specific emotional goals and more to the gradual and cumulative improvement of threshold emotional traits as learners face new challenges. (Oleksandr & Milos, 2018; Darling-Hammond et al., 2020)

According to Bloom, successful learning experiences should lead to enhanced attitudes toward school, a positive self-concept, and more active participation in future learning (London School of Management Education, 2019). The latter, through enhanced participation, leads to a third outcome: an improved learning rate. Now, before moving to the next unit, it is important to confirm that each unit has been mastered because the learning outcomes can affect the cognitive and affective input functions (Michael, 2023). By confirming mastery of each unit, learners can build a strong foundation for future learning and better incorporate new information into their cognitive and affective frameworks. Thus, enabling a successful learning experience.

Furthermore, this study is also anchored in the Ecological Systems Theory of Bronfenbrenner (1974) which places the development of the child at its center. He proposed that a child's environment is a layered collection of structures: namely, microsystems, mesosystems, exosystems, macrosystems, and chronosystems. Each of the five systems has an impact on a child's development concerning how it interacts with the others because they are interconnected (McLeod, 2023). The environmental factors that influence students' performance are the primary focus of this study.

The first level of Bronfenbrenner's theory is the microsystem which includes parents, siblings, teachers, classmates, and others who have direct contact with the child in their immediate environment. Relationships in microsystems are two-way. Children can be influenced by the people around them, and they can also change other people's beliefs and behaviors. A child's development depends on the intimate interactions taking place within microsystems. Second, the mesosystem encompasses the interaction between a child's microsystems. The individual microsystems of a person do not function independently but are connected and influence each other, like the interaction between a child's parents and teachers may affect the child's development. Third, exosystems define the larger social system in which the child does not function directly but may be affected or influenced by one of the microsystems. Neighborhoods, workplaces, friends, and the media are all examples of this system. Fourth, macrosystems explore how cultural factors affect child development such as the child's belief systems, values, and perceptions. An example of this is the culture's belief that parents should be solely responsible for raising their children so the culture will not provide resources to help parents which in turn, affects the structure in which the parents function. Lastly, Chronosystem consists of all environmental changes that occur over a lifetime and affect development, like significant life transitions and historical events. This

might include transitions typical of life, like starting school, and non-typical ones such as parents divorcing or needing to move to a new home (McLeod, 2023; Ryan, 2001).

Teachers are accountable for ensuring students receive accessible, responsive, and high-quality education throughout the health crisis, as stated in the "DepEd Order No. 034, s. 2022," which sought to resume five days of in-person classes on November 2, 2022, despite the COVID-19 pandemic's health crisis. This requires managing both positive and negative emotions as well as adjustments to the school environment, learning methods, and additional safety measures (Sarmiento, 2021). In addition, teachers impart knowledge, ethical principles, tradition, existing difficulties, and solutions to these difficulties to their students. Subsequently, executing face-to-face classes can assist with working on the scholarly execution, psychological wellness, and social commitment abilities of the students (MyPath Education, 2022).

The "No Child Left Behind Act of 2010," which aimed to protect and promote the right of all citizens to quality education at all levels, stipulates that teachers are responsible for providing students with equal opportunities and a well-rounded education. Additionally, teachers take the necessary steps to make such education accessible to all students considering the diverse needs and backgrounds of students (Truong, 2020). The objective is to provide the necessary framework and resources to implement education projects, programs, and services to achieve this objective.

The three factors: teacher-related, student-related, and environment-related are the various reasons for determining the student's mathematics performance. Teacher-related factors include personality traits, teaching skills, collaboration ability, and materials provided by teachers (Sherman, 2008). These include the teacher's ability to successfully involve students in the learning process and impart relevant knowledge. Student-related factors include learner interests, motivation, mental concentration, study habits, and self-directedness in learning (Ghasemi, 2018). These are considered unique prerequisites for mastering individual learning tasks. These also address learners' attitudes, beliefs, and emotional well-being. Environment-related factors include the school environment and the home environment. The school environment indicates the environment inside the school (Omolo, Otara, & Atieno, 2020). School environmental factors influencing academic performance in secondary schools, and the home environment indicates the family environment (Khan, Begum, & Imad, 2019). The capacity to learn and apply what one is reading or studying will result from a good study routine. These factors are determinants that can affect the mathematics performance of a student and are essential aspects of students' high failure rates in mathematics. Mathematics performance results from dynamic interactions between students, educators, mathematics activities, and educational conditions and environments.

1.3 Teacher-Related Factors

Teacher-related factors affect students' academic performance. Some of the key factors that can affect students' academic performance are methods, knowledge, expectations, classroom management, and feedback and assessment. On teaching methods, teachers should realize that learning becomes more effective if the students are tasked to perform rather than just ask

to remember some information (Ganyaupfu, 2013). Further, teachers' communication skills were good and influenced students' academic performance, but that teachers had excess workload that impinged their influence on students' academic performance (Obilor, 2020). On teacher knowledge, the teacher is indispensable in the instructional procedure; therefore, the quality of a teacher in terms of teaching experience, subject mastery, and questioning behavior can determine students' learning outcomes to a large extent (Olagbaju, 2020). A teacher's level of experience as well as the availability of learning materials significantly affect a student's academic performance (Briones et al., 2022). On classroom management, teachers who can maintain a positive and supportive classroom environment can help students feel more comfortable and engaged in their learning thus, significantly influencing and enhancing the academic performance of students. (Spencer, 2018; George, 2017). On teacher expectations, teachers who have high expectations for their students can motivate them to perform at a higher level (Pygmalion Effect) but teachers who have low expectations may inadvertently discourage students from achieving their full potential (Golem Effect). Teachers need to become aware of the potential negative consequences of communicating low expectations and adopt strategies that will help them raise expectations and students' performance (Keramida, 2010). On feedback and assessment, teacher feedback indirectly affects students' academic performance by promoting their learning engagement, and is more effective when the frequency, difficulty or diversity of assessments is high (Wang & Zang, 2020). However, the unsatisfactory academic performance of learners was due to some teacher-related factors such as: lack of teacher motivation, inadequate teacher preparedness, lack of punctuality and teaching aids as well as non-marking of learners' exercises (Siachifuwe, 2017).

1.4 Student-Related Factors

Student-related factors can also affect their academic performance. On motivation, the more motivated the student, the more likely to be engaged in class, complete assignments and seek help when needed. Students who are highly motivated are more likely to achieve academic success (Christiana, 2009; Kusurkar et al., 2013; Steinmayr et al., 2019) The attitude, self-efficacy, and mathematical skills of the students are predictive of their mathematical achievement. The type of school, that is private or public, educational organizations regularly assess the educational plan in relation to the achievement gap between public and tuition-based schools (Callaman & Itaas, 2020). On study habits, students who have good study habits including effective time management skills, note-taking strategies and active learning techniques are more likely to perform well in school (Sakirudeen & Sanni, 2017). Likewise, instructional materials used by teachers have an impact on student performance, additional activities for developing good study habits. Teachers can also use exercises to keep students interested and give them workbooks or textbooks to use as references (Landicho, 2021). On learning style, students have different learning styles which influenced motivation and learning outcomes (Pratama & Pinayani, 2019). Students preferred visual, group and kinesthetic as major learning styles while they manifest a moderate level of study habits as well as good level of academic achievement (Magulod, 2019). In terms of health, both physical and mental, can impact their academic performance. Poor health can result in missed

classes, decreased ability to concentrate, and lower energy levels which would result in a probability of failure, grade retention, and dropout (Shaw et al., 2015). Whereas, student's family background, including factors such as income level, parental education, and family support, involvement of parents with the things that their kids did at school except for gender, students are highly motivated to study, have fairly good study habits, have a slightly positive attitude toward education, and attribute their accomplishments to their efforts, and high students' performance (Balasico & Tan, 2020). Thus, parents have to pay attention and inspire their children to perform better in school. Colleges should also support students by creating an environment that encourages learning (Okbay et al., 2021). While, a student's relationships, positive peer relationships can lead to increased engagement and motivation, while negative peer relationships can lead to distraction and disengagement (Greater Good Science Center, 2022). Peer relationship was indirectly and positively associated with learning engagement via self-efficacy and academic resilience, respectively and sequentially (Shang & Kang, 2022). Peer teaching strategy as a tool can increase the mathematical achievement of students (Abuiyada, 2016).

The support and guidance provided by teachers can have a significant impact on a student's academic performance. There is strong evidence linking teacher support and students' academic emotions (Lei, Cui, & Chiu, 2018). Learner- and teacher-related factors influence mathematics performance (Mabena et al., 2021). On the other hand, undergraduate mathematics performance is positively correlated with school and government factors, albeit insignificantly so. Among other things, that the government and school administration should effectively manage lecturers and students and work with parents to improve undergraduate students' math performance (Zalmon et al., 2020).

It is essential to identify the best methods for secondary school math teachers that will assist them in providing future students with better entry-level knowledge for universities, as well as methods that will increase students' self-confidence and reduce their math anxiety, both of which have a significant impact on their performance in university mathematics because majority of the teachers have mixed feelings regarding the abilities of their students and the teaching-learning environment (Rus et al., 2020). The outcomes give data about the patterns of science accomplishment and related factors for teachers and different partners to think about the ramifications in educational program and informative acts of math at all degrees of schooling (Mazana et al., 2020). Most educators even have negative perceptions about instructors' capability, training technique, and understudies' inspiration to individually learn science. The majority of students have negative perceptions of the learning environment, teaching methods, and teachers' qualifications to teach mathematics (Demssie, 2019).

Student-related factors, and environment-related factors narrowed down to student-related factors (SRF), tutor-related factors (TRF), parent-related factors (PRF), and college-related factors (CRF) negatively correlated with each other and the learning outcomes students in their math performance (Kumah & Wonu, 2022).

Individual factors, teacher-based factors, and environmental factors were the three main themes that emerged from the data, along with eight subthemes (math anxiety, students'

inadequate practice, teachers' negative attitude toward mathematics, inappropriate teaching methods, an inconvenient teaching-learning environment, and family and social factors). The health and richness of the educational system can be harmed by these factors, particularly in mathematics (Kiarsi & Ebrahimi, 2019).

All of the student, family, and school-related characteristics were found to be significantly related to achievement. The most significant amount of variation in achievement was explained by factors related to students (Onder et al., 2021). Primarily, teacher competence is a school-level factor affecting mathematics performance of tertiary students, followed by classroom climate and school facilities, instructional materials, administrative and supervisory support (Velos et al., 2019). The school setting, prior students' mathematical achievement, parents' capacity to favorably affect their children's mathematical performance, and gender-related aspects also appear to be consistent which increased the number of enrolled students in tertiary institutions for statistics (Ayebale et al., 2020). Among ASEAN nations, the factors of students, families, teachers, schools, and policymakers influence mathematical achievement influence ASEAN countries' mathematical achievement so that close attention to all efforts to raise mathematical achievement (Maamin et al., 2021).

1.5 School-Environmental Factors

School environment is the set of relationships among school community members that are influenced by the educational institution's structural, personal, and functional factors, which distinguish schools (Fonllem et al., 2020). And, there is a positive relationship between the school environment and academic achievement, thus, efforts must be taken to strengthen the school environment (Harinarayanan, 2018). School environment that can impact the academic performance of students which include the key factors like curriculum, class size, school resources and culture, supportive environment, and parental involvement, adequate resources, libraries and high-quality instructional materials. A well-designed curriculum that is aligned with learning goals and standards can help students to achieve better academic outcomes (Samlesh et al., 2021). Another, the size of a class can also affect academic performance since students can find the opportunity to partake fully in all class activities but not with an overcrowded structure (Tsafe, 2014). Graphic and realia resources to be the most commonly used by teachers (Yusta et al., 2016). A positive school culture that promotes learning, respect, and academic excellence can inspire students to perform better academically because students can achieve higher scores on standardized tests in schools with healthy learning environments. (McNeil et al., 2009). School culture should be put into practice (Bayar & Karaduman, 2021). A positive and supportive school environment provides emotional and social support for students which includes having access to counseling services, peer support groups, and extracurricular activities with appropriate facilities, well-managed classrooms, and a clear, fair disciplinary policy (National Center on Safe Supportive Environments, 2023). Parent involvement in their child's education and support their academic pursuits can help to boost their academic performance and a child's academic performance, over and above the impact of the child's intelligence (Topor et al., 2010). Learning and mastery of mathematics can facilitate logical, analytical, critical, and abstract thinking among students (Cresswell & Speelman, 2020). On the other hand, students who

have poor performance in mathematics may suffer from mathematics anxiety, one of the categories of uneasiness and may harm students as it is continuously presented within mathematical problems (Yeo et al., 2015).

The theories and literature explained for this part come up with the framework in the conduction of this study. The teacher-related factors, student-related factors, and environmental-related factors were examined to determine the factors affecting the mathematics performance of the grade 10 students and the relationship between the identified factors and the mathematics performance of the students.

1.6 Statement of the Problem

This research conducted predictive analysis on the academic performance of Grade 10 students in Mathematics at the identified public high schools in Lapu-Lapu City and Cebu Province Division for school year 2022-2023 as the basis for proposed strategic intervention plans. In particular, data include the profile of respondents like age, sex, parents' highest educational attainment, and combined family monthly income. Further data on student-related factors – interest & study habits; teacher-related factors - personality traits, teaching skills and instructional materials used; environment-related factors - school environment and home environment; and, academic performance of the respondents in Mathematics. Based on the findings, a strategic intervention plan was proposed. To be tested at 0.05 level of significance, the identified factors do not significantly predict the academic performance of the respondents in Mathematics.

2. Research Methodology

2.1 Design

The researchers utilized a descriptive correlational design, which explains the variables and the connections that naturally exist between academic performance and teacher-related, student-related, and environment-related factors. This would provide a picture of the situation and establish a relationship (Panda, 2022). In this study, the data gathering would be in the form of a survey and would use simple random sampling techniques. The respondents would be measured once and would serve as a sample of the total population.

2.2 Environment

This study will be conducted in Lapu-Lapu City and Cebu Province Division, namely, Buyong High School (Mactan National High School Extension), Marigondon National High School, and Liloan National High School (formerly Arcelo Memorial National High School Extension). Marigondon National High School is located in Barangay Marigondon, Maximo V. Patalinghug Jr. Ave., Lapu-Lapu City. This is a public junior high school with a senior high school. It is 16.7 kilometers from Cebu City to Marigondon National High School. While, Buyong High School is located in Buyong Road, Barangay Maribago, Lapu-Lapu City. The school is within the perimeter of Buyong Elementary School. This school has been open for about three years. It is 19.3 kilometers from Cebu City to Buyong, Maribago, and Lapu-Lapu City via Basak-Marigondon Road. And, Liloan National High School is located in Barangay

Poblacion, Municipality of Liloan, Cebu, Philippines. Its geographical coordinates are 10°24' 20.4588'' north, 123°59' 42.3132'' east. It is 22.2 kilometers from Cebu City to Liloan via the Central Nautical Highway. The school is near the Municipal Health and Medical Center and the Panphil Frasco Sports Complex. It is a public school with an area of 9,214 square meters. This is a non-sectarian educational institution for junior and senior high school students.

2.3 Respondents

The research respondents of the study are the Grade 10 students from Buyong High School, Marigondon National High School, and Liloan National High School. There are 149, 1470, and 700 enrolled students in grade 10 at these schools for this year, 2022-2023, respectively. In this study, simple random sampling was administered, and a percentage of the population would be utilized to determine the appropriate number of respondents needed. For the number of respondents in each school, we have 75(17.24%) of the population of the students in Buyong High School, 220(50.57%) of the population in Marigondon National High School, and140(32.18%) of the population in Liloan National High School.

2.4 Instrument

One questionnaire, which consists of three parts, was used in this proposal. The first part is comprised of questions that inquire about the respondents' age, gender, parents' highest educational attainment, and combined family income. The second part is an adapted questionnaire from Balbalosa (2010), which consists of 30 statements describing student-related factors and mathematics-related factors. The third part is also adapted from Landicho (2021), which consists of 17 statements describing the environment-related factors. The respondents would check the intensity of feeling, emotion, or attitude once as to "extremely affected," "affected," "less affected," and not affected," wherein one (1) is the lowest and four (4) is the highest scale. Moreover, the mathematics performance of the respondents was measured using the first quarter grade. The grades would be retrieved with the aid of their subject teacher. (Appendix C).

2.5 Data Gathering Procedure

The researcher considered the steps to go through the data gathering process: permission from the DepEd superintendent, endorsed by the district supervisor and principal of the school, would be sought to administer the questionnaire to the respondents. A written letter request will be made for the superintendent's approval. The questionnaire would be personally administered to the students' respondents, with instructions on how they would answer it. Respondents were given the option of providing their names as part of The Data Privacy Act. We asked for their consent, and all data is considered confidential. To give ample time to the respondent to answer, the instrument would be retrieved the following day. The data would be sorted, summarized, tabulated, treated, interpreted, and analyzed.

2.6 Statistical Treatment of Data

After the retrieval and checking of the survey questionnaire, the data were gathered and

treated statistically. **Frequency Count** was used for tallying the number of respondents belonging to the same category. **Percentage** was be used to determine the proportion of the total respondents that belong to the category. **Weighted Mean** was used to determine the level of the data gathered as to the extent to which the factors affected the mathematics performance. **Multiple Regression** was used to test the relationship between the identified factors and the academic performance of the respondents in mathematics.

2.7 Scoring Procedure

To determine the level of factors affecting academic performance, rating scales 1 - not affected, 2 – less affected, 3 - affected, and 4 – extremely affected are used. When the rate falls within the range of 3.25-4.00, descriptive rating is extremely affected; 2.50-3.24 is affected, 1.75-2.49 is less affected, and 1.00-1.74 is not affected. The scoring ranges for academic performance are 90-100 as outstanding, 85 – 89 as very satisfactory, 80 – 84 as satisfactory, 75 – 79 as fairly satisfactory and below 75 as did not meet the expectations.

3. Results and Discussions

3.1 Profile: Age and Sex

Most of the respondents are the right age of schooling that is, expected age of the regular Grade 10 students with 15.45 years old while the average age of the female respondents is 15.5 years old. Most of them entered school at the age required by Department of Education. For those who are older than the other students, they could encounter the effects of attending a school that is older than their peers (Peteros et al., 2019). However, the composition of the respondents has more female students who are younger than the male students. Sex has a significant impact on students' academic performance, with female students performing better (Aransi, 2018). While, older students are more likely to employ academic success and achievement-linked learning strategies and older students are more mature and motivated to succeed academically. It is observed in their respective locations, where older students are more committed to their education and eager to complete assignments (Douglas et al., 2020).

Table 1. Parents' Highest Educational Attainment

Educational Attainment	Mother		Father	
	f	%	f	%
College Graduate	76	17.47	84	19.31
College Level	58	13.33	40	9.20
High School Graduate	171	39.31	173	39.77
High School Level	51	11.72	56	12.87
Elementary Graduate	39	8.97	31	7.13
Elementary Level	36	8.28	40	9.20
No Formal Schooling	2	0.46	5	1.15
No Response	2	0.46	6	1.38
Total	**435**	**100.00**	**435**	**100.00**

There were 171 out of 435 respondents' mothers whose highest educational attainment is high school graduate which comprised 39.31 percent of the respondents' mothers followed by 17.47 percent of them reached college level. Moreover, there were 173 or 39.77 percent were high school graduate followed by 84 or 19.31 percent of them were college graduate. There were only five or 1.15 percent of them had no formal schooling. In general, the respondents' mother had higher educational attainment than the respondents' fathers. Parents' level of education can motivate their children to do better in school which serves as inspirations and role models for their children. Parents who support their children's school works and activities will help enhance the sense of self-concept of the child. Particularly in Mathematics, when parents can contribute to the Math-related tasks of their child, this would help builds up a positive self-concept of the child because self-concept is developed through experience (Peteros et al., 2019). Parents' educational attainment encourages their children to have better performance in school (Yohannes et al., 2021). While, educated parents showed interest in their children's academic performances by meeting and cooperating with the school personnel to ensure their children seriousness in their studies. Thus, parents positive attitude influenced the children academic achievement (Ayebale et al., 2020).

3.2 Combined Family Monthly Income

Family income is defined as the combined gross income that is derived from any source by all family or household members who are currently residing together in the same dwelling unit. This variable is needed to help explain the results of the study.

Table 2. Combined Family Monthly Income

Monthly Income (in pesos)	f	%
Above 30,000	32	7.36
25,001-30,000	8	1.84
20,001-25,000	26	5.98
15,001-20,000	58	13.33
10,0001-15,000	87	20.00
10,000 and below	224	51.49
Total	**435**	**100.00**

There were 224 (51.49%) out of 435 respondents whose combined family monthly income is P10,000-and-belo of the respondents followed by 87(20%) of them has a combined family monthly income P10,001 to P15,000. Moreover, 32 (7.36 %) of the respondents has a combined family monthly income of above P30,000. There were 8(1.84%) them had a monthly income of P25,001 to P30,000. Higher family monthly income would give more financial support to students and therefore, they can buy and create the activities that the teacher required to do than those students' family who had lower monthly income. The combined family income of P10,000.00 and below with the highest frequency of 84(60%) implies the families below poverty line. In schooling the students need financial support for their school needs. In Abraham Maslow Theory, one of the hierarchy of needs is to meet the

psychological needs and need for security in order to reach the one's goal which can involve financial needs in education. Students needs financial support from their parents to do their learning task as to perform their duties as students, like doing their project and some other performance tasks that may require money or financial assistance (Noltemeyer et al., 2021). Besides, family social class or socioeconomic status has a significant impact on child development, laying the groundwork for lifelong growth, change, and functioning benefitting their physical, emotional, psychological, behavioral, cognitive, and educational outcomes resulting to a well-supported financially student is eager to complete their tasks in school (Wen et al., 2020).

3.3 Student-Related Factors

Student-related factors include interest and study habits. Interest is a powerful motivational process that stimulates learning, guides academic and professional decisions, and is essential to academic success. While, study habits pertain to the means and magnitude of attention the students spare to learn about their lessons.

Table 3. Student-related Factors: Interest

S/N	Indicators	WM	Verbal Description
1	I make myself prepared for the math subject.	2.86	Affected
2	I listen attentively to the lecture of my math teacher.	3.10	Affected
3	I actively participate in the discussion, answering exercises and/or clarifying things I did not understand.	2.64	Affected
4	I want to get good grades on tests, quizzes, assignments and projects.	3.37	Extremely Affected
5	I get frustrated when the discussion is interrupted or the teacher is absent.	2.46	Less Affected
	Aggregate Weighted Mean	**2.89**	**Affected**

Legend: 3.25-4.00-Extremely Affected; 2.50-3.24-Affected; 1.75-2.49-Less Affected; 1.00-1.74-Not Affected.

The table showed that the respondents' mathematics performance was affected by the student-related factors as to interest (μ=2.89). Item 4 (μ=3.37) signifies that the mathematics performance of the respondents was extremely affected by the desire of getting good grades on tests, quizzes, assignments, and projects. On the other hand, students were less affected by being frustrated when the discussion is interrupted or the teacher is absent (μ=2.46). This implies that students were eager to learn the subject and to get good grades by preparing for the subject as well as actively participating in the tasks given. Students' interest in mathematics plays a key role in the acquisition of math skills and knowledge and this means that it is a very important factor in order to achieve academic performance in Mathematics (Landicho, 2021). That students' interest in learning improves academic performance and provided insights into the role of academic interest in academic performance across

disciplines while lack of interest can lead to failure to read the culture, especially in mathematics textbooks and workbooks (Wu et al., 2019).

Table 4. Student-related Factors: Study Habits

S/N	Indicators	WM	Description
1	I do my assignments regularly.	3.19	Affected
2	I exert more effort when I do difficult assignments.	3.00	Affected
3	I spend my vacant time in doing assignments or studying my lessons.	2.58	Affected
4	I study the lessons I missed if I was absent from the class.	2.66	Affected
5	I study and prepared for quizzes and tests.	2.94	Affected
6	I study harder to improve my performance when I get low grades.	3.11	Affected
7	I spend less time with my friends during school days to concentrate more on my studies.	2.58	Affected
8	I prefer finishing my studying and my assignments first before watching any television program.	2.79	Affected
9	I see to it that extracurricular activities do not hamper my studies.	2.55	Affected
10	I have a specific place of study at home which I keep clean and orderly.	2.73	Affected
Aggregate Weighted Mean		2.81	Affected

In table 4, the mathematics performance of respondents was affected by the student-related factors as to study habits (μ=2.81). In addition, items 1(μ=3.19) and 6 (μ=3.11) imply that the mathematics performance of the respondents were affected on doing the assignments regularly and studying harder to improve their performance when they get low grades. On the contrary, items 3(μ=2.58) and 7(μ=2.58) indicate that the mathematics performance of the respondents was affected on spending their time in doing assignments or studying their lessons and spend less time with their friends during school days to concentrate more on their studies. This suggests that students were practicing good study habits, keen on studying harder, and getting good grades in school. Study habits can increase motivation and turn learning into a highly rewarding and effective process, ultimately increasing learning as what the researchers observed in their respective locale (Landicho, 2021). Students' interest on the subject and their study habits affects their mathematics performance.

3.4 Teacher-Related Factors

Teacher-related Factors includes personality traits, teaching skills and instructional materials used.

Table 5. Teacher-related Factors: Personality Traits

S/N	Indicators	WM	Description
1	Has a good relationship with the students and teachers.	3.05	Affected
2	Shows smartness, confidence and firmness in making decisions.	2.94	Affected
3	Imposes proper discipline and is not lenient in following the prescribed rules.	2.99	Affected
4	Has an appealing personality with good sense of humor.	3.00	Affected
5	Is open to suggestions and opinions and is worthy of praise.	2.93	Affected
Aggregate Weighted Mean		2.98	Affected

Table 5 shows that the respondents' mathematics performance is affected by the teacher-related factors as to personality traits (μ=2.90). Item number 1 (μ= 3.05) signifies that the mathematics performance of the respondents is affected by a good relationship between the students and teachers. IN addition, students are affected by being open to suggestions and opinions and is worthy of praise (μ=2.93). Students are motivated to learn based on the personalities of the teachers that have been shown (Adrales et al., 2019). By understanding personality profiles, educators can proactively identify who is a better fit for each student. Such a finding is true with what the researchers have noted in their respective locales, where students tend to study harder when the teacher shows and encourages positive traits, which would lead to better performance in school (Maazouzi, 2019).

Table 6. Teacher-related Factors: Teaching Skills

S/N	Indicators	WM	Description
1	Explains the objectives of the lesson clearly at the start of each period.	3.12	Affected
2	Has mastery of the subject matter.	3.07	Affected
3	Is organized in presenting subject matters by systematically following course outline.	3.01	Affected
4	Is updated with present trends, relevant to the subject matter.	2.85	Affected
5	Uses various strategies, teaching aids/devices and techniques in presenting the lessons.	3.05	Affected
Aggregate Weighted Mean		3.02	Affected

Table 6 shows that the respondents' mathematics performance is affected by the teacher-related factors as to teaching skills of the teachers (μ=3.02). Item number 1 (μ=3.12) signifies that the mathematics performance of the respondents is affected when the teacher explains the objectives of the lesson clearly at the start of each period. IN addition, item number 4 (μ=2.85) signifies that the respondents were affected by being updated with present trend, relevant to the subject matter. Teaching methods and abilities have an impact on

students' academic performance (Adrales et al., 2019). Teaching skills of teacher have positive impact on student's performance in mathematics and students tend to do better when there is a variety of teaching strategies as well as having a mastery of the subject (Landicho, 2021).

Table 7. Teacher-related Factors: Instructional Materials Used

S/N	Indicators	WM	Description
1	Chalk and blackboard in explaining the lessons.	3.23	Affected
2	workbooks/textbooks	2.82	Affected
3	PowerPoint presentations (visual aids)	2.90	Affected
4	Articles	2.61	Affected
5	materials for project development	2.86	Affected
Aggregate Weighted Mean		2.88	Affected

Table 7 shows that the respondents' mathematics performance is affected by teacher-related factors as to instructional materials used by the teacher (μ=2.88). Moreover, the use of chalk and blackboard in explaining the lessons are affecting the mathematics performance of the students (μ=3.23). However, the used of articles affect (μ=2.61). These materials help teachers and students share their knowledge and discover each student's full potential and the utilization of instructional materials helps students be motivated to learn the lesson, and through this, improved mathematics performance is evident (Abubakar, 2020). Instructional materials can let students interact with words, ideas, and symbols in ways that help them learn new skills. Learning is made more interesting, practical, real, and appealing by instructional materials which are highly important for teaching and may also serve as motivation on the teaching-learning process (Ordu & Amadi, 2019). Students and teachers effectively share their insights and actively participate using instructional materials (Abubakar, 2020). The instructional materials help students and teachers to communicate about learning, assist teachers to establish clear learning goals for students and to let the students understand and improve their performance (Ordu & Amadi, 2019).

3.5 Environment-Related Factors

Environment-related factors are factors such as school environment and home environment. These are different determinants that can affect the mathematics performance of a student and are very important aspect of students' high fail rate in mathematics.

Table 8. Environment-related Factors: School Environment

S/N	Indicators	WM	Description
1	The learning resources (textbooks, software, relevant reading materials, videos, and recordings) in my school are available.	2.92	Affected
2	Media affects my mathematics performance.	2.69	Affected
3	The facilities (electricity, water, toilet, transportation, and infrastructure) in my school are available.	2.92	Affected
4	The teaching and learning process (teachers, assessment, learning-workload, subject goal/objectives) in my school is evident.	3.13	Affected
5	The learning community (students, peer interaction, and the teacher) in my school affect my mathematics performance.	2.76	Affected
6	The cultural and social values (respect, kindness, honesty, technical knowledge, computer literacy and etc.) in school affect my mathematics performance.	2.93	Affected
	Aggregate Weighted Mean	2.89	Affected

Table 8 shows that the respondents' mathematics performance is affected by environment-related factors as to school environment (μ=2.89). Item number 4 (μ=3.13) signifies that the mathematics performance of the respondents is affected by the teaching and learning process (teachers, assessment, learning-workload, subject goal/objectives) in the school is evident. Additionally, media is affecting the mathematics performance of the students. Learning can't happen without a supportive and upbeat environment, a setting where good relationships with teachers and peers thrive. School environment rouses students to finish their responsibilities in school (Adewale et al., 2021). A positive nurturing environment motivates students to complete their schoolwork by an effective and improved school environment.

Table 9. Environment-related Factors: Home Environment

S/N	Indicators	WM	Description
1	Family ensures that you do your homework.	2.89	Affected
2	Family asks you about your school works.	2.91	Affected
3	The work given at home by my parents interfere with my mathematics performance.	2.54	Affected
4	My parents/guardians visit my school to inquire about my progress.	2.17	Less Affected
5	My parents/guardians provide me with all learning resources that I require.	2.89	Affected
6	My family praises me when I do well in school.	2.98	Affected
7	My family encourages me to work hard in school.	3.14	Affected
8	My parents/guardians buy me extra personal material required at school.	2.86	Affected
9	My parents/guardians give me money to attend school organized events/tours.	2.91	Affected

10	Coaching at home is evident.	2.43	Less Affected
11	The cultural and social values (respect, kindness, honesty, technical knowledge, computer literacy) at home affect my mathematics performance.	2.91	Affected
Aggregate Weighted Mean		2.78	Affected

The respondents' mathematics performance is affected by the environment-related factors as to home environment (μ=2.78). Item number 7 signifies that the mathematics performance of the respondents is affected by the family encouraging their child to work hard in school (μ=3.24). However, students are less affected by the parents/guardians visit the school to inquire their child's progress (μ= 2.17) and coaching at home is evident (μ=2.43). Family involvement might facilitate students' learning at home, encourage continuous follow-up, and motivate them to achieve better academic results. A good home environment improves students' mathematics performance. Such a result is consistent with what the researchers have observed: students are motivated to learn and do every task given when members of the family interact and encourage them to perform well in class (Khan et al., 2019). Student has learned from the subject at a minimal level. A student's achievement in mathematics is measured by how well they can complete math-related tasks and how competent they are in the subject (Abin et al., 2020).

Table 10. Academic Performance of the Respondents in Mathematics

Level	Numerical Range	f	%
Outstanding	90-100	64	14.71
Very Satisfactory	85-89	157	36.09
Satisfactory	80-84	180	41.38
Fairly Satisfactory	75-79	33	7.59
Did not Meet the Expectations	Below 75	1	0.23
Total		435	100
Mean		84.76	
St. Dev.		4.42	

In table 10, out of 435 respondents, 33(7.59%) had considerably fair satisfactory mathematics performance. 180(41.38%) had a satisfactory performance. 157(36.09%) had a very satisfactory and only 64(14.71%) had an outstanding academic performance in the mathematics subject. Only one of them did not meet the expectations or did not pass the subject. The student has learned from the subject at a minimal level. Generally, the respondents' average grade is 84.76 (satisfactory performance) after the first grading period. Students met the minimum standards as students in school but needs to be improved. The majority of respondents performed quite satisfactorily, which does not bode well when it comes to the teaching and learning process.

Table 11. Regression Analysis of the Respondents' Mathematics Performance

	R square	df	*F*	Standard coefficients(β)	*t* -Stat	*p*-value
Regression	0.096	7	6.453*			0.000
Residual		427				
Total		434				
Constant					61.060	.000
Students' Interest				.099	1.545	.123
Study Habits				.023	.344	.731
Teacher's Personality				.026	.356	.722
Teaching Skills				.240	3.116*	.002
Instructional Materials Used				-.133	-2.180*	.030
School Environment				-.004	-.070	.944
Home Environment				.055	.864	.388

**significant at p < 0.05*

The profile of the students explains 9.6% of the variation in their mathematics performance. The computed $F_{(7,427)} = 6.453$ and $p < 0.05$ denote that the model is a significant predictor of the mathematics performance of the students. Teaching skills affects the most of the mathematics performance with a beta value of 0.240 followed by students' interest (β = 0.099), home environment (β = 0.055), teacher's personality (β = 0.026), study habits (β = 0.023), school environment (β = -0.004) and instructional materials used (β = -1.33). The test on the significance of the regression coefficient of teaching skills (t = 3.116, p = 0.002) and instructional materials used (t = -2.180, p = 0.030) indicate that these variables are significant predictors of the mathematics performance of the students. However, the test of the regression coefficient of students' interest (t = 1.545, p = 0.123), home environment (t = 0.864, p = 0.388), teacher's personality (t = 0.356, p = 0.722), study habits (t = 0.344, p = 0.731), and school environment (t = -0.70, p = 0.944) imply that these variables are not significant predictors the mathematics performance of the students. To achieve academic success, teachers must have effective teaching skills and use instructional materials. Professional learning of the teacher prospects has great influence on student learning outcomes as its emphases on precise teaching skills (Didion et al., 2020). Teachers must enhance their skills by applying a variety of teaching strategies and use instructional materials (Ordu & Amadi, 2019). In this era of globalization and technological uprising, respondents still need to improve their skills. Students' study habits play a special role in their academic success and are the most significant predictor of academic performance (Jafari et. al, 2019; Tus et al., 2020). Additionally, the home environment is the most important factor in determining students' academic success (Khan et al., 2019).

4. Conclusion

The teacher's teaching skills and the instructional materials used by the teacher can predict the academic performance of respondents in mathematics.

5. Recommendations

In the light of the findings of the study, it is highly recommended that the proposed intervention plan be utilized and monitored to improve the academic performance of the respondents in Mathematics be adopted.

6. Output of the Study

This chapter presents the proposed strategic intervention plan which aimed to improve the study habits of the students in Marigondon National High School, Buyong High School and Liloan National High School in Cebu.

STRATEGIC INTERVENTION PLAN

Rationale

The teachers are expected to construct meaningful educational experiences that allow students to solve real-world problems and promote students' academic progress. They have seminars and trainings to enhance their teaching skills to meet with the school expectations. However, most of the students are satisfied with their satisfactory performance in mathematics. To be globally competitive and to achieve success, students must achieve outstanding performance.

Mathematics is the subject that most of the students find it difficult that is why it would result to low academic performance. The thing that makes this subject difficult for several students is that it takes patience and persistence. Hence, it is important that students exert more effort to learn better and understand more about the concepts. Otherwise, students will always have poor mathematics performance. Nonetheless, low performance in mathematics is still a problem in our country because some students are not able to meet the expectation set by Department of Education. It is time that this problem will be solved to achieve high performance in math.

Objectives

With the implementation of this intervention plan, it is expected that the following objectives are achieved:

- Shall have improved students' mathematics performance
- Shall have student learning centered classroom environment
- Shall have motivation to engage in ever discussion
- Shall have positive feedback with students' mathematics performance
- Shall have developed a sense of importance of math in real-life situations

Scheme of Implementation

In order that the proposal will be known to all students of the (3) identified schools namely: Marigondon National High School, Buyong High School and Liloan National High School, it

is planned that this proposal will be presented to the principals and all the teachers of the school. In addition, the topic of this study will be disseminated to the teachers prior to the enrollment of the students in school and will be given copies of the suggested activities of the proposal for improvement of the mathematics performance of the students. Evaluation will follow.

STRATEGIC INTERVENTION PLAN

(Marigondon National High School)

Areas of Concern	Objectives	Strategies	Persons Involved	Budget	Source of Budget	Time Frame	Expected Outcome	Actual Accomplishment	Remarks
A. Students' Interest	To develop students' interest in the subject	Apply different strategies and techniques to boost students' interest Teachers must refrain from always being absent from the class Provide activities that will let the students build confidence in solving mathematical problems	Teachers and students	P 5, 000	School MOOE	One year	Developed students' interest in the subject		
B. Students' Study Habits	To have effective study habits of the students	Raise awareness on the students about the study habits and its effectiveness Provide workshops to determine and apply their own effective study habits Supply activities that will let the students practice their ways of studying Encourage students to organize study group sessions and to manage their time wisely	Teachers and students	P 5,000	School MOOE	One year	Students were able to determine and practice their own effective study habits		

C. Students' Home Environment	To develop family involvement with the student	Establish awareness on the parents and guardians about the home environment and its impact on students' academic performance Conduct meetings with parents about the importance of family involvement with the student Give activities that will allow any of the family members to provide unending support to the student	Students, teachers, and parents	P 5,000	School MOOE	One year	Developed family involvement with the student		

STRATEGIC INTERVENTION PLAN

(Buyong High School)

Areas of Concern	Objectives	Strategies	Persons Involved	Budget	Source of Budget	Time Frame	Expected Outcome	Actual Accomplishment	Remarks
A. Students' Study Habits	To have a effective and efficient study habit of the students	Conduct seminars to know the importance of having study habits Provide awareness on the students to determine the different effective study habits and apply them to their own way of studying Encourage students in having study group sessions for interaction with their peers Provide a small and quiet place or room for students who wants to study on their own Let the students practice their ways of studying	Teachers and students	P 10, 000	School MOOE	One year	Students were able to determine their own effective and efficient way of studying		

B. Students' Learning Environment	To build a positive learning environment where learners are encourage and motivated to engage in every discussion. To provide an environment that foster social relationship among the learners in which they are respected and appreciated.	Know the learners well and make sure to attend to their needs Reiterate to them the value of respect in the classroom Establish awareness on the children about the diversity of people and how would this diversity be used as a strength for the class Promote respect on the individual differences Provide activities that will encourage interaction among the members of the class	Administ r ators, Teachers and Students	P 20,000	School MOOE	One year	Learners are motivated because they feel that they are supported Learners live harmoniously and they respect one another A friendly and suitable environment		

STRATEGIC INTERVENTION PLAN

(Liloan National High School)

Areas of Concern	Objectives	Strategies	Persons Involved	Budget	Source of Budget	Time Frame	Expected Outcome	Actual Accomplishment	Remarks
D. Student-Related Factor a. Attitudes	Develop upright attitudes towards learning	Conduct symposium Assess the lesson to determine the learning outcome Provide good study habit techniques	Administrato r, Teachers and students Teachers and students Teachers and students	P 5,000 P500	School MOOE, personal, solicited from stakeholder School MOOE, personal	One week Througho ut the year Three days	Enjoyed Math in learning process Improved academic performance Improved study habits and learning outcomes		
b. Study Habits	Develop study habits	Conduct peer study at least twice a week	Teachers and students	P500 P500	School MOOE, personal School MOOE, personal	Througho ut the year	Improved learning outcomes		

E. Teacher-Related Factor **a. Instructional Materials**	Enhance the utilization of instructional materials	Read and research multi-level instructional materials	Administrator and Teachers and Students	P50,000	School MOOE, personal	Throughout the year	Prepared instructional materials		
		Prepare and apply appropriate instructional materials in the lessons	Teachers and Students Administrator, Teachers	P5,000	School MOOE, personal	Throughout the year	Prepared appropriate instructional materials		
		Application, demonstration school exhibit in Mathematics instructional materials	and students Administrators and Teachers and students	P5,000	School MOOE, personal	Throughout the year	Prepared appropriate instructional materials		
		Provide teachers with appropriate assistive technology inside the classroom		P 50,000	School MOOE, PTA	One year	Teachers equipped with skills on using assistive technology and assessing children with special needs		
F. Environment-Related factors: **School** **a. Teaching and learning process, learning community**	To equip teachers with skills on using assistive technology and assessing children with special needs	Conduct trainings on using different assistive technology and modifying assessment for children with special needs	Administrators and Teachers and students	P 50,000	School MOOE, PTA	One year	Teachers equipped with skills on using assistive technology and assessing children with special needs		
		Collaborate with SPED teachers on designing the methods of assessment for children with special needs	Administrators and Teachers and students	P10,000	School MOOE, PTA	One year	Teachers equipped with skills on using assistive technology and assessing children with special needs		
Home **b. Family encouragement and support**	To keep the family aware of the school performance of the students	Parent orientation and involvement in school activities	Administrators and Teachers and students	P10,000.	School MOOE, PTA	One year	Collaborative effort of both school and parent		

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