STUDENTS’ ADVERSITY QUOTIENT AND PROBLEM SOLVING SKILLS IN MATHEMATICS

College of Teacher Education

BOHOL ISLAND STATE UNIVERSITY

Main Campus, Tagbilaran City

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June 2022

STUDENTS’ ADVERSITY QUOTIENT AND PROBLEM SOLVING SKILLS IN MATHEMATICS

A Thesis

Presented to the Faculty of

College of Teacher Education

BOHOL ISLAND STATE UNIVERSITY

Main Campus, Tagbilaran City

In Fulfillment of the Requirements

for the Degree

Bachelor of Secondary Education

Major in Mathematics

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June 2022

APPROVAL SHEET

This thesis entitled **"STUDENTS' ADVERSITY QUOTIENT AND PROBLEM SOLVING SKILLS IN MATHEMATICS"** prepared and submitted by Jeeannie S. Damiles, Fatima A. Hinampas and Mitchelle G. Torrejos - in fulfillment of the requirements for the degree Bachelor of Secondary Education major in Mathematics has been examined, recommended and accepted for implementation.

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ACKNOWLEDGEMENT

The researchers would like to express their deepest gratitude to the Almighty Father for the blessings, strength, courage, hard work, patience and wisdom to make all things possible and for building their strong faith to accomplish the study despite the circumstances.

Warmest appreciation and heartfelt thanks are also given to the following people who, in a way, contributed and inspired the researchers to the overall success and realization of the work:

Dr. Ernesto C. Rulida, Campus Director, for his approval to conduct the study on the Student's Adversity Quotient and Problem Solving Skills in Mathematics;

Dr. Maria Elena S. Mandin, Former Dean of the College of Teacher Education, for her approval in conducting the study;

Mrs. Analyn D. Pesidas, Research Instructor, for sharing her expertise, knowledge and comments for the improvement of the study, for the up to date follow ups and reminder for the research process and for providing all the necessary information used in the study;

Dr. Renario G. Hinampas Jr., thesis adviser and statistician, for sharing his brilliant ideas, his time and effort in correcting the research work and for the pieces of advice on the related literature, theoretical and conceptual background of the study and his assistance and suggestions in analysing and interpreting the results, for the proper guidance and genuine advice for the success of this study;

Ms. Ma. Jeane Franz B. Mascardo, thesis English critic, for her moral support, patience and sacrifices in correcting grammatical errors in the manuscript and suggestions to improve the output;

The respected panelists, Dr. Maria Elena S. Mandin, Dr. Renario G. Hinampas Jr., Dr. Ivy Corazon A. Mangaya-ay and Dr. Marice E. Climaco for their comments, suggestions and recommendations for the improvement and refinement of this study;

The Pilot Testing Respondents and Actual Respondents, who are the Mathematics major students of Bohol Island State University - Main Campus for the school year 2021-2022, for their full cooperation in answering the research instrument sincerely and honestly;

The Class Mayors of BSEd-Mathematics 1 to 4, who extended their full support and effort in convincing and informing their classmates regarding the study;

Dr. Arlan S. Coscos who suggested the topic about Adversity Quotient;

Peak Learning, Dr. Paul G. Stoltz and Allison Elliott who provided access to the Online Adversity Quotient Profile and gave understanding for the delay of the submission of the thesis;

The Bohol Island State University - Main Campus where the study was conducted;

The researcher's loving parents, brothers and sisters for their undying moral, spiritual and most especially, financial support, for always being there and being patient and understanding in guiding and inspiring the researchers;

The researcher's loved ones, special someone, friends and classmates who gave moral, valuable time, effort, understanding and all kinds of support that contributed to the success of the study;

The researchers who never get tired and never give up against all the odds on the making of the study, for extending each other's patience and for choosing to understand against circumstances;

And to all the people who contributed to the success of this endeavor by extending their support through prayers, valuable time, effort, assistance and whose names are not written here, a million thanks to all of you.

THE RESEARCHERS

ABSTRACT

The main aim of the study was to determine the levels of Adversity Quotient and problem solving skills in Mathematics of BISU - MC students taking BSEd-Mathematics in the school year 2021-2022. It sought to find if there was asignificant difference in the respondents' levels of AQ and problem solving skills in Mathematics across their age, gender and year level as well as their level of AQ as a significant predictor of their level of problem solving skills in Mathematics. It also aimed to develop a plan of action that would be proposed to improve these two aspects of their being. The total number of actual respondents was 163. Purposive sampling was used. The study utilized the quantitative type of study. It made use of the descriptive design to describe the characteristics of the population being studied and the regression design to infer the relationship between the independent variable and dependent variable. The Online AQ Profile was used for determining the respondents' level of AQ and a 10-item test was used for determining their level of problem solving skills in Mathematics. Both inquired their profile. The data provided by the respondents were collected and subjected to statistical treatment through IBM SPSS Statistics Trial software. Data revealed that the age of the respondents ranged from 18 to 22 years old. Females numerically dominated the analyzed field. Majority of the respondents were from the first and fourth year levels. Their AQ was below average while their problem solving skills in Mathematics was satisfactory. The age, gender and year level of students did not matter in identifying their level of AQ. On the other hand, the older students had a higher level of problem solving skills in Mathematics than the younger onesand the students in the higher year level had a higher level of problem solving skillsin Mathematics than those in the lower year level. Finally, their level of AQ gave a positive influence on their level of problem solving skills in Mathematics. The education system should be aligned with the profile of the students. The teachers would let the students read the book of Paul G. Stoltz, PhD titled "Adversity Quotient: Turning Obstacles into Opportunities". The students would also reflect on the word of God. Also, the teachers would let the students study the book by George Polya titled "How To Solve It". The students would also continue to solve various routine problems. Regardless of age, gender and year level, the family and friends of the students should encourage them in every way they can for their better future as they overcome their adversities. Mathematics curriculum makers and teachers work together to improvise teaching and learning Mathematicsspecifically problem solving for the younger students and those in the lower year level. Future researchers could replicate the study to further verify the results. Research could focus specifically on the CORE dimensions of AQ predicting the level of problem solving skills in Mathematics.

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THE PROBLEM AND ITS SCOPE

INTRODUCTION

Rationale

In the Philippines, where college students were still considered teenage youth, student welfare's social and mental health aspects in tertiary level institutions had gotten more attention from education stakeholders (Cleofas, 2019). According to news accounts, there was a rise in the number of college students who committed suicide in different ways, such as jumping from a building(Manila Bulletin, 2013) or shooting themselves with a pistol (Phnews, 2013). One suicide referral was made every day among teenagers (Tomacruz, 2018).

According to Juwita, Roemintoyo and Usodo (2020), the usage of the Adversity Quotient in the area of education that focused on students could be used to help students improve their character such that they had a positive mindset in the face of adversity. The AQ allowed students the ability to face adversity, challenging learning environments and concept and abstract learning while maintaining their level of trust in themselves (Dorji & Singh, 2019).

Moreover, in the study of Mathematics, problem solving was especially important (Fernandez, Hadaway & Wilson, 2011). The primary aim of teaching problem solving was for students to gain a general ability to solve real-world problems and to apply Mathematics in real-world situations (Gurat, 2018).

While it was undeniable that Mathematics played an important role in life, the majority of students found it extremely difficult to learn the various Mathematics skills and processes that they would need in their daily lives (Ganal & Guiab, 2014). Effendi (2012) as cited in Hajidin, Marwan and Sari (2019) suggested that problem solving skills for students needed to be sought so that students could find solutions to various problems, both in the field of Mathematics and problems in increasingly complex daily life.

During the pandemic, brought by the 2019 coronavirus disease, the researchers were experiencing various adversities coming from their personal lives and studies. There were times when the researchers were brave to face thesebut there were also times when they got down because of these. Cura and Gozum (2011) noted that during his or her journey through the past, present and future lives of an individual, there would be a specific time when he or she would be in a situation where he or she would put himself or herself through the test of his or her patience, his or her strength to overcome it, his or her decision-making wisdom and at the end a blinding light enlightening him or her that he or she had gained something to his or her advantage out of the terrible situations.

As Mathematics learners, the researchers also experienced problem solving activities that measured their skills in solving problems related to Mathematics and real life. The researchers did their best in problem solving activities all the time but there were times still when they were not able to solve certain problems. According to Meerah and Tambychik (2010), problem solving was a critical component of the Mathematics curriculum since it required students to use and integrate a variety of Mathematics concepts and skills while also making decisions. Students, on the other hand, were said to be having difficulty solving problems in Mathematics.

The researchers believed in the significance of their AQ and problem solving skills in Mathematics to their lives not just as students but also as human beings. Being able to deal with adversities positively and solve problems related to Mathematics and real life skillfully were great advantages to survive andsucceed in one's journey (Brooks, 2015; Our Bureau, 2013). The researchers alsobelieved that all of these applied not just to them but also to others.

For these reasons, the researchers were inspired to determine the levels of AQ and problem solving skills in Mathematics of students to be able to contribute to those with whom this research can be of help.

Literature Background

In the pursuit of its mandate, Bohol Island State University was supported by five fundamental pillars that included Responsiveness to Challenges and Search for Excellence. These could be related to the AQ and the problem solving skills in Mathematics of its students. The AQ and problem solving skills in Mathematics had been extensively researched in the past (Insani & Mardika, 2017).

This research was conducted based on laws that were being implemented in the Philippines. Article XIV Section 10 of the 1987 Constitution of the Republic of the Philippines stated that,

> Science and technology are essential for national development and progress. The State shall give priority to research and development, invention, innovation, and their utilization; and to science and technology education, training, and services. It shall

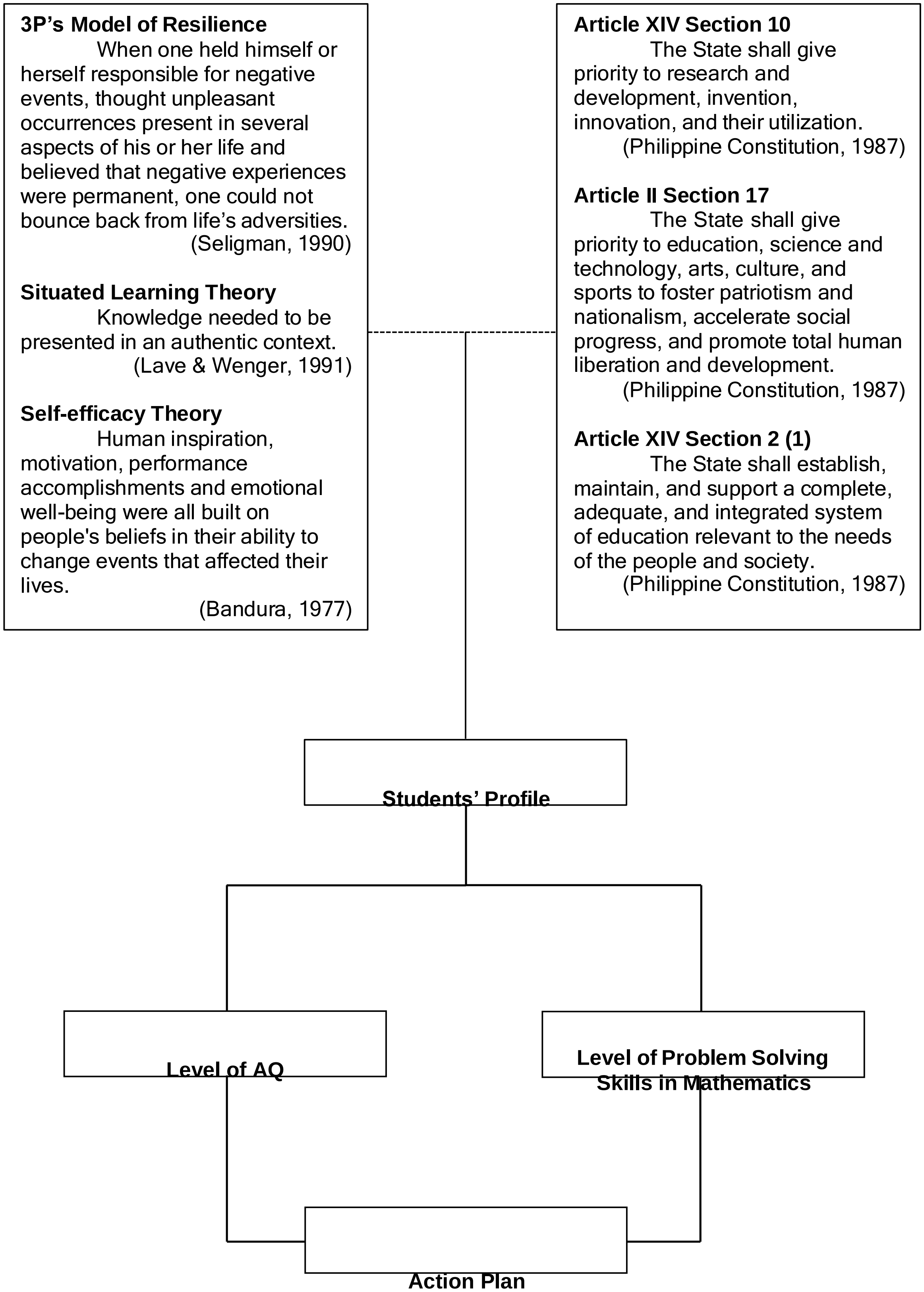

Figure 1: Theoretical and Conceptual Framework

> support indigenous, appropriate, and self-reliant scientific and technological capabilities and their application to the country's productive systems and national life.

By this, research was given support.

Article II Section 17 of the Constitution also stated that,

> The State shall give priority to education, science and technology, arts, culture, and sports to foster patriotism and nationalism, accelerate social progress, and promote total human liberation and development.

The AQ and the problem solving skills in Mathematics of the students were two aspects in the area of education that indeed, helped promote students' total development.

Additionally, Article XIV Section 2 (1) of the Constitution stated that,

> The State shall establish, maintain, and support a complete, adequate, and integrated system of education relevant to the needs of the people and society.

This implied that the system of education should be based on the needs of the people and society, such as the need for a high AQ and outstanding problem solving skills in Mathematics to survive and succeed in life.

The definition of adversity in Cambridge English Dictionary (n.d.) was "a difficult or unlucky situation or event". In line with this, the definition of AQ in PEAK Learning, Inc. (n.d.) was one's "hardwired pattern of response to any and all forms of adversity." Paul G. Stoltz, PhD, chief executive officer of PEAK Learning, Inc. was the originator of the AQ. This was a product of 19 years of research and 10 years of application about what it took to succeed. Dr. Stoltz oversaw a research agenda in 43 countries including the Philippines dedicated to exploring, expanding and advancing the applications of AQ. The AQ®, Adversity Quotient® and AQ

Profile® were registered trademarks of PEAK Learning, Inc., 3940 Broad Street, Ste. 7-385, San Luis Obispo, CA 93401.

In detail, one's AQ comprised four CORE dimensions. C stood for "control". It asked the question: To what extent could I influence whatever happened next? This dimension determined resilience, health and tenacity. O stood for "ownership". It asked the question: How likely was I to step up to do anything to improve the situation? This dimension determined accountability, responsibility, action and engagement. R stood for "reach". It asked the question: How far would it reach into and affect everything else? This dimension determined burden, stress, energy and effort and it tended to have a cumulative effect. E stood for "endurance". It asked the question: How long would it take to get past this situation/adversity? This dimension determined hope, optimism and willingness to persevere (Grant, 2019).

As support, Martin Seligman's 3P's model of resilience suggested that the following viewpoints assisted one in comprehending how his or her thoughts, mindsets and beliefs shaped his or her experiences. One might start being more resilient and learning to bounce back from life's adversities by understanding their significance in his or her ability to adjust effectively. "Personalization" was a cognitive distortion in which issues or failures were internalized. When one held himself or herself responsible for negative events, he or she placed a lot of unneeded guilt on himself or herself and made it more difficult to recover. "Pervasiveness" was thinking unpleasant occurrences present in several aspects of his or her life. An example was losing a contest and concluding that everything was doom and gloom. One could move on toward a better existence by realizing that terrible sentiments did not affect every aspect of his or her life. “Permanence” was defined as the belief that negative experiences or incidents were permanent rather than temporary or one-time occurrences. Permanence discouraged one from making an effort to improve his or her circumstances, leaving him or her feeling overwhelmed and hopeless (Seligman, 1990).

The research of Aquino-Malabanan and Vinas (2015) titled “Adversity Quotient and Coping Strategies of College Students in Lyceum of the Philippines University” determined the level of AQ of the college students in Lyceum of the Philippines University. The instrument used was a questionnaire adapted from Dr. Stoltz’s Adversity Response Profile, a previous version of AQ Profile. The results indicated that the respondents had an average AQ. The research of Española (2016) titled “Adversity Quotient (AQ) And Academic Performance Of Selected Students In MSU Marawi City” also determined the level of AQ of the third and fourth year college students in Mindanao State University - Main Campus. The instrument used was also a questionnaire adapted from Dr. Stoltz’s Adversity Response Profile. The results indicated that the respondents had an average AQ, too. Having an average AQ indicated a normal capacity for challenges, difficulties, setbacks and demands.

Further, the findings of Fernandez et al. (n.d.) in the research titled “Adversity Quotient Of First Year to Fourth Year Students From The BS Psychology, BS Education, and BS Business Administration Students” showed that the level of AQ of first to fourth year BS Psychology, BS Education and BS

Business Administration students statistically did not differ significantly in terms of age. Because the majority of the respondents were in their adolescent years, their responses to adversity would be comparable. The findings of Hanum (2018) in the research titled "Differences in Student Adversity Intelligence by Gender" also showed that the level of AQ of the undergraduate students in the Indonesia University of Education statistically did not differ significantly in terms of gender. The lack of gender differences in AQ was assumed to be due to the fact that men and women confronted identical challenges, hence their perceptions were similar (Merchant, 2012).

In contrast, the findings of Abdullah and Khairani (2018) in the research titled "Relationship Between Adversity Quotient and Academic Well-being among Malaysian Undergraduates" showed a significant difference in the level of AQ among different undergraduate year levels, notably between first and second year undergraduates and first and third year undergraduates. First year undergraduates reported a significantly lower level of AQ when compared to second and third year undergraduates.

On the other hand, the Situated Learning theory, by Jean Lave and Etienne Wenger had a principle that knowledge needed to be presented in an authentic context, such as settings and applications that would normally involve knowledge (Lave & Wenger, 1991). When applied to Mathematics, the theory suggested that lessons needed to be based on real life because it was where Mathematics was used. This could be observed in Mathematics problem solving.

A problem was a situation that required a solution. A problem in Mathematics was a problem presented in a problem solving activity in Mathematics in the form of sentence/s and was related to Mathematics and real life. In a book by George Polya which was published in 1945 and titled “How To Solve It”, there were four steps in Mathematics problem solving. First, one had to understand the problem. The second was to find the connection between the data and the unknown. One might be obliged to consider auxiliary problems if an immediate connection could not be found. He or she should obtain eventually a plan of the solution. The third step was to carry out the plan. The fourth was to examine the solution obtained.

One categorization of problem solving in Mathematics was routine problem solving. Routine problem solving, from a curricular standpoint, entailed applying at least one of the four arithmetic operations and/or a ratio to solve practical situations (Lacuis, 2011). Number problems, digit problems, age problems, clock problems, mixture and solution problems, work problems, uniform motion problems, investment and money problems, geometric problems and variation problems were all covered in routine problem solving.

The research of Pentang et al. (2021) titled “Problem-Solving Performance and Skills of Prospective Elementary Teachers in Northern Philippines” investigated the problem solving skills of prospective elementary teachers in the Northern Philippines in number sense, measurement, geometry, algebra and probability, done through a problem solving type of test. The majority of the respondents displayed a lack of problem solving skills. This could be explained by their insufficiency in describing the situation, creating mathematical models, using techniques to get outcomes and evaluating, analyzing and reporting conclusions.

Along with this, the findings of Matel (2013) in the research titled "Reading Comprehension and Mathematical Problem Solving Skills of Fourth Year High School Students of Tagaytay City Science National High School" showed that there was no significant difference in students' level of problem solving skills in Mathematics when grouped according to their age and gender. This meant that the age, as well as the gender of the students, did not matter in identifying their level of problem solving skills in Mathematics.

Conversely, the findings of Barth, Menon and Rosenberg-Lee (2011) in the research titled "What difference does a year of schooling make?" showed that there was a significant difference in the second grade and third grade pupils' level of arithmetic problem solving skills when grouped according to their grade level. Third grade pupils had a higher level of arithmetic problem solving skills than the second grade pupils.

Moreover, Andaya (2014) identified the factors that affected the achievements of students in Mathematics in the study titled "Factors that Affect Mathematics Achievements of Students of Philippine Normal University - Isabela Campus." A descriptive-correlational design was used in the study. It revealed that individual factors greatly affected achievements in fundamental Mathematics. Speaking of which, there were studies that determined whether the AQ of pre-service Mathematics teachers was a significant predictor of certain mathematical variables, such as their argumentation ability in Mathematics (Hidayat, Prabawanto & Wahyudin, 2018) and their understanding ability in Mathematics (Hidayat, Noto & Sariningsih, 2019), both using an experimental design. The studies revealed that the AQ of the pre-service Mathematics teachers was a significant predictor of their argumentation and understanding ability in Mathematics. It was explained further that AQ gave a positive influence on these variables.

In connection with this, Albert Bandura, in his Self-efficacy theory believed that none of the mechanisms of the human agency were more central or ubiquitous than people's beliefs in their ability to change events that affected their lives. Human inspiration, motivation, performance accomplishments and emotional well-being were all built on this underlying belief (Bandura, 1977). This supported that one’s level of AQ might be a significant predictor of his or her level of problem solving skills in Mathematics.

With all these in mind, the researchers were encouraged to find out if there was a significant difference in students’ levels of AQ and problem solving skills in Mathematics across their age, gender and year level as well as if the level of AQ of students was a significant predictor of their level of problem solving skills in Mathematics.

THE PROBLEM

Statement of the Problem

This study sought to determine the levels of Adversity Quotient and problem solving skills in Mathematics of Bohol Island State University - Main Campus students taking Bachelor of Secondary Education major in Mathematics in the school year 2021-2022.

Specifically, it sought answers to the following questions:

1. What is the profile of the students in terms of:
    1.1. age;
    1.2. gender; and
    1.3. year level?
2. What is the level of the students in terms of:
    2.1. AQ; and
    2.2. problem solving skills in Mathematics?
3. Is there a significant difference in the students' level of AQ across:
    3.1. age;
    3.2. gender; and
    3.3. year level?
4. Is there a significant difference in the students' level of problem solving skills in Mathematics across:
    4.1. age;
    4.2. gender; and
    4.3. year level?
5. Is the level of AQ of the students a significant predictor of their level of problem solving skills in Mathematics?
6. What plan of action will be proposed to improve the levels of AQ and problem solving skills in Mathematics among the students?

Statement of Hypotheses

HO_1: There is no significant difference in the students' levels of AQ and problem solving skills in Mathematics across their profiles.

HO_2: The level of AQ of the students is not a significant predictor of their level of problem solving skills in Mathematics.

Significance of the Study

The findings of the study would be of great help to the following:

Students. The findings of this study would give Mathematics major students awareness of AQ and problem solving skills in Mathematics. This awareness would lead them to be conscious and improve on these aspects of their lives.

Teachers. The findings of this study would motivate Mathematics teachers to strategize to help their students with their AQ and problem solving skills in Mathematics.

Parents. The findings of this study would inform parents on students' AQ and problem solving skills in Mathematics. This would inspire them to help their children with these.

School Administrators. The findings of this study would encourage school administrators to conduct programs supporting students' AQ and problem solving skills in Mathematics.

Future Researchers. The findings of this study would contribute ideas to future researchers who would like to conduct related studies. This would be a medium for other researchers to continue the significance of studying students' AQ and problem solving skills in Mathematics.

RESEARCH METHODOLOGY

Design

This study utilized the quantitative type of study which according to Adanza, Bermudo and Rasonabe (2009) is a scientific investigation of phenomena that gathered numerical values as its data and also investigated concepts, constructs and variables. In this type, researchers started with hypotheses and then collected data that could be used to determine whether empirical evidence that supported the hypotheses existed.

This study used descriptive and regression designs. The descriptive design was used to describe the characteristics of the population being studied and the regression design was used to infer the relationship between the independent variable and dependent variable. Survey and education methods, specifically, questionnaire and test, respectively were used for the collection of data. These were fitted to this study since the focus was to present, analyze and interpret data on students' levels of AQ and problem solving skills in Mathematics as well as looking for the association between these two aspects of the students' being.

Environment and Participants

The study was conducted in the premier public institution of higher education in Bohol which was Bohol Island State University - Main Campus. It was located along Carlos P. Garcia North Avenue, Tagbilaran City. One of the colleges of the said institution was the College of Teacher Education which was committed to provide quality education of different courses offered including Bachelor of Secondary Education major in Mathematics.

The respondents of the study were the students taking BSEd-Mathematics in the school year 2021-2022. Aside from being the best-fit respondents for this study, they were also the easiest to approach for data gathering. Twenty percent of the entire population of the students taking BSEd-Mathematics in the school year 2021-2022 were the pilot respondents of the study. A total of 163 individuals were actual respondents of the study.

The type of sampling used in choosing the sample was purposive sampling. It was a non-probability sampling method and it occurred when “elements selected for the sample are chosen by the judgement of the researcher” (Black, 2010). Meanwhile, stratified random sampling was used to identify the pilot respondents. This involved dividing the entire population into homogeneous groups called strata. Random samples were then selected from each stratum (Hayes, 2020). In this study, the strata were the different year levels.

Instrument

In determining the students’ level of AQ, the researchers utilized the Online AQ Profile developed by Dr. Stoltz. The items used to assess adversity response patterns included the four CORE dimensions which together comprised and described an individual’s AQ. Individuals completed a 14-item digital assessment that covered the subject’s perception of and response to a diverse series of hypothetical adverse events. Items were scored using interactive 10-point Likert scales. For example, one statement read, “You miss an importantappointment...To what extent can you influence what happens next? (1) not at all

» (10) completely.” Another question read, “You suffer a financial setback... How long will this situation negatively affect you? (1) Forever » (10) Momentarily, if at all."

The PEAK Learning team estimated the reliability and validity of the Online AQ Profile based on a diverse sample of 4,472 individuals from more than 39 countries and represented a broad range of job positions and responsibilities. The reliability of the Online AQ Profile was very good (.92) which indicated that the scores were suitable for drawing reliable inferences about individual test takers. Based on an examination of confirmatory factor analysis, all items loaded on their subsequent subscales with loadings of .50 or higher, demonstrating good discriminant validity (Grant, 2019).

The researchers also utilized a researcher-made 10-item test containing one problem for each of the different routine problems, namely: number problem, digit problem, age problem, clock problem, mixture and solution problem, work problem, uniform motion problem, investment and money problem, geometric problem and variation problem, constructed by the researchers to determine the level of problem solving skills in Mathematics of the students.

The problem solving test was originally a 20-item test containing two problems each of the different routine problems. It underwent pilot testing conducted to 44 BSEd-Mathematics students of BISU - MC in the school year 2021-2022. To estimate the reliability of the problem solving test, the researchers used Cronbach's alpha and the problem solving test was found to have very good reliability (.95). To estimate its validity, the researchers performed an item analysis. The discrimination index and the difficulty index of each item were considered so that one problem from each of the different routine problems remained. Very good items as well as marginal and poor items but displayed the capability of the students to perform the expected outcome were retained. Marginal and poor items were revised.

Both instruments inquired the profile of the students. The link to the Online AQ Profile and the Portable Document Format (PDF) of the problem solving test were posted in the Google Classroom created by the researchers where the respondents of the study were enrolled.

Procedure

Here were the steps the researchers took to gather the data:

I. Asking Permission

A letter asking permission to conduct the study to the BSEd-Mathematics students of BISU - MC in the school year 2021-2022 was sent to the Campus Director and Dean of the College of Teacher Education. After being approved, the researchers asked for consent from the class advisers of the respondents as well as from the respondents themselves. The letter presented the purpose of the study with the request for approval to conduct the study to the respondents.

II. Drafting the Instrument

The researchers requested access to the Online AQ Profile by sending an email to PEAK Learning. As the request was granted and signed as an agreement on the use of the instrument. The problem solving test was drafted and was shown to the thesis adviser, an expert Mathematics teacher and thesis critic, an expert

English teacher for improvement. Then, it was revised based on the adviser and critic's suggestions.

III. Pilot Testing

The Online AQ Profile was not anymore pilot tested because it was a standardized one. The problem solving test was pilot tested on the 44 BSEd-Mathematics students of BISU - MC in the school year 2021-2022. It was finalized after validity and reliability testing.

IV. Conducting the Instrument

The researchers conducted the instrument on the 163 BSEd-Mathematics students of BISU - MC in the school year 2021-2022 through Google Classroom. The Online AQ Profile was for determining the students' level of AQ and the problem solving test was for determining their level of problem solving skills in Mathematics.

V. Analyzing and Interpreting Data

The researchers gathered the data and the data gathered underwent statistical treatment. From the findings, a conclusion and recommendations were made.

Statistical Treatment

The data provided by the respondents were collected and subjected to statistical treatment through IBM SPSS Statistics Trial software.

To determine the profile of the respondents, the researchers used frequency and percentage distribution.

To determine the respondents' level of AQ, PEAK Learning provided the data results along with an AQ Profile Scoring Addendum.

	Control	Ownership	Reach	Endurance	Adversity Quotient
High	46-50	50	40-50	43-50	167-200
Above Average	41-45	46-49	33-39	37-42	148-166
Average	34-40	38-45	25-32	30-36	125-147
Below Average	29-33	28-37	20-24	25-29	112-124
Low	10-28	10-27	10-19	10-24	40-111

The explanations of the verbal interpretation of AQ were as follows:

***High*.** The person probably had the ability to withstand significant adversity and to continue to move forward and upward in life.

***Above Average*.** The person had probably done a fairly good job in persisting through challenges and in tapping a good portion of growing potential on a daily basis.

***Average*.** The person usually did descent job of navigating life as long as everything was going relatively smooth. However, the person might suffer unnecessarily from large setbacks, or might be disheartened by the accumulated burden of life's challenges.

***Below Average*.** The person was likely to be under-utilizing his potential. Adversity could take a significant and unnecessary toll, making it difficult to continue the ascent. The person might battle against a sense of helplessness and despair. Escape was possible by raising the AQ.

***Low*.** The person probably suffered unnecessarily in a number of ways. The motivation, energy, vitality, health, performance, persistence and hope could be greatly revitalized by learning and practicing the tools in raising AQ.

To determine the level of problem solving skills in Mathematics of the respondents, the rubric below that was developed and validated by the California State Department of Education Assessment Program and retrieved from Meier (1992) was used in scoring the respondents' solutions for the problem solving test. The scores that they got were converted into percentages and interpreted based on the following scale that was developed and validated by Oliveros (2014).

HOLISTIC RUBRIC FOR SCORING STUDENTS' RESPONSES TO THE PROBLEM SOLVING TEST BASED ON POLYA (1945)						
6 *Exemplary response*	**5** *Competent response*	**4** *Satisfactory with minor flaws*	**3** *Nearly satisfactory, but contained serious flaws*	**2** *Began problem but failed to complete solution*	**1** *Failed to begin effectively*	**0** *No attempt at solution*
The response was complete and included a clear and accurate explanation of the techniques used to solve the problem. It included accurate diagrams (where appropriate), identified important information, showed a full understanding of ideas and mathematical processes used in the solution, and clearly communicated this knowledge.	This response was fairly complete and included a reasonably clear explanation of the ideas and processes used. Solid supporting arguments were presented, but some aspects might not be as clearly or completely explained as possible.	The problem was completed satisfactorily, but the explanation was lacking in clarity or supporting evidence. The underlying mathematical principles were generally understood, but the diagram or description was inappropriate or unclear.	The response was incomplete. The problem was either incomplete or major portions had been omitted. Major computational errors might exist, or misuse of formulas or terms might be present. The response generally did not show a full understanding of the mathematical concepts involved.	The response was incomplete and showed little or no understanding of the mathematical processes involved. The diagram or explanation was unclear.	The problem was not effectively represented. Parts of the problem might be copied, but no solution was attempted. Pertinent information was not identified.	No attempt at copying or solving the problem was made.

Performance Rating (%)	Qualitative Description	Interpretation
81-100	Outstanding	This meant the students demonstrated comprehensive problem solving skills.

61-80	Very Satisfactory	This meant the students demonstrated substantial problem solving skills.
41-60	Satisfactory	This meant the students demonstrated adequate problem solving skills.
21-40	Poor	This meant the students demonstrated evidence of the basic problem solving skills, but required assistance.
0-20	Very Poor	This meant the students lacked basic problem solving skills.

To determine whether there was a significant difference in the respondents' level of AQ when grouped according to their age, the Kruskal-Wallis test, the nonparametric counterpart of One-way ANOVA was used since the assumption of homogeneity of variance was not met. To determine whether there was a significant difference in the respondents' level of AQ when grouped according to their gender, Mann Whitney U-test, the nonparametric counterpart of the Independent sample t-test was used since the assumption of normality distribution of the dependent variable for each group was not met. To determine whether there was a significant difference in the respondents' level of AQ when grouped according to their year level, the Kruskal-Wallis test, the nonparametric counterpart of One-way ANOVA was used since the assumption of homogeneity of variance was not met.

To determine whether there was a significant difference in the respondents' level of problem solving skills in Mathematics when grouped according to their age, One-way ANOVA was used since the assumptions for this parametric test were met. To determine whether there was a significant difference in the respondents' level of problem solving skills in Mathematics when grouped according to their gender, Mann Whitney U-test, the nonparametric counterpart of the Independent sample t-test was used since the assumption of normality distribution of the dependent variable for each group was not met. To determine whether there was a significant difference in the respondents' level of problem solving skills in Mathematics when grouped according to their year level, the Kruskal-Wallis test, the nonparametric counterpart of One-way ANOVA was used since the assumption of homogeneity of variance was not met.

To determine whether the level of AQ of the students was a significant predictor of their level of problem solving skills in Mathematics, assumptions for Linear regression were tested. The relationship between the dependent and the independent variable was linear since the value sig. Deviation from Linearity>0.05. The values of the residuals were independent since the Durbin-Watson statistic was approximately 2. The variance of the residuals was constant since the scatterplot of the residuals did not have an obvious pattern. The residuals were approximately normally distributed since the data points were near the diagonal of the P-P Plot of Regression Standardized Residual. There were no influential cases biasing the model since no instance of Cook's distance greater than one had occurred. Therefore, Linear regression was used.

DEFINITION OF TERMS

The following terms were operationally defined.

Adversity. This referred to a tough or unpleasant circumstance or occurrence that a person might experience like the unexpected death of someone close.

Adversity Quotient. This referred to the ability of a person to respond to adversity positively.

Problem in Mathematics. This referred to a routine problem, such as number problem, digit problem, age problem, clock problem, mixture and solution problem, work problem, uniform motion problem, investment and money problem, geometric problem and variation problem.

Problem Solving Skills in Mathematics. This referred to the ability of a student to solve a problem in Mathematics. This was their ability to understand the problem, devise a plan, carry out the plan and look back.

Profile. This referred to the age, gender and year level of the respondents of this study who were the BSEd-Mathematics students of BISU - MC in the school year 2021-2022.

Mathematics. This referred to the subject Algebra.

Chapter 2

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter covered the presentation, analysis and interpretation of the data gathered. It contained the profile and levels of AQ and problem solving skills in Mathematics of the BSEd-Mathematics students of BISU - MC in the school year 2021-2022. The data gathered were statistically treated and presented in the following tables for analysis and interpretation.

Table 1.1
Distribution of the Respondents' Age

Age	Frequency	Percentage (%)
18	32	19.6
19	34	20.9
20	37	22.7
21	29	17.8
22	31	19.0
TOTAL	**163**	**100**

Table 1.1 showed that the age of the respondents ranged from 18 to 22 years old. Based on Section 4 of Republic Act No. 10533, the entrant age to the senior high school level was typically 16 years old in two years of senior high school education (Republic Act No. 10533, 2013). This implied that the entrant ageto the college level was typically 18 years old. Since BSEd-Mathematics was a four-year program, the age of the students ranged from 18 to 22 years old.

Table 1.2
Distribution of the Respondents' Gender

Gender	Frequency	Percentage (%)
Female	138	84.7
Male	25	15.3
TOTAL	**163**	**100**

Table 1.2 showed that females numerically dominated the analyzed field. Tasner, Mihelic and Ceplak (2017) confirmed that the predominance of women in

the teaching profession(s) was an effect of the harmonization of the female respondents' habitus and their perception of the field they were entering.

Table 1.3
Distribution of the Respondents' Year Level

Year Level	Frequency	Percentage (%)
1	59	36.2
2	31	19.0
3	27	16.6
4	46	28.2
TOTAL	**163**	**100**

Table 1.3 showed that majority of the respondents were from the first and fourth year levels. This was because the first and fourth year levels both had two sections while second and third only had one section each.

Table 2.1
Respondents' Level of AQ
N = 163

Dimension	Mean	Qualitative Description
Control	37.91	Average
Ownership	37.44	Below Average
Reach	19.70	Below Average
Endurance	29.29	Below Average
AQ	**124.34**	**BELOW AVERAGE**

Table 2.1 showed that the AQ of the respondents had a mean of 124.34. This indicated a below average AQ that meant the respondents were likely to be under-utilizing their potential. Adversity could take a significant and unnecessary toll, making it difficult to continue the ascent. They might battle against a sense of helplessness and despair and escape was possible by raising the level of AQ.

This result was the same with Sanchez (2018) where the Psychology students of Pamantasan ng Lungsod ng Maynila fell in below average AQ which meant that even though the respondents might perceive control and responsibility over these temporary adverse events, they might under-utilize their potential to do so, thus these events might take unnecessary toll in their lives. Another study conducted by Fernando et al. (2018) discovered that more than half of the total number of Bachelor of Elementary Education III-D students at Bulacan State University - Bustos Campus had below average AQ.

As one would observe, the respondents in this study were college students like the respondents in the abovementioned studies. On the other hand, in the study conducted by Patdo, Mariano and Gonzales (2011), the respondents were those parents who were involved in child-care who might have more life experience and in general showed an average AQ. According to Venkatesh and Shivaranjani (2016), life experiences tended to improve a person's ability to respond to adversity.

Table 2.2
Respondents' Level of Problem Solving Skills in Mathematics
N = 163

	Very Satisfactory	**Satisfactory**	**Overall Mean (%)**	**Qualitative Description**
Problem Solving Skills in Mathematics	30%	70%	57.5399	Satisfactory

Table 2.2 showed that the problem solving skills in Mathematics of the respondents had a mean of 57.5399%. This indicated a satisfactory problem solving skills in Mathematics that meant the respondents demonstrated adequate problem solving skills. They did not require assistance in problem solving but they still had a room for improvement. The respondents were able to solve the routine problems because first year BSEd-Mathematics students already encountered Polya's 4 Steps Problem Solving Strategy in their subject Mathematics in the Modern World.

Table 3.1
Respondents' Level of AQ Across their Age
N = 163

Age	N	Mean Rank	Kruskal-Wallis H	df	Asymp. Sig.	Description	Decision
18	32	74.56	6.531	4	0.163	Insignificant	Accept H_0
19	34	75.37					
20	37	92.19					
21	29	72.03					
22	31	94.11					

Table 3.1 displayed the result of the Kruskal-Wallis test done to determine if there was a significant difference in the respondents' level of AQ across their age. The result indicated insignificant difference, $x^2(4)=6.531$, $p=0.163$. Since the p-value was greater than the significance level of 0.05, the null hypothesis was accepted. There was no significant difference in the level of AQ between 18, 19, 20, 21 and 22 years old respondents. This could be because the ages were very close to one another.

The result was the same with the findings of the study conducted by Fernandez et al. (n.d.) showing that the level of AQ of first to fourth year BS Psychology, BS Education and BS Business Administration students statistically did not differ significantly in terms of age. Because majority of the respondents were in their adolescent years, the researchers believed that their response to adversity would be comparable.

Table 3.2
Respondents' Level of AQ Across their Gender
N = 163

Gender	N	Mean Rank	Mann-Whitney U	Asymp. Sig. (2-tailed test)	Description	Decision
Female	138	80.66	1910.500	0.393	Insignificant	Accept H_0
Male	25	89.42				

Table 3.2 displayed the result of the Mann-Whitney U-test done to determine if there was a significant difference in the respondents' level of AQ across their gender. The result indicated insignificant difference between groups, [U=1910.500, p=0.393]. Since the p-value was greater than the significance level of 0.05, the null hypothesis was accepted. There was no significant difference in the level of AQ between males and females. This meant that regardless of the gender of the respondents, both had the same coping abilities when facing adversities in life.

This was similar to the result of the study conducted by Hanum (2018) among undergraduate students in the Indonesia University of Education, in which the researchers found no significant difference between the AQ of the respondents based on their gender. The lack of gender differences in AQ was assumed to be due to the fact that men and women confronted identical challenges, hence their perceptions were similar (Merchant, 2012).

Table 3.3
Respondents' Level of AQ Across their Year Level
N = 163

Year Level	N	Mean Rank	Kruskal -Wallis H	df	Asymp. Sig.	Description	Decision
1	59	80.22	3.250	3	0.355	Insignificant	Accept H_0
2	31	71.11					
3	27	92.07					
4	46	85.71					

Table 3.3 displayed the result of the Kruskal-Wallis test done to determine if there was a significant difference in the respondents' level of AQ across their year level. The result indicated insignificant difference, $x^2(3)=3.250$, p=0.355. Since the p-value was greater than the significance level of 0.05, the null

hypothesis was accepted. There was no significant difference in the level of AQ between first, second, third and fourth year respondents. The result was different from Abdullah and Khairani (2018) who found significant differences in AQ scores among the different undergraduate year levels, specifically between first and second as well as first and third year undergraduates. This might be due to the huge differences in the distribution of the respondents for each year level in this study.

Table 4.1
Respondents' Level of Problem Solving Skills in Mathematics Across their Age
N = 163

	Sum of Squares	df	Mean Square	F	Sig.	Description	Decision
Between Groups	6986.263	4	1746.566	6.727	<.001	Significant	Reject H_0
Within Groups	41024.227	158	259.647				
Total	48010.491	162					

Table 4.1 displayed the result of the One-way ANOVA that was employed to determine if there was a significant difference in the respondents' level of problem solving skills in Mathematics across their age. The result indicated a significant difference, [F(4,158)=6.727, p=<.001]. Since the p-value was lesser than the significance level of 0.05, the null hypothesis was rejected. At least one of the age groups had significantly different level of problem solving skills in Mathematics. Rodriguez (2016) supported that age differences often showed in the academic performance of students, especially in core subjects such as readingand mathematics.

To determine which groups differred, post hoc analysis was needed to be run. Scheffee was used since there was prior knowledge of the need for all contrasts to be tested.

Table 4.1.1
Scheffee on the Significant Difference in Level of Problem Solving Skills in Mathematics Across Age
N = 163

(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
18	19	0.51838%	3.96871%	1.000	-11.8520%	12.8888%
	20	-6.61993%	3.88992%	.577	-18.7447%	5.5048%
	21	-12.91164%*	4.13126%	.049	-25.7887%	-0.0346%
	22	-15.96169%*	4.06075%	.005	-28.6189%	-3.3044%
19	18	-0.51838%	3.96871%	1.000	-12.8888%	11.8520%
	20	-7.13831%	3.82808%	.484	-19.0703%	4.7937%
	21	-13.43002%*	4.07309%	.032	-26.1257%	-0.7343%
	22	-16.48008%*	4.00155%	.003	-28.9528%	-4.0073%
20	18	6.61993%	3.88992%	.577	-5.5048%	18.7447%
	19	7.13831%	3.82808%	.484	-4.7937%	19.0703%
	21	-6.29171%	3.99635%	.649	-18.7482%	6.1648%
	22	-9.34176%	3.92342%	.231	-21.5710%	2.8874%
21	18	12.91164%*	4.13126%	.049	0.0346%	25.7887%
	19	13.43002%*	4.07309%	.032	0.7343%	26.1257%
	20	6.29171%	3.99635%	.649	-6.1648%	18.7482%
	22	-3.05006%	4.16282%	.970	-16.0255%	9.9253%
22	18	15.96169%*	4.06075%	.005	3.3044%	28.6189%
	19	16.48008%*	4.00155%	.003	4.0073%	28.9528%
	20	9.34176%	3.92342%	.231	-2.8874%	21.5710%
	21	3.05006%	4.16282%	.970	-9.9253%	16.0255%

*. The mean difference is significant at the 0.05 level.

Table 4.1.1 displayed the result of the Scheffee ran to determine which age groups had significantly different level of problem solving skills in Mathematics. Result in the pairwise comparison of means revealed that the level of problem solving skills in Mathematics was significantly different between 18 and 21, 18 and 22, 19 and 21 and 19 and 22 ($p<0.05$). The 18 years old respondents had lower level of problem solving skills in Mathematics than the 21 (mean difference=-

12.912) and 22 (mean difference=-15.962) years old respondents. Also, the 19 years old respondents had lower level of problem solving skills in Mathematics than the 21 (mean difference=-13.430) and 22 (mean difference=-16.480) years old respondents. This could be because the 21 and 22 years old respondents weremore exposed to various problems in their academic journey compared to the 18 and 19 years old respondents. However, this was not the case between 18 and 19(mean difference=0.518), 18 and 20 (mean difference=-6.620), 19 and 20 (mean difference=-7.138), 20 and 21 (mean difference=-6.292), 20 and 22 (mean difference=-9.342) and 21 and 22 (mean difference=-3.050).

In the study of Ozdayi (2019), the results revealed that there was a statistically significant difference in the level of problem solving skills between ages. The age group 22-25 had the lowest level of problem solving skills while the age group 30 and above had the highest level of problem solving skills. Bakare (2015) assumed that the more growth, the better the person, due to accumulation of experiences, which in no small way always guided the decision making of such individual.

Table 4.2
Respondents' Level of Problem Solving Skills in Mathematics Across their Gender
N = 163

Gender	N	Mean Rank	Mann-Whitney U	Asymp. Sig. (2-tailed test)	Description	Decision
Female	138	81.06	1854.500	0.551	Insignificant	Accept H_0
Male	25	87.18				

Table 4.2 displayed the result of the Mann-Whitney U-test done to determine if there was a significant difference in the respondents' level of problem solving skills in Mathematics across their gender. The result indicated insignificant

difference between groups, [U=1854.500, p=0.551]. Since the p-value was greater than the significance level of 0.05, the null hypothesis was accepted. There was no significant difference in the level of problem solving skills in Mathematics between males and females.

A study of Matel (2013) titled “Reading Comprehension and Mathematical Problem Solving Skills of Fourth Year High School Students of Tagaytay City Science National High School”, the result indicated that there was no significant difference in the students’ level of problem solving skills in Mathematics when grouped according to their gender. This meant that the gender of the students did not matter in identifying their level of problem solving skills in Mathematics. The reason for the equal performance of male and female students might not be unconnected with the fact that both saw themselves as equals and capable of competing and collaborating in classroom activities (Ajai & Imoko, 2015).

Table 4.3
Respondents’ Level of Problem Solving Skills in Mathematics Across their Year Level
N = 163

Year Level	N	Mean Rank	Kruskal-Wallis H	df	Asymp. Sig.	Description	Decision
1	59	55.53	49.438	3	<.001	Significant	Reject H_0
2	31	65.08					
3	27	112.07					
4	46	109.70					

Table 4.3 displayed the result of the Kruskal-Wallis test done to determine if there was a significant difference in the respondents’ level of problem solving skills in Mathematics across their year level. The result indicated a significant difference, $x^2(3)=49.438$, p=<.001. Since the p-value was lesser than the significance level of 0.05, the null hypothesis was rejected. There was a significant

difference in the level of problem solving skills in Mathematics between first, second, third and fourth year respondents. At least one of the year level groups had significantly different level of problem solving skills in Mathematics. According to Cakiroglu, Kuruyer and Ozsoy (2015), when students proceeded through higher classes, acquired skills were developed further and higher skills were inculcated in students. A similar process was followed in the inculcation of mathematical skills.

To determine which groups differred, post hoc analysis was needed to be run. Mann-Whitney U-test was used since it was a nonparametric test.

Table 4.3.1
Mann-Whitney U-test on the Significant Difference in Level of Problem Solving Skills in Mathematics Across Year Level
N = 163

Year Level	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Asymp. Sig. (2-tailed)	Description	Decision
1	59	42.84	2527.50	757.500	0.182	Insignificant	Accept H_0
2	31	50.56	1567.50				
Total	90						
1	59	32.71	1930.00	160.000	<.001	Significant	Reject H_0
3	27	67.07	1811.00				
Total	86						
1	59	39.98	2359.00	589.000	<.001	Significant	Reject H_0
4	46	69.70	3206.00				
Total	105						
2	31	19.85	615.50	119.500	<.001	Significant	Reject H_0
3	27	40.57	1095.50				
Total	58						
2	31	26.66	826.50	330.500	<.001	Significant	Reject H_0
4	46	47.32	2176.50				
Total	77						
3	27	32.43	875.50	497.500	.157	Insignificant	Accept H_0
4	46	39.68	1825.50				
Total	73						

Table 4.3.1 displayed the result of the Mann-Whitney U-test ran to determine which year level groups had significantly different level of problem solving skills in Mathematics. Result in the pairwise comparison of means revealed

that the level of problem solving skills in Mathematics was significantly different between 1 and 3, 1 and 4, 2 and 3 and 2 and 4 ($p<0.05$). The first year respondents had lower level of problem solving skills in Mathematics than the third and fourth year respondents. Also, the second year respondents had lower level of problem solving skills in Mathematics than the third and fourth year respondents. This could be because of the experience in higher mathematical topics that the third and fourth year college students encountered in their study compared to the first and second year college students. However, this was not the case between 1 and 2 and 3 and 4.

This was the same result with Barth, Menon and Rosenberg-Lee (2011) in their research titled "What difference does a year of schooling make?", there was a significant difference in second grade and third grade pupils' level of arithmetic problem solving skills when grouped according to their grade level. Third grade pupils had a higher level of arithmetic problem solving skills than the second grade pupils. According to Bingham (1998), problem solving skill was a learnable concept that could be developed through experience.

Table 5
Respondents' Level of AQ Predicting their Level of Problem Solving Skills in Mathematics
N = 163

Model	R Square	Adjusted R Square	Unstandardized B	Sig.	Hypothesis Testing Result at 95% confidence interval
1	0.028	0.022	0.212	0.032	Reject H_0 (0.032 < 0.05)

a. Predictor: Level of AQ
b. Dependent Variable: Level of Problem Solving Skills in Mathematics

Table 5 displayed the result of the Linear regression done to determine if the respondents' level of AQ was a significant predictor of their level of problem solving skills in Mathematics. As reflected, 2.2% of variance in level of problem solving skills in Mathematics was explained by level of AQ. Since the p-value was 0.032 which was lesser than the significance level of 0.05, the null hypothesis was rejected. Hence, level of AQ significantly explained level of problem solving skills in Mathematics. Further, the unstandardized coefficient B was positive. Hence, the respondents' level of AQ positively predicted their level of problem solving skills in Mathematics. For every unit increase in level of AQ, level of problem solving skills in Mathematics was predicted to be 0.212 units higher. Supporting this result, Hakim and Murtafiah (2020) found that the level of AQ of the Mathematics Education Study Program students at Universitas Sulawesi Barat positively affected their level of problem solving skills in Mathematics.

Albert Bandura, in his Self-efficacy theory, believed that none of the mechanisms of human agency were more central or ubiquitous than people's beliefs in their ability to change events that affected their lives. Human inspiration, motivation, performance accomplishments and emotional well-being were all built on this underlying belief (Bandura, 1977).

With the help of appropriate statistical tools, the data gathered were able to produce valid and reliable results that were presented, analyzed and interpreted unbiasedly in this chapter. Relevant sources supported that the BSEd-Mathematics students of BISU - MC in the school year 2021-2022 were 18 to 22 year-olds, mostly females and first and fourth years in majority. Their AQ was below average while their problem solving skills in Mathematics was satisfactory. There was no significant difference in their level of AQ across their profile but there was a significant difference in their level of problem solving skills in Mathematics across their age and year level. The 18 and 19 year-olds had lower level of problem solving skills in Mathematics than the 21 and 22 year-olds. The first and second years had lower level of problem solving skills in Mathematics than the third and fourth years. Just as importantly, level of AQ positively predicted level of problem solving skills in Mathematics.

Chapter 3

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

This chapter manifested the summary of the study as well as its conclusion based on the findings. Recommendations were provided as bases for the proposed action plan.

Summary of Findings

The main aim of the study was to determine the levels of Adversity Quotient and problem solving skills in Mathematics of BISU - MC students taking BSEd-Mathematics in the school year 2021-2022. It desired to find if there was a significant difference in the respondents' levels of AQ and problem solving skills in Mathematics across their age, gender and year level as well as their level of AQ as a significant predictor of their level of problem solving skills in Mathematics. It also aimed to develop a plan of action that would be proposed to improve these two aspects of their being.

The locale of the study was Bohol Island State University - Main Campus. The respondents were students taking Bachelor of Secondary Education major in Mathematics in the school year 2021-2022. The total number of actual respondents was 163. Purposive sampling was used.

The study utilized the quantitative type of study. It made use of the descriptive design to describe the characteristics of the population being studied and the regression design to infer the relationship between the independent variable and dependent variable. The Online AQ Profile was used for determining the respondents' level of AQ and a 10-item test was used for determining their level of problem solving skills in Mathematics, both inquired their profile.

The data provided by the respondents were collected and subjected to statistical treatment through IBM SPSS Statistics Trial software. To determine their profile, the researchers used frequency and percentage distribution. To determine their level of AQ, PEAK Learning provided the data results along with an AQ Profile Scoring Addendum. To determine their level of problem solving skills in Mathematics, a rubric that was developed and validated by the California State Department of Education Assessment Program was used in scoring their solutions for the problem solving test. The scores that they got were converted into percentages and interpreted based on a scale that was developed and validated by Oliveros (2014).

To determine whether there was a significant difference in the respondents' level of AQ when grouped according to their age and year level, the Kruskal-Wallis test was used. To determine whether there was a significant difference in their level of AQ when grouped according to their gender, Mann Whitney U-test was used. To determine whether there was a significant difference in their level of problem solving skills in Mathematics when grouped according to their age, One- way ANOVA was used. To determine whether there was a significant difference intheir level of problem solving skills in Mathematics when grouped according to their gender, Mann Whitney U-test was used. To determine whether there was a significant difference in their level of problem solving skills in Mathematics when grouped according to their year level, the Kruskal-Wallis test was used. To determine whether their level of AQ was a significant predictor of their level of problem solving skills in Mathematics, Linear regression was used. Assumptions were checked to ensure the appropriateness of the statistical tools used.

Findings

The results of the study were summed up as follows:

1. **Profile of the Respondents**

   Age. Data revealed that the age of the respondents ranged from 18 to 22 years old.

   Gender. Data revealed that females numerically dominated the analyzed field.

   Year Level. Data revealed that majority of the respondents were from the first and fourth year levels.

2. **Respondents' Levels of AQ and Problem Solving Skills in Mathematics**

   Level of AQ. Data revealed that the AQ of the respondents had a mean of 37.91 in terms of Control, 37.44 in terms of Ownership, 19.70 in terms of Reach, 29.29 in terms of Endurance and 124.34 in terms of overall AQ. In general, this indicated a below average AQ that meant they were likely to be under-utilizing their potential. Adversity could take a significant and unnecessary toll, making it difficult to continue the ascent. They might battle against a sense of helplessness and despair and escape was possible by raising the level of AQ.

   Level of Problem Solving Skills in Mathematics. Data revealed that the problem solving skills in Mathematics of the respondents was 30%

very satisfactory and 70% satisfactory. It had an overall mean of 57.5399%. This indicated satisfactory problem solving skills in Mathematics which meant they demonstrated adequate problem solving skills. They did not require assistance in problem solving but they still had room for improvement.

3. **Difference in Respondents' Level of AQ**

Across Age. Data revealed an insignificant difference, $x^2(4)=6.531$, $p=0.163$. Since the p-value was greater than the significance level of 0.05, the null hypothesis was accepted. There was no significant difference in the level of AQ between 18, 19, 20, 21 and 22 years old respondents.

Across Gender. Data revealed an insignificant difference between groups, [$U=1910.500$, $p=0.393$]. Since the p-value was greater than the significance level of 0.05, the null hypothesis was accepted. There was no significant difference in the level of AQ between males and females.

Across Year Level. Data revealed an insignificant difference, $x^2(3)=3.250$, $p=0.355$. Since the p-value was greater than the significance level of 0.05, the null hypothesis was accepted. There was no significant difference in the level of AQ between first, second, third and fourth year respondents.

4. **Difference in Respondents' Level of Problem Solving Skills in Mathematics**

Across Age. Data revealed a significant difference, [$F(4,158)=6.727$, $p=<.001$]. Since the p-value was lesser than the significance level of 0.05, the null hypothesis was rejected. The level of problem solving skills in Mathematics was significantly different between 18 and 21, 18 and 22, 19 and 21 and 19 and 22 ($p<0.05$). The 18 and 19 years old respondents had a lower level of problem solving skills in Mathematics than the 21 and 22 years old respondents. However, this was not the case between 18 and 19, 18 and 20, 19 and 20, 20 and 21, 20 and 22 and 21 and 22.

Across Gender. Data revealed an insignificant difference between groups, [U=1854.500, p=0.551]. Since the p-value was greater than the significance level of 0.05, the null hypothesis was accepted. There was no difference in the level of problem solving skills in Mathematics between males and females.

Across Year Level. Data revealed a significant difference, $x^2(3)=49.438$, p=<.001. Since the p-value was lesser than the significance level of 0.05, the null hypothesis was rejected. The level of problem solving skills in Mathematics was significantly different between 1 and 3, 1 and 4, 2 and 3 and 2 and 4 ($p<0.05$). The first and second year respondents had a lower level of problem solving skills in Mathematics than the third and fourth year respondents. However, this was not the case between 1 and 2 and 3 and 4.

5. **Respondents' Level of AQ Predicting their Level of Problem Solving Skills in Mathematics**

Data revealed that 2.2% of the variance in the level of problem solving skills in Mathematics was explained by the level of AQ. The p-value was 0.032 which was lesser than the significance level of 0.05. Therefore, the null hypothesis was rejected. The respondents' level of AQ was a significant predictor of their level of problem solving skills in Mathematics. Further, the unstandardized coefficient B was positive. Hence, the respondents' level of AQ positively predicted their level of problem solving skills in Mathematics. If the level of AQ increased for one unit, the level of problem solving skills in Mathematics increased by 0.212 units.

Conclusion

Based on the findings of the study, the conclusion was drawn:

The age, gender and year level of students did not matter in identifying their level of AQ. On the other hand, the older students had a higher level of problem solving skills in Mathematics than the younger ones and the students in the higher year level had a higher level of problem solving skills in Mathematics than those in the lower year level. Finally, their level of AQ gave a positive influence on their level of problem solving skills in Mathematics.

Recommendations

In line with the findings of the study, the conclusion reached and their various implications, the following recommendations were hereby made:

1. The education system should be aligned with the profile of the students.
2. The teachers would let the students read the book of Paul G. Stoltz, PhD titled "Adversity Quotient: Turning Obstacles into Opportunities". The

students would also reflect on the word of God. Also, the teachers would let the students study the book by George Polya titled “How To Solve It”. The students would also continue to solve various routine problems.

3. Regardless of age, gender and year level, the family and friends of the students should encourage them in every way they can for their better future as they overcome their adversities.
4. Mathematics curriculum makers and teachers work together to improvise teaching and learning Mathematics specifically problem solving for the younger students and those in the lower year level.
5. Future researchers could replicate the study to further verify the results. Research could focus specifically on the CORE dimensions of AQ predicting the level of problem solving skills in Mathematics.

Proposed Guidance Program for Students

Rationale

Ecclesiastes 3 said, “There is a given time for everything and a time for every happening under heaven:… A time for tears, a time for laughter; a time for mourning, a time for dancing..” Life was not always easy. Regardless of any status in life, adversity was present. Nevertheless, it was not about the adversity. It was how one dealt with it that mattered.

The researchers discovered after having a study of BISU - MC students taking up BSEd-Mathematics in the school year 2021-2022 that their level of AQ was below average and this influenced their level of problem solving skills in Mathematics. For these reasons, the researchers proposed a guidance program for school administrators that could provide counseling to students.

Objectives

The pursuance of this program concerned the following purposes:

1. To help students open up about their adversities;
2. To hire a school psychologist;
3. To improve the level of AQ of students; and
4. To improve the level of problem solving skills in Mathematics of students.

Mechanics of Implementation

The proposed guidance program would be presented to the Guidance Center. It would be submitted to the Campus Director for the approval of its implementation. Upon approval, it would be recommended to the College Dean as a reference in the conduct of the counseling.

Schedule of Implementation

The program would be for the whole school year and for the next school years to come. It was the free will of the students when they would approach for counseling.

Evaluative Measure

For the success of the guidance program, the Guidance Office as the dependable office in counseling would evaluate and monitor its implementation. The school's technical group would also offer assistance since the educational setting was online.

Matrix of Proposed Guidance Program

Areas of Concern	Objectives	Strategies	Time Frame	Persons Involved	Budget	Evaluative Measure
1. The Hiring of a School Psychologist	To provide students with professional counseling	Social Media Post	One month	Guidance Counselors	10,000	License
2. Application for Counseling	To accept students who are willing to receive counseling	Make an accessible website for the program	From the second month of the present school year to the next whole school years to come	Guidance Counselors Students	10,000	Interview
3. Giving of Certificates	To show appreciation to the participants	Send in a Portable Document Format (PDF) through Gmail	After every counseling	Guidance Counselors Students School Psychologist	10,000	Participation

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APPENDICES

Appendix A-1
Letter to the Campus Director

Republic of the Philippines
BOHOL ISLAND STATE UNIVERSITY
Main Campus, Tagbilaran City

Vision: A premier S & T university for the formation of a world-class and virtuous human resource for sustainable development in Bohol and the country.
Mission: BISU is committed to provide quality higher education in the arts and sciences, as well as in the professional and technological fields; undertake research and development, and extension services for the sustainable development for Bohol and the country.

April 30, 2021

ERNESTO C. RULIDA, PhD
Campus Director
Bohol Island State University - Main Campus
Tagbilaran City, Bohol 6300

Sir:

A blessed day! We, undersigned students of Bachelor of Secondary Education major in Mathematics are conducting a study titled, **Students' Adversity Quotient and Problem Solving Skills in Mathematics** at Bohol Island State University - Main Campus in partial fulfillment of the requirements in Research in Mathematics.

In connection with this, the researchers seek approval from your good office to allow us to assess the level of Adversity Quotient and the level of problem solving skills in Mathematics of the BSEd-Mathematics students of BISU-MC in the school year 2021-2022. Your approval is of great help in the realization of this study. Thank you and may God bless you always.

Respectfully yours,

(Sgd) **JEEANNIE S. DAMILES**
Thesis Group Leader

(Sgd) **MITCHELLE G. TORREJOS**
Thesis Group Member

(Sgd) **FATIMA A. HINAMPAS**
Thesis Group Member

Noted by:

(Sgd) **RENARIO G. HINAMPAS JR., PhD**
Thesis Adviser

Recommending Approval:

(Sgd) **MARIA ELENA S. MANDIN, PhD**
Dean, College of Teacher Education

Approved by:

(Sgd) **ERNESTO C. RULIDA, PhD**
Campus Director

Appendix A-2
Letter to the College Dean

Republic of the Philippines
BOHOL ISLAND STATE UNIVERSITY
Main Campus, Tagbilaran City

Vision: A premier S & T university for the formation of a world-class and virtuous human resource for sustainable development in Bohol and the country.
Mission: BISU is committed to provide quality higher education in the arts and sciences, as well as in the professional and technological fields; undertake research and development, and extension services for the sustainable development for Bohol and the country.

April 30, 2021

MARIA ELENA S. MANDIN, PhD
Dean, College of Teacher Education
Bohol Island State University - Main Campus
Tagbilaran City, Bohol 6300

Ma'am:

A blessed day! We, undersigned students of Bachelor of Secondary Education major in Mathematics are conducting a study titled, **Students' Adversity Quotient and Problem Solving Skills in Mathematics** at Bohol Island State University - Main Campus in partial fulfillment of the requirements in Research in Mathematics.

In connection with this, the researchers seek approval from your good office to allow us to assess the level of Adversity Quotient and the level of problem solving skills in Mathematics of the BSEd-Mathematics students from the College of Teacher Education of BISU - MC in the school year 2021-2022. Your approval is of great help in the realization of this study. Thank you and may God bless you always.

Respectfully yours,

(Sgd) **JEEANNIE S. DAMILES**
Thesis Group Leader

(Sgd) **MITCHELLE G. TORREJOS**
Thesis Group Member

(Sgd) **FATIMA A. HINAMPAS**
Thesis Group Member

Noted by:

(Sgd) **RENARIO G. HINAMPAS JR., PhD**
Thesis Adviser

(Sgd) **ANALYN D. PESIDAS, PhD**
Research in Mathematics Instructor

Approved by:

(Sgd) **MARIA ELENA S. MANDIN, PhD**
Dean, College of Teacher Education

Appendix A-3
Letter to the Statistician / Adviser

Republic of the Philippines
BOHOL ISLAND STATE UNIVERSITY
Main Campus, Tagbilaran City

Vision: A premier S & T university for the formation of a world-class and virtuous human resource for sustainable development in Bohol and the country.
Mission: BISU is committed to provide quality higher education in the arts and sciences, as well as in the professional and technological fields; undertake research and development, and extension services for the sustainable development for Bohol and the country.

April 30, 2021

RENARIO G. HINAMPAS JR., PhD
Instructor, College of Teacher Education
Bohol Island State University - Main Campus
Tagbilaran City, Bohol 6300

Sir:

A blessed day! We, **JEEANNIE S. DAMILES**, **FATIMA A. HINAMPAS** and **MITCHELLE G. TORREJOS**, third year students of Bohol Island State University - Main Campus pursuing a degree Bachelor of Secondary Education major in Mathematics are currently enrolled in Research in Mathematics 1.

We are writing to humbly request for your service and expertise to serve as the Statistician / Adviser for our thesis with a running title of: **STUDENTS' ADVERSITY QUOTIENT AND PROBLEM SOLVING SKILLS IN MATHEMATICS**. We believe that your knowledge and insights will be valuable and would greatly enrich our research. Thank you and may God bless you always.

Respectfully yours,

(Sgd) **JEEANNIE S. DAMILES**
Thesis Group Leader

(Sgd) **MITCHELLE G. TORREJOS**
Thesis Group Member

(Sgd) **FATIMA A. HINAMPAS**
Thesis Group Member

Noted by:

(Sgd) **ANALYN D. PESIDAS, PhD**
Research in Mathematics 1 Instructor

Approved by:

(Sgd) **MARIA ELENA S. MANDIN, PhD**
Dean, College of Teacher Education

Conforme:

(Sgd) **RENARIO G. HINAMPAS JR., PhD**

Appendix A-4
Letter to the English Critic

Republic of the Philippines
BOHOL ISLAND STATE UNIVERSITY
Main Campus, Tagbilaran City

Vision: A premier S & T university for the formation of a world-class and virtuous human resource for sustainable development in Bohol and the country.
Mission: BISU is committed to provide quality higher education in the arts and sciences, as well as in the professional and technological fields; undertake research and development, and extension services for the sustainable development for Bohol and the country.

April 30, 2021

MA. JEANE FRANZ B. MASCARDO, LPT
Instructor, College of Teacher Education
Bohol Island State University - Main Campus
Tagbilaran City, Bohol 6300

Ma'am:

A blessed day! We, **JEEANNIE S. DAMILES**, **FATIMA A. HINAMPAS** and **MITCHELLE G. TORREJOS**, third year students of Bohol Island State University - Main Campus pursuing a degree Bachelor of Secondary Education major in Mathematics are currently enrolled in Research in Mathematics 1.

We are writing to humbly request for your service and expertise to serve as the English Critic for our thesis with a running title of: **STUDENTS' ADVERSITY QUOTIENT AND PROBLEM SOLVING SKILLS IN MATHEMATICS**. We believe that your knowledge and insights will be valuable and would greatly enrich our research. Thank you and may God bless you always.

Respectfully yours,

(Sgd) **JEEANNIE S. DAMILES**
Thesis Group Leader

(Sgd) **MITCHELLE G. TORREJOS**
Thesis Group Member

(Sgd) **FATIMA A. HINAMPAS**
Thesis Group Member

Noted by:

(Sgd) **ANALYN D. PESIDAS, PhD**
Research in Mathematics 1 Instructor

Approved by:

(Sgd) **MARIA ELENA S. MANDIN, PhD**
Dean, College of Teacher Education

Conforme:

(Sgd) **MA. JEANE FRANZ B. MASCARDO, LPT**

Appendix B-1
AQ Profile Technical Report 2019

SUMMARY

This report provides good evidence that the AQ Profile® can be used as a predictor of resilience for the English and Chinese versions.

English Version

- The reliability of the AQP® was very good (.92) which indicates that the scores are suitable for drawing reliable inferences about individual test takers. The reliability of the AQP® subscales were also very good (.85 - .93).
- Based on an examination of Cronbach's alpha if an item were deleted, all items should remain in the calculation of AQP® and each of the AQP® subscales.
- Based on an examination of a confirmatory factor analysis, all items loaded on their subsequent subscales with loadings of .50 or higher, demonstrating good discriminant validity.

Chinese Version

- The reliability of the AQP® was very good (.92) which indicates that the scores are suitable for drawing reliable inferences about individual test takers. The reliability of the AQP® subscales were also very good (.84 - .89).
- Based on an examination of Cronbach's alpha if an item were deleted, all items should remain in the calculation of AQP® and each of the AQP® subscales.
- Based on an examination of a confirmatory factor analysis, all items loaded on their subsequent subscales with loadings of .50 or higher, demonstrating good discriminant validity.

While this report provides a review of the psychometric properties of the AQ Profile®, users should review the assessment characteristics and judge the appropriateness of the assessment for their use.

Appendix C-1
Pilot Testing Data

Students	Number Problem 1	Digit Problem 1	Age Problem 1	Clock Problem 1	Mixture and Solution Problem 1	Work Problem 1	Uniform Motion Problem 1	Investment and Money Problem 1	Geometric Problem 1	Variation Problem 1
1	6	6	6	5	5	3	5	6	6	5
2	5	5	5	5	5	5	6	4	5	5
3	5	5	6	3	6	6	6	6	5	5
4	5	5	3	5	5	5	5	5	5	5
5	4	6	2	3	6	5	5	5	5	5
6	5	5	5	3	5	5	5	5	5	5
7	5	4	5	3	5	5	5	5	5	5
8	5	5	3	5	3	5	5	5	5	5
9	5	0	5	3	5	5	5	6	3	5
10	5	5	5	3	5	5	5	5	5	5
11	5	0	6	5	5	5	6	0	3	6
12	3	5	3	5	3	5	5	5	5	5
13	6	0	6	5	6	6	6	6	6	5
14	5	5	5	0	5	5	5	5	6	5
15	5	3	5	3	5	5	5	5	3	5
16	5	3	3	3	4	5	5	5	5	5
17	5	3	3	3	4	5	5	5	5	5
18	5	0	5	0	5	5	5	5	3	5
19	3	3	5	5	3	5	5	3	5	5
20	5	3	3	3	4	5	5	5	5	0
21	3	5	3	3	3	3	5	5	2	5
22	5	0	5	3	5	5	5	5	3	5
23	5	3	3	3	0	5	5	5	5	5
24	5	5	5	0	5	3	5	0	2	5
25	5	0	4	5	0	5	5	5	5	5
26	5	0	5	0	5	5	5	0	3	5
27	5	5	2	3	5	5	5	0	0	5
28	6	2	5	1	0	5	5	0	2	5
29	5	0	0	4	5	6	5	5	0	0
30	3	0	0	5	0	5	6	5	0	5
31	5	0	0	4	5	6	5	5	0	0
32	5	0	3	2	0	5	3	3	5	0
33	5	0	3	0	0	3	5	2	5	2
34	3	0	3	3	0	5	6	6	0	0
35	3	2	0	2	0	3	3	2	2	1
36	5	3	0	2	0	5	0	2	2	0
37	2	2	2	1	1	1	2	0	0	1

38	1	2	2	1	1	1	2	1	0	1
39	2	2	2	1	0	1	2	0	0	1
40	2	2	2	1	0	1	2	0	0	1
41	2	2	0	1	1	1	2	2	0	0
42	2	3	1	1	0	1	1	0	0	0
43	5	0	0	0	0	0	0	0	0	0
44	5	0	0	0	0	0	0	0	0	0

Students	Number Problem 2	Digit Problem 2	Age Problem 2	Clock Problem 2	Mixture and Solution Problem 2	Work Problem 2	Uniform Motion Problem 2	Investment and Money Problem 2	Geometric Problem 2	Variation Problem 2	Total Score	In Percent
1	5	6	5	3	5	5	5	5	5	5	102	85%
2	5	3	5	5	5	5	6	5	5	5	99	83%
3	3	3	6	3	5	6	3	5	5	5	97	81%
4	3	3	5	5	5	5	5	5	5	5	94	78%
5	6	6	6	3	5	5	5	2	5	3	92	77%
6	3	3	5	3	5	4	5	5	5	5	91	76%
7	3	3	5	3	5	4	5	5	5	5	90	75%
8	2	5	5	3	5	4	5	5	5	4	89	74%
9	5	3	5	3	5	5	5	5	5	5	88	73%
10	3	3	5	3	5	4	5	5	4	3	88	73%
11	3	3	6	3	5	5	6	0	6	6	84	70%
12	3	3	5	5	3	5	5	3	5	3	84	70%
13	2	3	6	3	5	4	3	0	0	5	83	69%
14	2	5	5	0	5	5	5	0	5	5	83	69%
15	3	3	5	3	5	5	5	0	5	5	83	69%
16	2	3	3	3	5	5	5	2	5	5	81	68%
17	2	3	3	3	5	5	5	2	5	5	81	68%
18	2	3	5	0	5	5	5	6	5	5	79	66%
19	2	2	5	5	5	4	3	3	5	3	79	66%
20	2	3	5	3	5	5	3	2	5	5	76	63%
21	3	3	5	3	3	5	3	3	5	5	75	63%
22	3	0	5	0	5	5	5	0	5	5	74	62%
23	2	3	3	3	0	5	5	2	5	5	72	60%
24	5	3	3	0	3	5	5	0	5	5	69	58%
25	2	0	5	0	0	5	5	0	5	5	66	55%
26	3	3	5	0	5	5	5	0	2	5	66	55%
27	5	3	3	0	0	5	5	0	0	5	61	51%
28	5	1	5	1	0	4	5	0	2	5	59	49%
29	3	0	3	3	5	4	5	0	0	0	53	44%
30	5	3	0	0	0	5	5	0	0	5	52	43%
31	0	0	3	4	5	4	5	0	0	0	51	43%

32	2	3	5	1	0	5	3	3	3	0	51	43%
33	5	0	5	0	0	5	5	0	5	0	50	42%
34	5	6	0	0	0	4	3	0	0	0	44	37%
35	2	1	3	2	0	3	3	1	2	1	36	30%
36	2	2	5	1	0	5	0	0	0	0	34	28%
37	1	1	2	2	1	1	2	0	0	1	23	19%
38	1	1	2	2	1	1	2	0	0	0	22	18%
39	1	1	2	2	1	1	2	0	0	0	21	18%
40	1	1	2	2	1	1	2	0	0	0	21	18%
41	1	1	0	2	1	1	2	1	0	0	20	17%
42	2	0	1	2	1	1	1	0	0	0	17	14%
43	3	0	0	0	0	0	0	0	0	0	8	7%
44	2	0	0	0	0	0	0	0	0	0	7	6%

Appendix C-2
Item Analysis Report

*A total of 44 students answered the test.

Item	Mean	StDev	Difficulty	Discrimination
1A	4.34	1.27	0.73-An item that displays the capability of the students to perform the expected outcome	0.27-Marginal item, usually needing improvement
1B	2.84	1.43	0.23	-0.09-Poor item, to be rejected or improved by revision
2A	2.48	2.12	0.32- An item that displays the capability of the students to perform the expected outcome	0.45-Very good item
2B	2.39	1.67	0.11	0.14-Poor item, to be rejected or improved by revision
3A	3.16	1.99	0.41	0.45-Very good item
3B	3.80	1.86	0.59- An item that displays the capability of the students to perform the expected outcome	0.64-Very good item
4A	2.64	1.74	0.27- An item that displays the capability of the students to perform the expected outcome	0.18-Poor item, to be rejected or improved by revision
4B	2.09	1.58	0.11	0.14-Poor item, to be rejected or improved by revision
5A	2.95	2.34	0.52- An item that displays the capability of the students to perform the expected outcome	0.59-Very good item
5B	2.95	2.28	0.52- An item that displays the capability of the students to perform the expected outcome	0.77-Very good item
6A	4.09	1.76	0.70	0.41-Very good item
6B	3.98	1.64	0.80- An item that displays the capability of the students to perform the expected outcome	0.41-Very good item
7A	4.27	1.72	0.75- An item that displays the capability of the students to perform the expected outcome	0.50-Very good item
7B	3.91	1.65	0.61	0.32-Reasonably good item, but possibly subject to improvement
8A	3.39	2.29	0.59- An item that displays the capability of the students to perform the expected outcome	0.64-Very good item
8B	1.70	2.11	0.23	0.45-Very good item
9A	2.98	2.25	0.45	0.55-Very good item
9B	3.05	2.36	0.57- An item that displays the capability of the	0.77-Very good item

			students to perform the expected outcome	
10A	3.36	2.27	0.64- An item that displays the capability of the students to perform the expected outcome	0.64-Very good item
10B	3.16	2.29	0.57	0.50-Very good item

ITEM ANALYSIS Summary

Score: Problem Solving Test

Reliability: 0.94589212

Standard error of measurement: 6.40252685

	Difficulty
Discrimination	**An item that displays the capability of the students to perform the expected outcome**
Very good items (≤ 0.40)	2A, 3B, 5A, 5B, 6B, 7A, 8A, 9B, 10A
Reasonably good items, but possibly subject to improvement (0.30 - 0.39)	
Marginal items, usually needing improvement (0.20 - 0.29)	1A
Poor items, to be rejected or improved by revision (≥ 0.19)	4A

Reliability *coefficient alpha - a measure of the internal consistency of the exam. This statistic ranges from 0 to 1.00, and the higher the value the better.*

Standard error of measurement *a measure of accuracy of individual student scores. The smaller the number, the more accurate the measurement.*

Difficulty *the percentage of students answering the question correctly. In cases of more complex weighting, it is the percentage of points gained divided by the total points.*

Discrimination *the correlation of responses to individual items with overall test score. The higher the correlation, the more the item results are consistent with the test as a whole.*

Note: *The difficulty index takes a different meaning when used in the context of criterion-referenced interpretation or testing for mastery. An item with a high difficulty index will not be considered as an “easy item” and therefore a weak item, but rather an item that displays the capability of the students to perform the expected outcome.*

Appendix C-3
Problem Solving Test

Instructions: Fill in the blanks with the required pieces of information. Read the following problems and show your respective solutions. Write clearly on a clean paper and use the Scanner feature of Google Classroom to submit your work. The holistic rubric below will be used for scoring.

*Age:*_____ *Gender:*_____ *Year Level:*_____

1. Number Problem
   Find four consecutive odd integers such that the sum of the first and second odd integer is twelve more than one-half of the sum of the third and fourth odd integer.

2. Digit Problem
   The value of the ones digit of a three-digit number is the sum of the hundreds and tens digit. The difference between the hundreds and tens digit is 6. If the order of the digits is reversed, the resulting number is 99 more than the original number. Find the original number.

3. Age Problem
   Fatty is three years younger than Annie. Annie is twice as old as Mitch. The sum of their ages is 42. How old is each?

4. Clock Problem
   When the minute hand is seven minutes behind the hour hand, what time is it between 5 and 6 o'clock?

5. Mixture and Solution Problem
   How many liters of water must be added to 40 liters of a 30% salt solution to produce a 25% salt solution?

6. Work Problem
   James can build a dog house by himself in 4 days. Rodel can build the same dog house by himself in 8 days. How long could it take them to build a dog house if they had to work together?

7. Uniform Motion Problem
   Motorcycle A and B leave the same place and traveling in opposite directions. If motorcycle A is traveling at 25 kilometers per hour and motorcycle B is traveling at 35 kilometers per hour, in how many hours will they be 120 kilometers apart?

8. Investment and Money Problem
   Kageyama has ₱3,000 consisting of ₱20, ₱50, ₱100 and ₱200 bills. The number of ₱20 bills is the same as the number of ₱100 bills. The number of ₱200 bills is twice the number of ₱100 bills. The number of ₱50 bills is three more than the number of ₱20 bills. How many of each type of bill does he have?

9. Geometric Problem
   When a length of a certain rectangle was decreased by 5 cm and the width was increased by 5 cm, the resulting figure was a square with a perimeter of 64 centimeters. Find the dimensions of the original rectangle.

10. Variation Problem
    Suppose f varies directly as the square of m and inversely as j. Also, f=6 when m=2 and j=10. Find f, if m=4 and j=6.

HOLISTIC RUBRIC FOR SCORING STUDENTS' RESPONSES TO THE PROBLEM SOLVING TEST BASED ON POLYA (1945)						
6 *Exemplary response*	**5** *Competent response*	**4** *Satisfactory with minor flaws*	**3** *Nearly satisfactory, but contained serious flaws*	**2** *Began problem but failed to complete solution*	**1** *Failed to begin effectively*	**0** *No attempt at solution*
The response is complete and includes a clear and accurate explanation of the techniques used to solve the problem. It includes accurate diagrams (where appropriate), identifies important information, shows a full understanding of ideas and mathematical processes used in the solution, and clearly communicates this knowledge.	This response is fairly complete and includes a reasonably clear explanation of the ideas and processes used. Solid supporting arguments are presented, but some aspects may not be as clearly or completely explained as possible.	The problem is completed satisfactorily, but the explanation is lacking in clarity or supporting evidence. The underlying mathematical principles are generally understood, but the diagram or description is inappropriate or unclear.	The response is incomplete. The problem is either incomplete or major portions have been omitted. Major computational errors may exist, or misuse of formulas or terms may be present. The response generally does not show a full understanding of the mathematical concepts involved.	The response is incomplete and shows little or no understanding of the mathematical processes involved. The diagram or explanation is unclear.	The problem is not effectively represented. Parts of the problem may be copied, but no solution was attempted. Pertinent information was not identified.	No attempt at copying or solving the problem is made.

Developed and validated by: California State Department of Education Assessment Program (Meier, 1992)

Appendix D
Statistical Test Computations

1. What is the profile of the students in terms of:
   1.1. age;

Age

	N	%
18	32	19.6%
19	34	20.9%
20	37	22.7%
21	29	17.8%
22	31	19.0%

   1.2. gender; and

Gender

	N	%
Female	138	84.7%
Male	25	15.3%

   1.3. year level?

YearLevel

	N	%
1	59	36.2%
2	31	19.0%
3	27	16.6%
4	46	28.2%

2. What is the level of the students in terms of:
   2.1. AQ; and

Descriptive Statistics

	N	Mean
Control	163	37.91
Ownership	163	37.44
Reach	163	19.70
Endurance	163	29.29
AdversityQuotient	163	124.34
Valid N (listwise)	163	

   2.2. problem solving skills in Mathematics?

Descriptive Statistics

	N	Mean
NumberProblem	163	61.4601%
DigitProblem	163	61.4969%
AgeProblem	163	74.7791%
ClockProblem	163	47.9939%
MixtureandSolutionProblem	163	54.3006%
WorkProblem	163	54.2270%
UniformMotionProblem	163	58.0429%
InvestmentandMoneyProblem	163	59.1350%
GeometricProblem	163	50.3252%
VariationProblem	163	53.6258%
ProblemSolvingSkillsinMathematics	163	57.5399%
Valid N (listwise)	163	

3. Is there a significant difference in the students' level of AQ across:

3.1. age;

Test Assumptions for One-way ANOVA

a. Normality Distribution of the Dependent Variable for Each Group

ANOVA is robust to non-normality. This test can still be considered even if the distribution is not normal and is even better than its non-parametric counterpart (McDougal & Rayner, 2004).

b. Homogeneity of Variance

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
AQ	Based on Mean	3.357	4	158	.011
	Based on Median	3.036	4	158	.019
	Based on Median and with adjusted df	3.036	4	142.018	.019
	Based on trimmed mean	3.202	4	158	.015

Since p-value<0.05, then equal variance cannot be assumed.

Nonparametric Counterpart: Kruskal-Wallis test

Ranks

	Age	N	Mean Rank
AQ	18	32	74.56
	19	34	75.37
	20	37	92.19
	21	29	72.03
	22	31	94.11
	Total	163	

Test Statistics[a,b]

	AQ
Kruskal-Wallis H	6.531
df	4
Asymp. Sig.	.163

a. Kruskal Wallis Test

b. Grouping Variable: Age

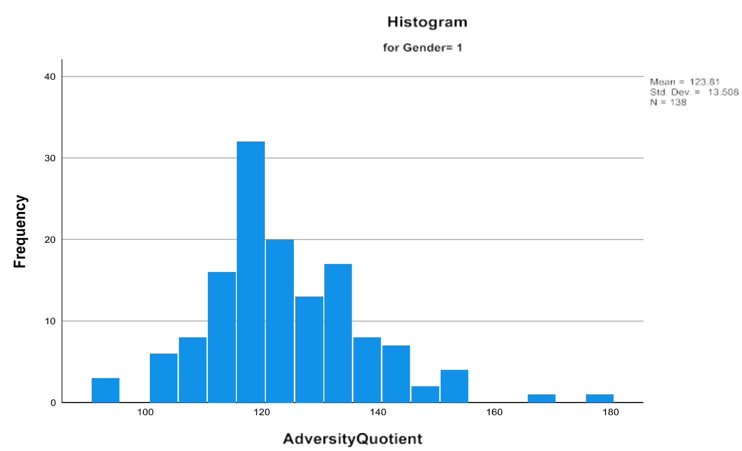
A Kruskal-Wallis H test showed that there was no statistically significant difference in the students' level of AQ across their age.

3.2. gender; and

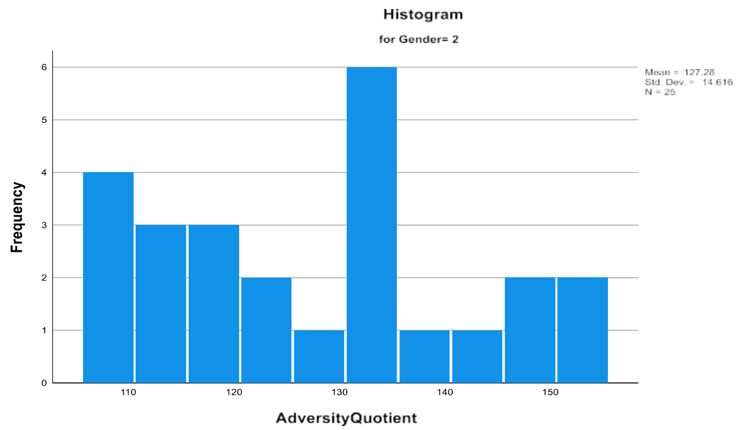
Test Assumptions for Independent sample t-test

a. Normality Distribution of the Dependent Variable for Each Group

Female



Male



Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Gender	Statistic	df	Sig.	Statistic	df	Sig.
AQ	Female	.090	138	.009	.967	138	.002
	Male	.137	25	.200*	.932	25	.095

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Here, the level of AQ in Female is not significantly normal and in Male is significantly normal.

Nonparametric Counterpart: Mann Whitney U-test

Independent-Samples Mann-Whitney U Test Summary

Total N	163
Mann-Whitney U	1910.500
Wilcoxon W	2235.500
Test Statistic	1910.500
Standard Error	217.040
Standardized Test Statistic	.855
Asymptotic Sig.(2-sided test)	.393

Since the Asymptotic Sig.(2-sided test) is more than 0.05, then researchers have evidence that there is not a statistically significant difference in the level of AQ between the female and male students.

3.3. year level?

Test Assumptions for One-way ANOVA

a. Normality Distribution of the Dependent Variable for Each Group

ANOVA is robust to non-normality. This test can still be considered even if the distribution is not normal and is even better than its non-parametric counterpart (McDougal & Rayner, 2004).

b. Homogeneity of Variance

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
AQ	Based on Mean	4.148	3	159	.007
	Based on Median	3.497	3	159	.017
	Based on Median and with adjusted df	3.497	3	141.156	.017
	Based on trimmed mean	4.002	3	159	.009

Since p-value<0.05, then equal variance cannot be assumed.

Nonparametric Counterpart: Kruskal-Wallis test

Ranks

	YearLevel	N	Mean Rank
AQ	1	59	80.22
	2	31	71.11
	3	27	92.07
	4	46	85.71
	Total	163	

Test Statistics[a,b]

	AQ
Kruskal-Wallis H	3.250
df	3
Asymp. Sig.	.355

a. Kruskal Wallis Test
b. Grouping Variable: YearLevel

A Kruskal-Wallis H test showed that there was no statistically significant difference in the students' level of AQ across their year level.

4. Is there a significant difference in the students' level of problem solving skills in Mathematics across:
   4.1. age;

Test Assumptions for One-way ANOVA

a. Normality Distribution of the Dependent Variable for Each Group

ANOVA is robust to non-normality. This test can still be considered even if the distribution is not normal and is even better than its non-parametric counterpart (McDougal & Rayner, 2004).

b. Homogeneity of Variance

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2
ProblemSolvingSkills inMathematics	Based on Mean	.159	4	158
	Based on Median	.029	4	158
	Based on Median and with adjusted df	.029	4	137.580
	Based on trimmed mean	.064	4	158

Tests of Homogeneity of Variances

		Sig.
ProblemSolvingSkills inMathematics	Based on Mean	.958
	Based on Median	.998
	Based on Median and with adjusted df	.998
	Based on trimmed mean	.992

Since p-value>0.05, then equal variance can be assumed.

c. Level of Measurement

The level of problem solving skills in Mathematics is a ratio level. It is required to be atleast interval.

d. Independence

Subjects cannot have more than one age at the same time.

One-way ANOVA

ANOVA

ProblemSolvingSkillsinMathematics

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6986.263	4	1746.566	6.727	<.001
Within Groups	41024.227	158	259.647		
Total	48010.491	162			

At least one of the age groups has significantly different level of problem solving skills in Mathematics. To determine which groups differ, we need to run post hoc analysis. Scheffee will be used since we have prior knowledge of the need for all contrasts to be tested.

Post Hoc Tests

Multiple Comparisons

Dependent Variable: ProblemSolvingSkillsinMathematics

Scheffee

(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
18	19	0.51838%	3.96871%	1.000	-11.8520%	12.8888%
	20	-6.61993%	3.88992%	.577	-18.7447%	5.5048%
	21	-12.91164%*	4.13126%	.049	-25.7887%	-0.0346%
	22	-15.96169%*	4.06075%	.005	-28.6189%	-3.3044%
19	18	-0.51838%	3.96871%	1.000	-12.8888%	11.8520%
	20	-7.13831%	3.82808%	.484	-19.0703%	4.7937%
	21	-13.43002%*	4.07309%	.032	-26.1257%	-0.7343%
	22	-16.48008%*	4.00155%	.003	-28.9528%	-4.0073%
20	18	6.61993%	3.88992%	.577	-5.5048%	18.7447%
	19	7.13831%	3.82808%	.484	-4.7937%	19.0703%
	21	-6.29171%	3.99635%	.649	-18.7482%	6.1648%
	22	-9.34176%	3.92342%	.231	-21.5710%	2.8874%
21	18	12.91164%*	4.13126%	.049	0.0346%	25.7887%
	19	13.43002%*	4.07309%	.032	0.7343%	26.1257%
	20	6.29171%	3.99635%	.649	-6.1648%	18.7482%
	22	-3.05006%	4.16282%	.970	-16.0255%	9.9253%
22	18	15.96169%*	4.06075%	.005	3.3044%	28.6189%
	19	16.48008%*	4.00155%	.003	4.0073%	28.9528%
	20	9.34176%	3.92342%	.231	-2.8874%	21.5710%
	21	3.05006%	4.16282%	.970	-9.9253%	16.0255%

*. The mean difference is significant at the 0.05 level.

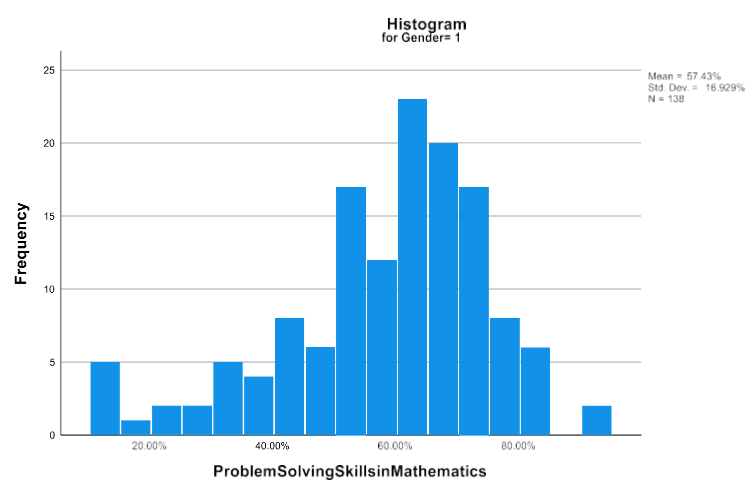
Result in the pairwise comparison of means reveal that the level of AQ is significantly different between 18 and 21, 18 and 22, 19 and 21 and 19 and 22. The 18 year-olds have lower level of problem solving skills in Mathematics than the 21 and 22 year-olds. Also, the 19 year-olds have lower level of problem solving skills in mathematics than the 21 and 22 year-olds. This is not the case of the others.

4.2. gender; and

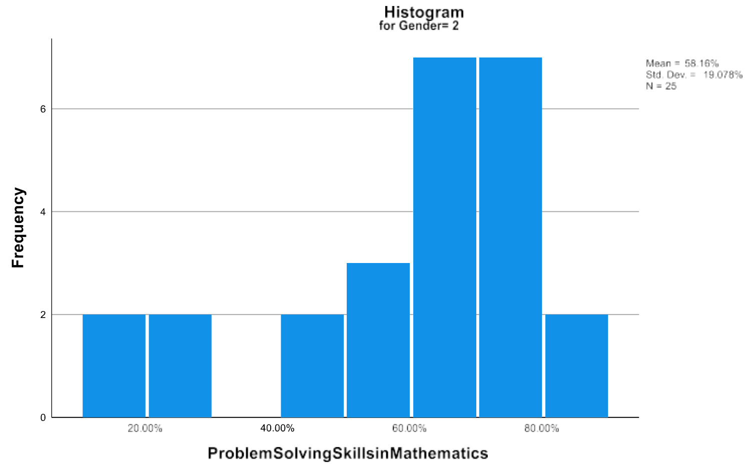
Test Assumptions for Independent sample t-test

a. Normality Distribution of the Dependent Variable for Each Group

Female



Male



Tests of Normality

	Gender	Kolmogorov-Smirnov[a] Statistic	df	Sig.	Shapiro-Wilk Statistic	df
ProblemSolvingSkillsin Mathematics	1	.135	138	<,001	.948	138
	2	.196	25	.014	.857	25

Tests of Normality

	Gender	Shapiro-Wilk[a] Sig.
ProblemSolvingSkillsin Mathematics	1	<,001
	2	.002

Here, the level of problem solving skills in Mathematics in both groups is not significantly normal.

Nonparametric Counterpart: Mann Whitney U-test

Independent-Samples Mann-Whitney U Test Summary

Total N	163
Mann-Whitney U	1854.500
Wilcoxon W	2179.500
Test Statistic	1854.500
Standard Error	216.918
Standardized Test Statistic	.597
Asymptotic Sig.(2-sided test)	.551

Since the Asymptotic Sig.(2-sided test) is more than 0.05, then researchers have evidence that there is not a statistically significant difference in the level of problem solving skills in Mathematics between the female and male students.

4.3. year level?

Test Assumptions for One-way ANOVA

a. Normality Distribution of the Dependent Variable for Each Group

ANOVA is robust to non-normality. This test can still be considered even if the distribution is not normal and is even better than its non-parametric counterpart (McDougal & Rayner, 2004).

b. Homogeneity of Variance

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2
ProblemSolvingSkillsin Mathematics	Based on Mean	7.265	3	159
	Based on Median	4.184	3	159

	Based on Median and with adjusted df	4.184	3	108.009
	Based on trimmed mean	6.289	3	159

Tests of Homogeneity of Variances

		Sig.
ProblemSolvingSkillsin Mathematics	Based on Mean	<.001
	Based on Median	.007
	Based on Median and with adjusted df	.008
	Based on trimmed mean	<.001

Since p-value<0.05, then equal variance cannot be assumed.

Nonparametric Counterpart: Kruskal-Wallis test

Ranks

	YearLevel	N	Mean Rank
ProblemSolvingSkillsinMathematics	1	59	55.53
	2	31	65.08
	3	27	112.07
	4	46	109.70
	Total	163	

Test Statistics[a,b]

	ProblemSolvingSkills inMathematics
Kruskal-Wallis H	49.438
df	3
Asymp. Sig.	<.001

a. Kruskal Wallis test

b. Grouping Variable: YearLevel

A Kruskal-Wallis H test showed that there was a statistically significant difference in the students' level of problem solving skills in Mathematics across their year level. At least one of the year levels has significantly different level of problem solving skills in Mathematics. To determine which groups differ, we need to run post hoc analysis. Mann-Whitney Test will be used.

Post Hoc Tests

Ranks

	YearLevel	N	Mean Rank	Sum of Ranks
ProblemSolvingSkillsinMathematics	1	59	42.84	2527.50
	2	31	50.56	1567.50
	Total	90		

Test Statistics[a]

	ProblemSolvingSkillsin Mathematics
Mann-Whitney U	757.500
Wilcoxon W	2527.500
Z	-1.336
Asymp. Sig. (2-tailed)	.182
Exact Sig. (2-tailed)	.183
Exact Sig. (1-tailed)	.092
Point Probability	.001

a. Grouping Variable: YearLevel

Since the Asymp. Sig. (2-tailed) is more than 0.05, then researchers have evidence that there is not a statistically significant difference in the level of problem solving skills in Mathematics between the first and second year students.

Ranks

	YearLevel	N	Mean Rank	Sum of Ranks
ProblemSolvingSkillsinMathematics	1	59	32.71	1930.00
	3	27	67.07	1811.00
	Total	86		

Test Statistics[a]

	ProblemSolvingSkillsin Mathematics
Mann-Whitney U	160.000
Wilcoxon W	1930.000
Z	-5.931
Asymp. Sig. (2-tailed)	<.001
Exact Sig. (2-tailed)	<.001
Exact Sig. (1-tailed)	<.001
Point Probability	.000

a. Grouping Variable: YearLevel

Since the Asymp. Sig. (2-tailed) is less than 0.05, then researchers have evidence that there is a statistically significant difference in the level of problem solving skills in Mathematics between the first and third year students. The first year students have lower level of problem solving skills in Mathematics than the third year students.

Ranks

	YearLevel	N	Mean Rank	Sum of Ranks
ProblemSolvingSkillsinMathematics	1	59	39.98	2359.00
	4	46	69.70	3206.00
	Total	105		

Test Statistics[a]

	ProblemSolvingSkillsin Mathematics
Mann-Whitney U	589.000
Wilcoxon W	2359.000
Z	-4.964
Asymp. Sig. (2-tailed)	<.001
Exact Sig. (2-tailed)	<.001
Exact Sig. (1-tailed)	<.001
Point Probability	.000

a. Grouping Variable: YearLevel

Since the Asymp. Sig. (2-tailed) is less than 0.05, then researchers have evidence that there is a statistically significant difference in the level of problem solving skills in Mathematics between the first and fourth year students. The first year students have lower level of problem solving skills in Mathematics than the fourth year students.

Ranks

	YearLevel	N	Mean Rank	Sum of Ranks
ProblemSolvingSkillsinMathematics	2	31	19.85	615.50
	3	27	40.57	1095.50
	Total	58		

Test Statistics[a]

	ProblemSolvingSkillsin Mathematics
Mann-Whitney U	119.500
Wilcoxon W	615.500
Z	-4.689
Asymp. Sig. (2-tailed)	<.001
Exact Sig. (2-tailed)	<.001
Exact Sig. (1-tailed)	<.001
Point Probability	.000

a. Grouping Variable: YearLevel

Since the Asymp. Sig. (2-tailed) is less than 0.05, then researchers have evidence that there is a statistically significant difference in the level of problem solving skills in Mathematics between the second and third year students. The second year students have lower level of problem solving skills in Mathematics than the third year students.

Ranks

	YearLevel	N	Mean Rank	Sum of Ranks
ProblemSolvingSkillsinMathematics	2	31	26.66	826.50
	4	46	47.32	2176.50
	Total	77		

Test Statistics[a]

	ProblemSolvingSkillsin Mathematics
Mann-Whitney U	330.500
Wilcoxon W	826.500
Z	-3.981
Asymp. Sig. (2-tailed)	<.001
Exact Sig. (2-tailed)	<.001
Exact Sig. (1-tailed)	<.001
Point Probability	.000

a. Grouping Variable: YearLevel

Since the Asymp. Sig. (2-tailed) is less than 0.05, then researchers have evidence that there is a statistically significant difference in the level of problem solving skills in Mathematics between the second and fourth year students. The second year students have lower level of problem solving skills in Mathematics than the fourth year students.

Ranks

	YearLevel	N	Mean Rank	Sum of Ranks
ProblemSolvingSkillsinMathematics	3	27	32.43	875.50
	4	46	39.68	1825.50
	Total	73		

Test Statistics[a]

	ProblemSolvingSkillsin Mathematics
Mann-Whitney U	497.500
Wilcoxon W	875.500
Z	-1.415
Asymp. Sig. (2-tailed)	.157
Exact Sig. (2-tailed)	.159
Exact Sig. (1-tailed)	.079
Point Probability	.001

a. Grouping Variable: YearLevel

Since the Asymp. Sig. (2-tailed) is more than 0.05, then researchers have evidence that there is not a statistically significant difference in the level of problem solving skills in Mathematics between the third and fourth year students.

5. Is the level of AQ of the students a significant predictor of their level of problem solving skills in Mathematics?

   Test Assumptions for Linear regression

   1. The relationship between the dependent and the independent variable is linear.

ANOVA Table

			Sig.
ProblemSolvingSkillsinMathematics * AQ	Between Groups	(Combined)	.255
		Linearity	.030
		Deviation from Linearity	.349
	Within Groups		
	Total		

The value sig. Deviation from Linearity>0.05, then the relationship between the independent variable is linear.

2. The values of the residuals are independent.

Model Summary[b]

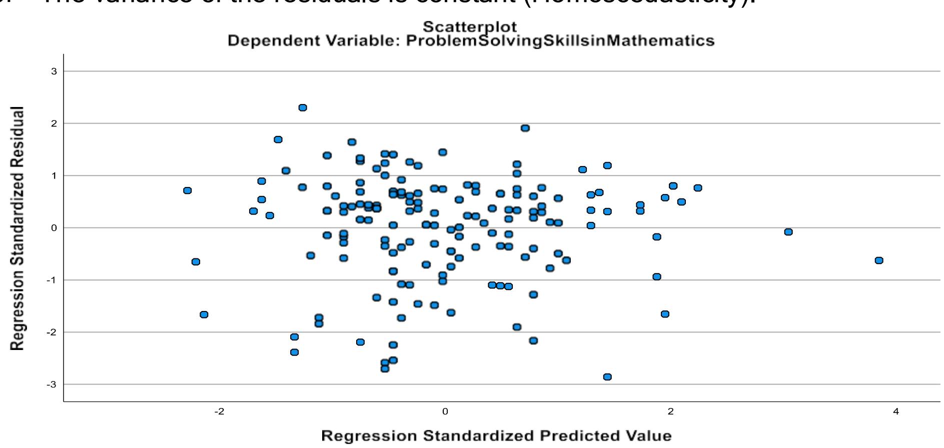
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.169[a]	.028	.022	17.02157%	1.706

a. Predictors: (Constant), AdversityQuotient

b. Dependent Variable: ProblemSolvingSkillsinMathematics

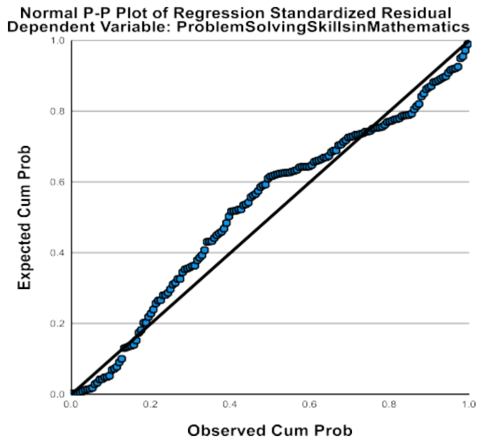
As a general rule of thumb, the residuals are uncorrelated when the Durbin-Watson statistic is approximately 2. Values below 1 and above 3 are cause for concern and may render your analysis invalid. In this, the residuals are uncorrelated.

3. The variance of the residuals is constant (Homoscedasticity).



The scatterplot of the residuals does not have an obvious pattern.

4. The values of the residuals are normally distributed (Serial Correlation).



Data points are near to our diagonal line indicating that the residuals are approximately normally distributed.

5. There are no influential cases biasing the model. (No outliers)

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	50.9002%	68.6945%	57.5399%	2.90097%	163
Std. Predicted Value	-2.289	3.845	.000	1.000	163
Standard Error of Predicted Value	1.334	5.312	1.793	.585	163
Adjusted Predicted Value	50.4160%	69.8485%	57.5413%	2.92658%	163
Residual	-48.70384%	39.13413%	0.00000%	16.96895%	163
Std. Residual	-2.861	2.299	.000	.997	163
Stud. Residual	-2.889	2.318	.000	1.003	163
Deleted Residual	-49.63968%	39.77191%	-0.00138%	17.17883%	163
Stud. Deleted Residual	-2.957	2.350	-.002	1.011	163
Mahal. Distance	.001	14.785	.994	1.711	163
Cook's Distance	.000	.080	.006	.011	163
Centered Leverage Value	.000	.091	.006	.011	163

a. Dependent Variable: ProblemSolvingSkillsinMathematics

No instance of Cook's distance greater than one has occurred. Thus, there is no significant outlier.

Linear regression

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.169[a]	.028	.022	17.02157%

a. Predictors: (Constant), AdversityQuotient

b. Dependent Variable: ProblemSolvingSkillsinMathematics

2.2% of variance in level of problem solving skills in Mathematics is explained by level of AQ.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1363.333	1	1363.333	4.705	.032[b]
	Residual	46647.158	161	289.734		
	Total	48010.491	162			

a. Dependent Variable: ProblemSolvingSkillsinMathematics

b. Predictors: (Constant), AdversityQuotient

Since the p-value is less than 0.05, then there is enough evidence to support that regression coefficients is not equal to 0. Thus, level of AQ significantly explains level of problem solving skills in Mathematics.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	31.199	12.216		2.554	.012
	AQ	.212	.098	.169	2.169	.032

Level of AQ is a significant predictor of level of problem solving skills in Mathematics.

Model

ProblemSolvingSkillsinMathematics=0.212AdversityQuotient

Interpretation

For every unit increase in level of AQ, level of problem solving skills in Mathematics is predicted to be 0.212 units higher.