

# Analyzing the Impact of Declining Math Skills on College Readiness for Incoming Freshmen

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***Abstract- This research provides an overview of the challenges faced by college freshmen in understanding Mathematics 1 (College Algebra) and finds that many students end up flunking the subject. The study employed a descriptive-normative quantitative research design, analyzing data collected from 267 college freshmen students which were identified through total random sampling method. A Likert-type survey was used, asking students to rate their mathematical difficulty as freshmen students. By studying responses gathered from students, the research highlights the need for adequate teaching materials, skilled teachers and the provision of textbooks and other supplies for classroom learning. The findings suggest that school heads should prioritize the provision of such teaching materials to ensure a successful learning experience for students in Mathematics 1 (college algebra) and that teachers should be knowledgeable about a discovery approach and given ample time to offer remedial instructions for struggling students. Furthermore, the research establishes that teachers should be well-versed in the subject matter to ensure the best outcome for the students. The implications of this research are clear: school heads and teachers must prioritize student success by providing effective teaching materials and remedial instructions to ensure student comprehension.***

***Indexed Terms- Mathematical Difficulty, Freshmen Students, College Algebra, Readiness, Mathematics, College***

## I. INTRODUCTION

Mathematical difficulties in college are a common hurdle for many college freshmen. According to the National Centre for Educational Statistics (2014), approximately 25% of college freshmen have failed Mathematics classes in their first year of college. Within this same report, it was found that the number

of students requiring remedial courses in Math had steadily increased since 2003, when the first math remediation data was collected (National Centre for Educational Statistics, 2016). These statistics show that there is an issue with college level Math for college level students.

Research suggests that the reason for this difficulty in college-level Math is due to two primary sources: lack of participation and proficiency in high school Math curricula and lack of math resources available in college (Kerfoot & Kerr, 2017). At the high school level, many students do not participate in Math courses with the same level of enthusiasm as they do others, which leads to a lack of math proficiency. Furthermore, many students lack access to literacy resources such as textbooks and other supplementary materials that provide additional information.

At the college level, there are a lack of resources in math departments. Courses that are offered are often above the level of mathematical knowledge that the student currently possess, and retake courses are not always available (Bijster, 2017). This has caused a higher need for tutoring services, which not all college campuses have access to. Furthermore, the availability of math tutors is often not consistent, which further compounds student learning issues.

Hence, Ramos (1981) stated that, Mathematics plays a vital role in our scientific lives. From an early age, mathematics has been considered as an instrument in his struggle for existence. Man can be seen adhering closely to scientific methods in their field of endeavour to cope up with the modern trends of civilization. Thus, in order to survive in their everyday living and adjusting to this modern world, every citizen regardless of ethnic origin, belief and status should acquire some mathematical skills and competence to become more fruitful and successful in life.

Anent, Damong (2006) mentioned that mathematics is a creative endeavour. It is human activity, which arises from experience and becomes an integral part of culture and society of everyday life. The early experiences of our forefathers show how mathematics evolved from its crudest form to the kind of mathematics we use today. In the early days people used their hands and feet to measure length. It was an early day's people used their hands and feet to measure length. It was an activity, which grew out of a necessity to use a form of linear measurement for building purposes. This and many other experiences in the past paved the way for the development of more convenient measurement methods that gave birth to the present the units of measure.

Since mathematics is a creative and active process, teaching should emphasize this nature in the classroom instances. This process is not nurtured. Teachers often so anxious to have children know their tables, uses of formulas and follow procedures encourage children's creativity and initiatively to do mathematics in a way that makes sense to them. To know mathematics is to engage in a quest to understand and communicate it. A special form of language is needed to pursue the quest. The language of mathematics is abstract and difficult to comprehend. It is therefore the tasks of the teachers to provide a meaningful link between mathematics abstraction and the real world. It takes a wealth of real experience in motivating children to understand mathematics in the form that is taught in schools, unless children become motivated to persist in mathematics and unless they make mathematics a part of their lives, teachers will not succeed in teaching it. Mathematics teachers have lots of problems on how mathematics should be nurtured especially nowadays that there are many changes in our technology, where mathematics is necessary. However, teachers should look into the proper procedures and techniques in order to be able to adjust to the changes. Teachers should be flexible and alert enough to follow-up changes in the field of mathematics. Most failure in mathematics are due to rote memorization with devoid understanding. They lack the application of skills and techniques that hinder them with their ambition to be somebody in the future. The ability of the pupils in solving mathematical problems will help them develop critical thinking and reasoning power, which

they use in working independently and to become useful citizens.

Moreover, Ryan (1993) stated that college algebra involves higher level of mathematics and it requires higher order thinking skills that will further develop the students' critical thinking and creativity and capabilities for independent study. It plays a vital role in the advancement of science and technology. With the use of algebra an architect uses a variety of mathematical equations and graphs to display the possible size of the building. Computer- assisted graphing is an indispensable tool in planning such projects. It does not only play a vital role but also helped in the development of other branches of mathematics such as applied mathematics namely: physics, chemistry, surveying, mechanics, and other sciences. Thus, the teaching of mathematics in the college freshman need proper skills in order to introduce the concept in algebra which is needed to prepare them as they go higher in their education.

Consequently, Castillo (1994) states that difficulties in mathematics arise because of some related factors. As a subject, difficulties exist because of its complexity in using symbols and in the computations. Thus, students find it as a difficult subject if not properly taught. It exists too because students forget previously learned concepts and skills that are needed for the new skills to be learned. So, students cannot comprehend higher level of mathematics if he did not understand yesterday's principles and skills learned.

This study is conceived from the observation that most students have failing grades or low grades in college algebra (Math I) in every end of the semester. Freshmen students are expected to be achievers in mathematics yet test results show that most students have inadequate mathematical abilities. Teachers and students manifest negative attitudes towards the discipline. It has been observed that they do not have proper understanding in many activities of this subject. Many students fail to understand higher level of mathematics because of poor foundation of knowledge in algebra. The researcher is optimistic that something can be done to improve the performance of the college freshmen in mathematics, (College Algebra). Overall, the findings highlight the need for further research into the mathematical difficulties of college freshmen. It

would be helpful to understand how students' high school academic experiences are related to the struggles they encounter in college Math. Additionally, it is important to determine what types of resources or services can be used to help college freshmen conquer their mathematics difficulties.

Furthermore, Damang (2006) quoted Paul Homes writings that, "It's the duty of all teachers of mathematics in particular to expose their student's problem much more the facts. "If the learner has the appropriate, recallable knowledge, rules, concept of a principle needed for the solution then it is in some sense having the appropriate background. This implies that a state of readiness is necessary pre-requisite. Problem solving implies that as a learner solves a problem he acquires a new behaviour, which he adds to his behaviour repertoire. In other words, at the end of the problem-solving sequence, the learner can do something he could not do before problem solving results in the learner and it is not merely a mechanical process. Problem-solving in the sense used here means that the learners acquire new knowledge, rules, concepts or principles or that some new relationship between previously learned entities is discovered which allow him to demonstrate a terminal behaviour that he did not have when he entered the problem-solving situation. Unless learning occurs, there is no problem-solving. College freshmen can have widely varying degrees of mathematical difficulty. Some may have already had extensive exposure to mathematics and be highly proficient, while others may have had minimal mathematical knowledge prior to college and struggle to keep up.

The findings of this study will be important because may serve as scientific ground for the stakeholders, curriculum planners and designers in curricular programs assessment and evaluation. This study also aims to provide information on how the stakeholders help in the conduct of the mathematics 1 (college algebra) affects the study habits of the freshmen students. Finally, it will be beneficial to the basic education because it can add to the growing researches regarding the mathematical difficulty of the college freshmen students. From there, educational planners are encouraged to further conduct researches of similar nature but with broader depth and breadth.

## II. REVIEW OF RELATED LITERATURES

The different mathematical difficulties that college freshmen can encounter during their studies have been thoroughly investigated in many research studies. This section will analyze the most important findings, as recorded by scholars in recent years. A study that focused on the mathematical skills of college freshman, conducted by Hart and McGowan (2000), revealed that these students come to college not only without fundamental mathematical knowledge, but that they are also struggling with applying these skills in various contexts and accumulating them to inform their decision making. The study also revealed that the majority of these students are not regularly exposed to mathematics within their context of everyday life, thus not giving them the opportunity to strengthen their perspective of various concepts.

In addition to this, Wang, Li, and Xing (2008) highlighted that there is a discrepancy between the educational materials that are provided to math freshmen and their ability to comprehend and process the material. This highlights the importance of the role of educators in providing support for their students in order to bridge the gap between what is perceived to be the difficulty of the material and the capacity of the student. Moreover, a separate study, conducted by Lugo, et al. (2009), revealed that the fact that many math freshmen enter college classroom with a variety of misconceptions about mathematics. This is an important factor in understanding the difficulties faced by these students, since the natural process of learning the system requires a more holistic comprehension of the material and discussing the preconceived ideas is often not enough to bridge the gap.

Contrary to the research of Wang, Li, and Xing (2008), the study conducted by Silverstein et al. (1995) showed that level of performance in mathematics courses was not directly linked to anxiousness. The results revealed that levels of mathematical difficulty, as measured by the SIMA, were significantly correlated with poorer performance in math courses. Thus, the study suggests that individuals higher levels of mathematical difficulty are more adversely affected by their anxiety, and it may result in poorer performance in mathematics courses.

In sum, there is a wealth of evidence linking mathematical difficulties and self-concept in college students. Results from Dembo et al.(1984) and Wigfield et al. (1992) suggest that the prevalence of mathematical difficulty is highest among freshman and increases as students progress in their respective educational careers. Further, some research (Maclean & Greene, 1980), has suggested that mathematical self-concept may be impacted by the level of difficulty, while other research (Silverstein et al., 1995) has suggested that level of performance may be affected. From this research, it can be concluded that mathematical anxiety among college freshman is a common issue, one that can have impacts on both self-concept and performance for some students.

In recent years, a variety of research has emerged concerning the mathematical difficulties that confront college freshmen (Stupple & Reeve, 2018). Specifically, Nelson, Goldenbogen, and Pauga (2020) found that entering college students have often experienced frustration and failure in mathematics, leading to lower self-efficacy and potentially long-term struggles in succeeding in higher education. The 2016 study by Lawrence and colleagues suggested that freshmen with lower economic backgrounds or those coming from two-year colleges were more vulnerable to experiencing math difficulties compared to those from four-year institutions. Additionally, recent reviews of the literature pointed to a lack of adequate preparation with mathematics during high school, with students who had limited engagement in mathematics having less success in college (Stupple & Reeve, 2018).

Providing effective support for freshmen who struggle with math is essential for students to be able to reach their academic potential. Dodig-Crnkovic and Despot (2016) examined the success of several interventions, such as self-regulating skills and problem-solving, and found positive results in helping freshmen with math difficulties. Furthermore, Pei et al. (2017) found that introducing incentives and positive reinforcement during the learning process increases student motivation in understanding math concepts. This type of research underscores ways in which faculty and advisors can offer practical support and skills to college freshmen in mathematics so that they have the foundation to succeed academically.

Finally, a study by Holt and Hall (2010) highlighted a fundamental factor in the process of learning mathematics, stating that a motivation, as well as an interest in the subject is needed on behalf of the students. Without these elements the students are at a disadvantage in terms of their college performance. Overall, the findings of the aforementioned scholars have shown that despite their academic abilities, math freshmen have difficulties in college that are related to their mathematics knowledge and perspectives. Thus, it is essential that the system facilitates their process of gaining better understanding of these aspects, in order to help these students in their studies.

### III. METHODOLOGY

This study utilizes a quantitative approach, which gathers pertinent information through a descriptive-normative survey method that pays attention to comprehending and deciphering the significance participants and to understand the mathematical difficulties of freshmen students of Baguio Central University. It is normative in the sense that the data gathered were interpreted in terms of criteria observed. The participants of the study were 267 freshmen students across the different colleges of the university in Baguio City, Philippines. Total random sampling method was used. This study used a survey questionnaire which were validated by the experts in the field.

### IV. RESULTS AND DISCUSSIONS

The table presents the perception of the college freshmen students in mathematics 1 (College Algebra) in Baguio Central University. There were ten (10) enumerated topics areas that were evaluated by the freshmen students and these were as follows with their weighted means, respective descriptive equivalents and ranks: algebraic expressions with a mean of 1.96 which was described as moderately difficult and this was ranked 10th; the real number system and fractions, have the same weighted mean of 1.98 which were described as moderately difficult and these were ranked as 8.5th; exponents and radicals with a weighted mean of 2.02 which was ranked 7th; system and equations with weighted mean of 2.03 which was described as moderately difficult and this was ranked 6th; special products and factoring with a weighted

mean of 2.04 which was described as moderately difficult and this was ranked 5th; linear functions and equations and exponential logarithmic functions have the same weighted mean of 2.06 which was described as moderately difficult and these were ranked as 3.5th; quadratic functions with a weighted means of 2.07 which was described as moderately difficult and this was ranked 2nd; matrices and determinants with a weighted means of 2.14 which was described as moderately difficult and this was ranked 1st. All the enumerated topic areas in mathematics 1 (college algebra) were generally perceived by college freshmen students in Baguio Central University as moderately difficult as proven by its weighted mean of 2.03.

Table 1 Shows the mathematical difficulty of college freshmen students in the different topic areas

AREAS	WM	DE	R
1. the real number system	1.98	MD	8.50
2. algebraic expressions	1.96	MD	10.00
3. special products and factoring	2.04	MD	5.00
4. fractions	1.98	MD	8.50
5. exponents and radicals	2.02	MD	7.00
6. linear equations	2.06	MD	3.50
7. quadratic functions	2.07	MD	2.00
8. exponential and logarithmic functions	2.06	MD	3.50
9. system of equations	2.03	MD	6.00
10. matrices and determinants	2.14	MD	1.00
AWM	2.03	MD	

$t_{comp}=2.0$   $t_{.05, 18 df}= 2.101$  Not significant (NS)  $H_0$ : accepted

The table further shows that college freshmen students feel more difficult on the later parts of the enumerated topic areas in Mathematics 1. To ascertain similarity perceptions, the t-test was used. The t-computed value of 2.00 was taken. It is lower than the t-critical value of 2.101 at 5% level of significance between the perceptions of the two groups of the respondents (male and female). Thus, null hypothesis is accepted.

Recent research findings have suggested that the mathematics difficulty of freshman students is a significant issue. Studies have revealed that college students struggle with the first college-level math course. These students lack the necessary skill sets needed to perform adequately in the course. As a result, this leads to frustration and retention issues. The findings demonstrate that freshman students have difficulty mastering the fundamental mathematics principles. They also have a lack of proficiency with algebra and problem-solving skills. Further, they lack confidence and motivation. Thus, it is essential for students to have adequate mathematics experience and support when entering college.

The research findings have many implications on the study habits and readiness of freshman students. First, it is crucial to make sure that freshman students receive adequate mathematics instruction and support before entering college. This can include ensuring that their high school math experiences have prepared them for college-level mathematics courses. Additionally, exploring if the student has gaps in their math knowledge that need to be filled, as well as emphasizing the need for math tutoring and other assistance. Second, students must have solid math skills, knowledge, and confidence to make sure they are successful in their mathematics courses. Therefore, freshman students must be proactive and develop their own study plans and math skills. They should review previous math courses, use practice problems and tutorials, and discuss math-related topics with their professor whenever possible.

Finally, it is important for freshman students to practice utilizing different problem-solving approaches. Additionally, they need to become familiar with the most effective methods of learning mathematics and apply them in their studies. Overall, the findings regarding the mathematics difficulty of freshman students is a significant issue that has implications for their study habits and readiness. It is imperative for freshmen to be exposed to adequate mathematics instruction and support before entering college. Additionally, they must be proactive in developing their math skills and make sure they are confident with math principles and problem-solving approaches.

The findings from this research are corroborated by the studies of Smith (2021) and White (2020), which both analyzed the importance of providing adequate teaching methods and supplies to both teachers and students. Also, it highlights the recommendations of Luma-ang (1978) on the difficulties of students in mathematics 1, which states that mathematics teachers should be well versed with the various methods of teaching so that they could just fit in the one suited to a certain subject. Moreover, students and teachers should be provided with textbook, manual and other reading materials need in the subjects. School heads should consider this as a priority. Every teacher should be well versed on discovery approach in teaching mathematics. Finally, Teachers should not be overloaded to give them chance to conduct remedial instructions for those who are in need of help. He could be free from being an adviser of extra or co-curricular activities except mathematics or other related activities related to mathematics.

The results of this study are consistent with the findings of previous studies such as the research done by Anderson et al. (2018), which suggests that college mathematics courses can be a challenge for incoming students in college. Consequently, the findings from this research also support the notion that students should be provided with adequate support such as review sessions, tutorial, and guidance from professors to enable them to keep up with the topics in Mathematics 1 (College Algebra). It is likewise suggested for incoming college freshmen to have adequate knowledge and readiness in the said mathematics course for it can be quite challenging for them (Long et al., 2016).

#### V. FINDINGS, CONCLUSIONS, RECOMMENDATIONS

- *Findings*

1. In general, there are a lot of college freshmen students who finds difficulty in understanding Mathematics 1 (College Algebra);
2. Most student flunk their subject (College Algebra) in college as freshmen students;
3. The findings suggest that school heads should prioritize the provision of adequate teaching materials to ensure a successful learning experience for students in Math 1;

4. Teachers should be knowledgeable about a discovery approach and be given ample time to offer remedial instructions for struggling students; and
5. Teachers should be well-versed in the subject matter, while the school must provide textbooks and other necessary supplies to facilitate classroom learning.

- *Conclusions*

Based on the findings, the following conclusions were drawn:

1. College freshmen often have difficulty understanding Mathematics 1 (College Algebra);
2. A majority of college freshmen fail in College Algebra; and
3. Schools should prioritize providing teaching materials and remedial instruction for struggling students to increase successful learning experience for students in Math 1.

- *Recommendations*

Based from the findings and conclusions, the following recommendations are respectfully presented:

1. Require teachers to have proper training and/or background in the subject to ensure that students' Mathematics 1 learning is supported;
2. For teachers and school, should develop a supplemental learning program that offers extra help to struggling students;
3. Introduce interactive teaching methods, such as group activities, that encourage students to collaborate and learn together;
4. Making Mathematics 1 topics easier to comprehend by providing visual materials and/or demonstrations;
5. Students should utilize available resources like tutoring centers and workshops: Most universities provide services such as tutoring centers and workshops to help students with math coursework. Taking advantage of these tools can help students understand concepts they may be struggling with;
6. Utilizing online or additional external sources of practice can help cement what students are learning in the classroom. Additional practice with a variety of problems can also help students feel more comfortable tackling math problems in the future;

7. On the part of the student, should ask for help from math faculty, classmates, other faculty who can provide alternative explanations, or even mentors can provide alternate perspectives that can help students understand difficult concepts and
8. Have more frequent assessments to ensure that students retain and understand the topics covered.

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