Mathematical Abilities of Freshman Students: Basis in the Development of an Enrichment Material

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ABSTRACT

The study determined the mathematical ability of the freshman students who were product of the K12 Curriculum to have a basis in the development of an enrichment material. This study sought to answer the following problems: the respondents' profile, their mathematical abilities in the diagnostic test implemented, and significant difference in the mathematical abilities of the students across their profile variables.

This study used a descriptive-developmental research method in the development and validation of the diagnostic test on selected topics in General Mathematics and Basic Statistics and Probability. The main data gathering instrument used in this study includes a questionnaire checklist and a diagnostic test.

It was found out that the overall mean score of the freshman students on the diagnostic test in terms of the mathematic topics covered is 23.46 with a standard deviation of 5.84. Also, out of the 50-items diagnostic test, students got 60.15% correct answer which is greater than half of the total number of items. Therefore, students have the conceptual understanding on the mathematics topics but does not perform well in procedural knowledge which affects their problem-solving ability.

In the light of the findings and conclusions, it is recommended to have intense and advanced enhancement on the problem-solving skills of the students especially in work problem must be implemented through giving problem sets and exercises by giving more emphasis on their process of solving. Therefore, there is a need for an Enrichment material on the basic mathematics and problem-solving.

Keywords: *Mathematical Abilities, Development, Enrichment Material*

Introduction

Mathematics, one of the analytical fields of knowledge for understanding various aspects of life, is considered the technological foundation of modern society. Recent studies revealed that science and mathematics are related to the technological progress of the community. A mathematically literate student recognized the role of mathematics to make justified judgments and decisions needed by productive, engaged, and reflective citizens (OECD, 2020). However, not all students see mathematics in that way. They consider mathematics as a tough, unimportant, and uninteresting subject that affects their performance in Mathematics.

Many students struggle in Mathematics and become disaffected as they continually encounter obstacles to engagement. The students studying mathematics also have had continuous negative experiences with Mathematics. However, they are still taking up the subject because of the irresistible pressure from the teachers, the whole school system, and the curriculum. Consequently, hopelessness towards Mathematics affects the students' mathematical abilities and the students' performance. Difficulties in the concepts learned, instructional competence, and availability of appropriate instructional materials for teaching were some of the aspects that result in the student's poor performance in Mathematics (Amir et al., 2018).

The condemning goal of the refinement of education in the United States is the increasing academic achievement for all students. The improvement of student learning in STEM subjects is the focus of educators and policymakers because workers' proficiency in STEM fields is considered vital to the economy (Atkinson and Mayo 2010; PCAST 2012). TIMSS – Trends in International Mathematics and Science Studies, evaluates the level of mathematics and science competencies of the students worldwide every three years. TIMSS data shows that the skills and competencies in mathematics and science rank at the bottom: 41st and 42nd, respectively, from 45 participating countries. (Icutan et al., 2016). About the declination of the Filipino students' performance in Mathematics, Dinglasan et al. (2013) revealed that the students who took Algebra and Trigonometry could not meet the required criteria in Mathematics.

By understanding the underlying cognitive functions is one of the ways we can improve these. Theoretical and experimental evidence suggests that "core" and "noncore" skills lead to mathematical ability. The innate capacity to attend to and numerical process information are the core skills. At the same time, "noncore" competency is non-exclusive to the mathematical domain such as executive functions, spatial skills, and attention but is crucial for mathematical cognition. (Kadosh, 2016)

The Philippine curriculum has been restructured from the former 10-year fundamental education into a 13-year mandatory education by Republic Act No. 10533, known as the "Enhanced Basic Education Act of 2013". As the study of Jaudinez (2019) shows, teachers are flexible and resourceful in all means to deliver the intended curriculum effectively. There are deficiencies along with teaching strategies, mathematical and technological tools, training, and performance-based activities. The contents and competencies of the lessons are repeated or inappropriate from the fundamental education has been disregarded. It is, therefore, envisioned that the graduates of the K to 12 programs have employment opportunities by preparing them to be globally competitive (Cabansag, 2014).

Even after passing out from high school, students do not possess conceptual understanding in all mathematics content domains, which might affect their fluency in problem-solving. Problem-solving is one of the utmost processes defined in the National Council of Teacher of Mathematics (NCTM) Standards for School Mathematics (NCTM, 2000). Problem-solving can provide opportunities for students to apply content knowledge in all the mathematics domains. Students must learn both fundamental concepts and other procedural mastery for problem-solving. National Research Council (2001) outlined in this document "Adding It Up: Helping Children Learn Mathematics," which includes conceptual understanding.

According to the World Bank report (2007), in most developing countries, not enough Mathematics teachers are being produced by Universities and Colleges. Therefore, College and University graduates are being encouraged to pursue these courses purposely to fill the gap. Students' performance in mathematics has been investigated through bilateral surveys in two European countries (Robertson, 2000). Teacher's quality, supported by training and experiences, has an influencing role in effective teaching-learning. Teaching experience plays a vital role in the success of education. The requirement of urgent attention to improve the performance of the secondary school was indicated, considering societal needs.

A study by Icutan et al. (2016 p 37) concludes that students under other courses performed below average in college algebra and found difficulty in two areas of the subject: radicals and problem-solving. With these results, we can say that students lack critical thinking and understanding of the basic concepts in mathematics. Therefore, instructors should emphasize their teaching strategies in teaching problem solving and let them understand in interpret mathematical statements, then teach them intensely the needed solving skills. However, the said study differs from the current study in terms of the respondents' course, subject areas involved, and some of the statements of the problems.

Urdaneta City University aims to produce professionals. Two of the courses under the undergraduate program are Bachelor in Elementary Education and Bachelor in Secondary Education. The College of Teacher Education sets the ideals for excellent future teachers who will translate the best possible quality of learning in their institutions. With this, there is an urgent need to make sure that the student teachers produced by the institution will be nationally or even globally competent by being well-versed in Mathematics, especially in problem-solving.

Hence, the wishes to determine the mathematical abilities of the Freshman students under the K12 program not only to find out their strengths and weaknesses in the area of Mathematics but also to have a basis in making an enrichment material for future student teachers.

Literature Review

Mathematical Ability

These skills contribute towards the processing of information effectively in solving problems. It begins with a clearer understanding of the concept, strategic knowledge, that helps children devise and monitor a solution vital for solving problems successfully (Mayer, 2008).

Conceptual Understanding

Students demonstrate conceptual understanding in mathematics when they provide evidence that they can recognize, label, and generate example of concepts; use and interrelate models, diagrams, manipulatives, and varied representations of concepts; identify and apply principles, know and apply facts and definition; compare, contrast, and integrate related concepts and principles; recognize, interpret, and apply the signs, symbols and terms used to represent concepts. Conceptual understanding reflects a students' ability to reason in setting involving the careful application of concept definitions, relations, or representations of either.

Procedural Knowledge

Students demonstrate procedural knowledge in mathematics when they select and apply appropriate procedures correctly; verify or justify the correctness of a procedure using concrete models or symbolic methods; or extend or modify procedures to deal with factors inherent in problem settings. Procedural knowledge encompasses the abilities to read and produce graphs and tables, execute geometric constructions, and perform non-computational skills such as rounding and ordering. Procedural knowledge is often reflected in a student's ability to connect an algorithmic process with a given problem situation, to employ that algorithm correctly, and to communicate the results of the algorithm in the context of the problem setting.

Problem Solving

Students demonstrate problem solving in mathematics when they recognize and formulate problems; determine the consistency of data; use strategies, data, models; generate, extend, and modify procedures; use reasoning in new settings; and judge the reasonableness and correctness of solutions. Problem-solving situations require students to connect all of their mathematical knowledge of concepts, procedures, reasoning, and communication skills to solve problems.

Conceptual Understanding and Procedural Knowledge

Concepts are the building blocks of knowledge (Charlesworth, 2012). Conceptual understanding and procedural knowledge are essential to develop skills in problem solving (Geary, 2004). These skills contribute towards the processing of information effectively in solving problems. The five strands of mathematical proficiency, conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive disposition, by Kilpatrick,

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Swafford and Findell (2001) presents the interdependence of the five components of learner's mathematics proficiency in problem solving. It starts with a clear grasp and understanding of the concept, to acquisition of mathematical concepts, strategic knowledge, which is required to help children devise and monitor a solution, is vital for solving problems successfully (Mayer, 2008).

Conceptual knowledge is in general an abstract knowledge addressing the essence of mathematical principles and relations among them, while procedural knowledge consists of symbols, conditions, and processes that can be applied to complete a given mathematical task (Hiebert & Lefevre, 1986). Procedural knowledge is meaningful only if it is connected to a theoretical fact. Faulkenberry (2003) suggests that conceptual knowledge is rich with relations, and refers to the basic mathematics constructs and relations between the ideas that illustrate mathematical procedures, and gives it a meaning. On the other hand, procedural knowledge addresses the mastery of mathematical skills, acquaintance of the procedures to determine the mathematical components, algorithms, and definitions. Many researchers suggest that both conceptual knowledge and procedural knowledge are important components in understanding mathematics (Desimone et al., 2005; Hiebert et al., 2005).

For instance, in understanding of area measurement, procedural fluency, and reflections on the accuracy of solutions for measuring areas, represents higher-order thinking skills (Lehrer, 2003). While investigating children's conceptions of Area Measurement and their strategies for solving Area Measurement problems, Huang, Witz (2012) found that children who had a good understanding of the concept of area and the area formula (by using the property of multiplication) exhibited competency in identifying geometric shapes, using formulas for determining areas, and self-correcting mistakes. The children who had a good understanding of multiplication underlying the area formula, but misunderstood the concept of area, showed some ability to use area formulas. Conversely, the children who were unable to interpret the property of multiplication underlying the area formula irrespective of their conceptions of area exhibited the common weaknesses in identifying geometric shapes and differentiating between area and perimeter. The general concept of area refers to the amount of a 2D region within a boundary, while area measurement concerns measuring the quantity of a surface enclosed within a 2-D region (Lehrer, 2003). This incorporates the prior concept of area and measurement skills. The strategic knowledge of area measurement contains a conceptual understanding of basic facts and the knowledge of efficient strategies in solving problems with justified reasoning. Though there are various ways to solve area measurement problems, appropriate use of formulas based on conceptual understanding can be considered an efficient strategy (Lehrer et al., 2003).

Problem Solving

Problem Solving is one of the major processes defined in the National Council of Teachers of Mathematics (NCTM) Standards for School Mathematics (NCTM, 2000). Problem solving involves students in applying four other processes: Reasoning, Communication, Connection and Representation. Jonassen (2003) defines problem solving as an individual thought process because the previously learned law can be applied in solving problems in any situations. It is also deemed to be a new type of learning and is the result of application of knowledge and procedures of the problems (Mc Gregor, 2007).

Problem solving can also provide opportunities for students to apply content knowledge in the areas of Number and Operations, Algebra, Geometry, Measurement, and Data Analysis and Probability. Problem solving provides a window into children's mathematical thinking and thus is a major technique of assessment.

According to Jawhara (1995), problem solving activities can open opportunities for students to learn freely. In their own ways, students will be encouraged to investigate, seek for the truth, develop ideas, and explore the problem. These features are necessary in order to face the challenges of future (Kilpatrick et al.,2001), Pugale (2005), Moyer-Packenham (2007) and Ginsburg (2012) concluded that the increase on the levels of cognitive demand, mathematical intricacy and levels of abstraction balances the procedural fluency of students in problem solving tasks is based on their ability to use intellectual knowledge and skills in interpreting the problem.

Mathematical Abilities and Achievement in Mathematics

The studies carried out by Naiz (1993) as cited by Nizoloman (2013) seemed to lead credence to the efficacy of mathematical ability groupings on learning outcomes. Despite the students demonstrating confidence in their abilities, the overall performance on mathematics achievement test was quite poor, particularly considering the basic nature of the questions. The students were seen to demonstrate a procedural knowledge of the ability to reason though the given mathematical situations, the ability to connect, employ and communicate an algorithm process within the given problems with little ease. That is to say, the higher the mathematical ability of the student is, the higher his/her achievement in mathematics and the lower the mathematical ability of the student is, the lower his/her achievement in mathematics.

Methodology

Research Design

This study used a descriptive-developmental research method to develop a diagnostic test on selected topics in General Mathematics and Basic Statistics and Probability.

Descriptive research surveys widely used in education based on the premise that practice improves through observation, analysis, and description. The survey is the most common descriptive research method that includes questionnaires that can generate qualitative and quantitative results that define the state of the study, which the researcher will employ to determine the mathematical abilities of the freshman students.

Wiggins (2017) defines enrichment as any experience that substitutes, supplements, or extends instruction beyond that offered by schools. It can help the students master the basic foundations of Mathematics and serve as a labor-saving device for teachers in enriching the students' learning.

Population and Locale of the Study

The researcher computed for the sample population of the freshman students. Therefore, this study will have a total of one hundred fifty-seven (157) respondents from Urdaneta City University (UCU) under the College of Teacher Education.

Data Collection Instruments

The data gathering instrument used includes a questionnaire checklist and a diagnostic test. The questionnaire checklist consists of the respondents' profile regarding sex, type of school graduated, and their strand during their Senior High School. The diagnostic test was a multiple-choice question of the selected topics in General Mathematics and Basic Statistics.

In preparing the diagnostic test, the researcher reviewed the Competencies of Senior High School students in General Mathematics and Basic Statistics, based on the curriculum guide prescribed by DepEd. From the review, the researcher constructed the diagnostic test to find out the mathematical abilities of the students. It is composed of questions in the following topics: from General Mathematics, it has 14 items under Basic Business Mathematics and 13 items under Logic, and from Basic Statistics, 10 units fall under Sampling and Estimation Parameters, and 13 under hypothesis testing. The diagnostic test was then administered to the respondents to gather the final data needed for the analysis and to determine the mathematical abilities of the students in said topics.

The researcher asked the permission and approval from the Dean of the College of Teacher Education. The researcher gathered all the necessary information needed regarding the profile of the respondents. Before administering the questionnaire and diagnostic test, the 50-point diagnostic test used was validated by five (5) Senior High School teachers first. Diagnostic test was conducted using Google form.

Upon completing the questionnaire given, the researcher collected and tabulated the necessary data and get the mean score and items with the lowest means under the specific mathematical ability for the development of the enrichment material.

Table 1. Distribution of the Respondents' Profile (n = 157)

Profile		frequency (f)	Percentage(%)
Sex	Male	37	23.60
	Female	**120**	**76.40**
Type of School Graduated From	Private	30	19.11
	Public (Barangay School)	**65**	**41.40**
	Public (Mother School)	62	39.49
Strand in Senior High School	STEM	12	7.64
	GAS	**68**	**43.31**
	HMMS	24	15.29
	ABM	21	13.38
	TechVoc	32	20.38

It is presented on the table that there are 37 or 23.60% male freshman students. In comparison, 120 or 76.4% female freshman students are the dominant sex of freshmen students who have taken up Mathematics in the Modern World last semester, Academic Year 2019-2020. Most freshmen students were graduates at barangay public school with a frequency of 65 or 41.40%, while 62 or 39.49% are graduates from public mother school and 30 or 19.11% are graduates from private schools.

In terms of their strand in Senior High School, most of the students took up General Academic Strand (GAS) with 68 or 43.41%. Thirty-two of the respondents took up Technical Vocational (TechVoc), 24 respondents on Humanities and Social Sciences (HMMS), 21 on Accountancy, Business and Management (ABM), and only 12 have taken Science, Technology, Engineering, and Mathematics (STEM) as their strand during their Senior High School.

General Academic Strand (GAS) is one of those four strands of the academic track for the Senior High wherein many students are taking because it can help them decide what course to take up in college. The students taking up GAS prefer a diverse selection of courses (Nemenzo, 2019).

Table 2. Distribution of the mean scores of the Freshman Students in their Diagnostic Test in terms of Conceptual Understanding, Procedural Knowledge and Problem Solving

Profile		frequency (f)	Percentage(%)
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	CU	PK	PS	Total
Mean	7.5732	11.7389	3.7516	23.0637
Median	8.0000	12.0000	4.0000	24.0000
Mode	8.00[a]	13.00[a]	4.00	24.00[a]
Std. Deviation	1.80528	3.48283	2.05581	5.50371
Variance	3.259	12.130	4.226	30.291
Skewness	-.455	-.410	.255	-.208
Std. Error of Skewness	.194	.194	.194	.194
Minimum	3.00	4.00	.00	10.00
Maximum	12.00	19.00	10.00	37.00

The median of Conceptual Understanding, which is 8.00, is greater than the mean, which is 7.57 that means it is negatively skewed. And out of 15-items, students got 50.47% correct answer which is more than half of the total number of items. Therefore, we can say that the freshman students somewhat understand concepts in mathematics. According to Wiggins (2014), common core standards stress the importance of conceptual understanding as a component of mathematical expertise.

In terms of Procedural Knowledge (PK) of the students, the mean scores of the freshman students are 11.74, and the standard deviation is 3.48. We can say that the scores of the students in terms of procedural knowledge are low, and there is confusion in terms of the process of solving in General Mathematics and Statistics. Procedural knowledge is supreme since students should learn algorithms. Students who only learn procedure will find themselves, at the upper levels, carrying out algorithms without understanding why the steps work. (Bauer, 2016)

Meanwhile, the mean scores of the students in Problem Solving (PS) are 3.75 with a standard deviation of 2.06, which means that the students' scores are close to each other. Also, out of 10-items, students got 37.50% correct answers which is less than half of the total number. Therefore, we can say that the students are not performing well in problem-solving. Problem-solving develops mathematical power, and so it gives the students tools to apply their mathematical knowledge to solve hypothetically. Also, problem-solving places focus on the student making sense of mathematical ideas. When students solve problems, they are exploring the mathematics within problem context rather than as an abstract.

To sum it up, the overall mean score of the freshman students on the diagnostic test in terms of mathematical abilities is 23.06, with a standard deviation of 5.50. Also, out of the 50-items diagnostic test, students got 46.12% correct answer which is not more than half the total number. Therefore, we can say that the students lack conceptual understanding and procedural knowledge, which affects their problem-solving.

Performance of the Freshman Students in selected topics on General Mathematics and Basic Statistics

Level of performance of the freshman students on the topics Basic Business Mathematics (BBM), and Logic (L) for General Mathematics, and Sampling and Estimation Parameters (SEP) and Hypothesis Testing (HT) for Basic Statistics with the corresponding values of the statistical tools utilized.

Table 3. Distribution of the mean scores of the Freshman Students in their Diagnostic Test in terms of the Selected Topics on General Mathematics and Statistics and Probability

	Min	Max	Mean	SD	Variance
BBM	1.00	14.00	8.8790	2.64175	6.979
Logic	.00	9.00	4.5669	2.05774	4.234
SSEP	1.00	10.00	5.5987	2.30623	5.319
HT	.00	9.00	4.4140	2.04765	4.193
Total	9.00	39.00	23.4586	5.84467	34.160

As shown, the mean score of the students in Basic Business Mathematics (BBM) is 8.87, with a standard deviation of 2.64. Out of 14-item test under BBM, 63.42% of the students passed the items under Basic Business Mathematics. The students got the minimum and maximum scores of 1 and 14, respectively.

Also, the mean scores of the students in Logic are 4.59 with a standard deviation of 2.06, which means that the students' scores are close to each other. Out of 13-items, students got 35.31% correct answer which is less than half of the total number of items. The minimum score under logic is 0, which means students do not get any correct answers from the given test under the topic Logic. Therefore, we can say that the students are not performing well in logic.

The overall mean score of the freshman students on the diagnostic test in terms of the mathematic topics covered is 23.46, with a standard deviation of 5.84. Also, out of the 50-items diagnostic test, students got 60.15% correct answer where the total number of items is higher. It can also be seen on the overall scores on the appendix that there are students who do not get any correct answer on the problem-solving part. Therefore, we can say that the students have a conceptual understanding of the mathematics topics but do not perform well in procedural knowledge, which affects their problem-solving ability.

These indicate that the freshman students got low performances on the problem-solving part of all the mathematics topics covered on the diagnostic test, which implies they need to have an enrichment material to provide an additional source of knowledge and enhance their problem-solving skills. Problem-solving is often challenging for the students because they do not understand the problem-solving process or lack procedural knowledge. A study by Yu et al. (2015) analyzed the students' problem-solving process performance where the results show that context-based learning may effectively enable students to establish their problem-solving process that will develop their problem-solving skills be prepared to face increasingly complex academic issues.

Significant Difference between the mathematical abilities of the respondents in terms of conceptual understanding, procedural knowledge, and problem-solving across their Profile Variables

The significant difference between the respondents' mathematical abilities across their profile variables is below.

Table 4. t-distribution between the Mathematical Abilities of the Respondents in terms of Conceptual Understanding, Procedural Knowledge and Problem-Solving across their Sex

Math Abilities	Mean		Mean Diff	t-value	Sig.
CU	M	7.59	0.03	.082	0.94
	F	7.57			
PK	M	11.18	-0.71	-1.10	0.27
	F	11.91			
PS	M	3.05	-0.94	-2.40	0.18
	F	3.97			
Total				-1.56	0.12

The t-value in terms of the problem-solving ability of the respondents is 0.018, which is lesser than the 0.05 level of significance with 155 degrees of freedom. Since the t-value is less than the 0.05 level of importance, therefore the null hypothesis is rejected. Also, the significant difference in the mathematics ability of male and female students is in favor of females with a mean of 3.97, while males have an average of 3.05.

The table implies that the respondents' sex does vary to the problem-solving ability of the respondents. The result of this study is the same as the result of Zhu (2007), which states that the

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individuals' cognitive preparedness, particularly in mathematical problem-solving are related to their sex the same as Schmader (2002), which entails that sex influences performance of the students in mathematics.

Significant Difference between the Mathematical Abilities of the respondents across the Type of School they Graduated From

The table below shows the significant difference between the respondents' mathematical ability across the type of school where they graduated.

Table 5. F-distribution on the respondents' mathematical ability across the school the respondents graduated from

Math Abilities	F	Sig.
CU	.111	.895
PK	1.966	.144
PS	**3.667**	**.028**
Total	2.874	.060

The F-value in terms of the problem-solving ability of the respondents is 0.028, which is lighter than the 0.05 level with 2 degrees of freedom. Since the F-value is lesser than the 0.05 level of significance, therefore the null hypothesis is rejected.

The table implies that the respondents' school where they graduated from does vary in their problem-solving ability. The result of this study is the same as the work of Harrison (2005), which states that the mathematical problem-solving skills were difficult to apply due to the growing number of students in the classroom and the insufficient learning time for practice. Therefore, we can say that teachers can focus on improving the mathematical abilities in private schools since there are lesser students in that type of school.

Significant Difference between the Mathematical Abilities of the respondents across their Strand in Senior High School

The significant difference between the respondents' mathematical ability across their strand in Senior High School is in the table below.

Table 6. F-distribution on the respondents' mathematical ability across the Strand they have taken in Senior High School

Math Abilities	F	Sig.
CU	.868	.504
PK	.901	.482
PS	.792	.557
total	.999	.421

F-values in terms of the mathematical abilities of the respondents were all greater than the 0.05 level of significance. Therefore, the null hypothesis is accepted. Thus, we can say that there is no significant difference between the abilities in mathematics across their strand in Senior High School.

Significant Difference between the mathematical abilities of the respondents in terms of the mathematics topics covered in the diagnostic test across their Profile Variables

The t-value on the mathematics topic Sampling and Estimation Parameters is 0.013, which is lower than the 0.05 level with 155 degrees of freedom. Since the t-value is lesser than the 0.05 level of significance, therefore the null hypothesis is rejected. Also, in the appendix, the significant difference in the mathematics ability of male and female students is in favor of females with a mean of 5.85, while males have a norm of 4.78.

Table 7. t-distribution of the mathematical abilities of the respondents in terms of the mathematics topics covered in the diagnostic test across their Sex

Topics in Math	Mean		Mean Diff	t-value	Sig.
BBM	M	8.74	-0.14	-1.9	0.06
	F	8.88			
Logic	M	4.59	0.01	0.46	0.64
	F	4.57			
SSPE	M	5.54	0.06	-2.50	0.01
	F	5.60			
HT	M	4.12	-0.01	-1.22	0.22
	F	4.14			

According to the study of Kula (2020), statistical inference is difficult to understand because it contains two logics that operate in opposite directions, the logic of construction and the logic of an application. That is why the performance of the students in Sampling and Estimation parameters is low. On the other hand, meta-analyses on gender differences demonstrate improvements in females' results over time. Focusing on Mathematics, in US math data, the magnitude of gender difference has declined over the years based on the study of Hyde et al. 1990 as cited by Baye and Monseur (2016). Also, Blondin and Lafontine's (2005) study concluded that there is a gender gap in favor of boys in mathematics and physical science in terms both of achievement and attitude, which is in contrast to the present study.

Significant Difference between the mathematical abilities of the respondents in terms of the mathematics topics covered in the diagnostic test across the type of school they graduated from

Table 8. F-distribution of the mathematical abilities of the respondents in terms of the mathematics topics covered in the diagnostic test across the school, they graduated

	Mean Square	F	Sig.
BBM	11.403	1.648	.196
	6.921		
Logic	7.439	1.774	.173
	4.193		
SEP	**32.586**	**6.564**	**.002**
	4.965		
HT	2.521	.598	.551
	4.215		

The F-value on the following mathematics topics is 0.378, 0.261, 0.301, and 0.280, respectively, which are not less than 0.05. Therefore, the null hypothesis is accepted.

The result of this study is the same as Sison's study that highlighted the focus of each strand of the academic tracks and the conclusion of Cerbito (2020) that students from different strands possess different mathematical abilities. Learners must strive harder in learning math concepts and be encouraged to be well-informed that how they perform on the assessments affect themselves and the school.

Results and Discussion

After a systematic and in-depth analysis of the data gathered, the investigations finally come up with the following results: (1) Majority of the freshman students are male with a frequency of 37 or 23.60%, graduates at barangay public school with a frequency of 65 or 41.40%, and 68 or 43.41% took up General Academic Strand (GAS). (2) The overall mean score of the freshman students on the diagnostic test is 23.06, with a standard deviation of 5.50. Also, out of the 50-items diagnostic test, students got 46.12% correct answer which is not more than half. (3) The overall mean score of the freshman students on the diagnostic test in terms of the mathematic topics covered is 23.46, with a standard deviation of 5.84. Also, out of the 50-items diagnostic test, students got 60.15% correct answer which is above half the total items. (4) Problem-solving ability of the respondents has a significant difference across their sex and the school they graduated from.

(5) Mathematical abilities of the students in sampling and estimation parameters across their sex and the school they graduated has a significant difference; and (6) An enrichment material is designed to enhance students' problem-solving ability on the mathematics topics covered.

Conclusion

Based from the following findings, conclusions were drawn: (1) The students lack conceptual understanding and procedural knowledge, which affects their problem-solving. (2) The respondents' sex and school where they graduated from does vary to their mathematical ability in terms of problem-solving. (3) The respondents' sex and school where they graduated from vary to their mathematical ability in terms and the topic Sampling and Estimation Parameter. (4) The enrichment material designed can help the students to improve their problem-solving abilities.

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