

Adversity Quotient and Problem-solving Skills in Advanced Algebra

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ABSTRACT

Problem-solving is a 21st century necessity, but the disconcerting results in the recent international assessment of problem-solving skills reveal an obvious failure to put this into action in classrooms. The purpose of the study was to ascertain the adversity quotient and its relationship to the problem-solving skills of 76 fourth-year high school students. Specifically, the study intended to determine the students' adversity profile in terms of the dimensions of adversity quotient and level of problem-solving skills in terms of the cognitive processes and to ascertain which adversity quotient dimension would best predict the problem-solving skills. The researcher employed a descriptive-correlation method, utilized a questionnaire adapted from Stoltz's Adversity Response Profile and a constructed problem-solving test in Advanced Algebra, and used mean, Pearson r , and multiple regression in the analysis of data. The findings revealed that the adversity quotient profile of the students is moderate and the problem-solving skill of the students is satisfactory. The level of adversity quotient and problem-solving skills of the respondents were found to be significantly related, and reach is the most efficient predictor of one's problem-solving skills.

Keywords – Mathematics Education, adversity quotient, problem-solving skills, advanced algebra, descriptive-correlation design, Davao City, Philippines

INTRODUCTION

Problem-solving skill is an indicator of one's readiness to advanced degrees and ultimately the country's innovative capacity. However, worldwide assessment performances revealed a glaring difficulty among students.

Twenty-three percent or approximately 100,000 out of almost 470, 000 fifteen-year old students from 65 countries and economies failed to reach at least Level 2 in the Programmed for International Student Assessment of Mathematical Literacy (OECD, 2010). Level Two is considered a baseline level on the PISA scale at which students are expected to use mathematics actively in solving problems (OECD, 2004). In most countries, more than 10 percent of students were unable to solve basic problems and on average in OECD countries, half of the students were unable to solve problems that are more difficult than basic problems. Though East Asian students are hailed as superior, their scholastic achievements are at odds with the low general performance of their peers worldwide.

As it gears towards global competitiveness, the Philippines aimed to equip its young generation with skills in science and mathematics. However, results of 2008 Trends in International Mathematics and Science Study (TIMSS-Advanced) involving only students from selected science high schools showed that among the countries that participated in the assessment the country ranked lowest with an average scale score of 355 and with only 1% of the Filipino students reaching the Advanced Level (Ogena et al., 2010). It was further noted that the average percent correct in algebra is a dismal 24 percent while in problem-solving it is even lower at 21 percent. Similar unfavorable results occurred in the National Career Assessment Examination (NCAE). The fourth-year high school students obtained an overall Mean Percentage Score (MPS) in mathematics of close to 41.7 percent in their NCAE (Virola, 2009).

However, life as a student, nowadays, is not anymore as smooth as waltz but a battlefield of challenges and trials. How the students respond to these personal adversities demonstrates their adversity quotient which may in some manner influence their performance in problem-solving tasks particularly in a complex subject such as Advanced Algebra. Thus, this study in ascertaining the possible relationship between one's adversity quotient and problem-solving skills was put in place.

FRAMEWORK

This study is anchored on Bandura's construct (1977) on self-efficacy which states that how resilient they will be in the face of adverse situations determine the level of accomplishment that one ultimately achieves in challenging tasks and activities like mathematical problem-solving. Self-efficacy theory concurs that students work harder on a learning task when they judge themselves as more capable than when they lack confidence in their ability to learn.

Likewise, Stoltz (1997) theorized that there is a relationship between adversity quotient and academic success. He maintained that if students take positive action to solve them via a structured game plan, they increase their self-esteem, motivation to complete tasks and the capacity to succeed in academic pursuits. Hence, one's problem-solving skill is in some extent influenced by the person's adversity profile.

While most studies focused on relating IQ and/or EQ to academic performance, this study, however, focused on Adversity Quotient (AQ) and its influence on the problem-solving skills of advanced algebra students. The respondent's adversity quotient is the independent variable while the skill in problem-solving is the dependent variable.

Adversity quotient is further categorized by Stoltz (2000) into four dimensions – Control, Ownership, Reach and Endurance. The control dimension score measures the amount of control a person perceives that he or she has over adverse events. Ownership dimension score is the measure of the extent to which a person regards himself as accountable for improving the situation. The reach dimension score is the degree to which a person perceives their ability to minimize the impact of adversity to the other areas of their lives. Lastly, endurance dimension score is a measure of the perceived time of recovery from the hardship.

Problem-solving skills are determined by combining scores in an advanced algebra test involving selected functions noted in the diagnostic test as areas having low mean scores such as polynomial, exponential and circular functions. The problem-solving skill of each participant will be evaluated in terms of the four problem-solving processes specified in the framework of the PISA 2012 problem-solving assessment (Funke et al., 2010). Exploring and understanding skills indicate the ability of the respondents in searching for information, finding limitation or obstacles and understanding relevant concepts. Representing and formulating skills refer to the ability to construct symbolic representations of a problematic situation to make it more solvable. Planning and executing skills

encompass goal setting and carrying out strategies to provide what the problem requires. Monitoring and reflecting skills demand that the respondents critically evaluate the solutions or assumptions on a given situation.

OBJECTIVES OF THE STUDY

The main intent of this study was to determine the relationship between the adversity quotient and problem-solving skills of the fourth-year students.

Specifically, this study attempted to determine the adversity quotient profile of Advanced Algebra students in terms of control, ownership, reach and endurance dimensions. Also, this intended to determine the level of problem-solving skills of Advanced Algebra students in terms of exploring and understanding, representing and formulating, planning and executing; and monitoring and reflecting domains. Then, the study assessed the significant relationship between the adversity quotient and problem-solving skills of Advanced Algebra students and identified the adversity quotient dimensions significantly influence the problem-solving skills of Advanced Algebra students.

METHODOLOGY

The present study made use of the descriptive survey method using correlation design. The actual respondents of the study included only 76 fourth year high school students. This particular group was chosen as the respondents of this study considering that they were the ones taking up Advanced Algebra, and they fit the profile of the PISA takers.

The proponent gathered data using these research instruments: Adversity Response Profile and Problem-solving Questionnaire. The researcher obtained an informed consent from the respondents in compliance to research ethics protocol.

The Adversity Response Profile (ARP) measures an individual's style of responding to the adverse situation (Stoltz, 2000). Moreover, since the respondents are high school students the original questionnaire was modified to suit the level of understanding of the participants of the study. The simplified ARP described 20 problematic situations adapted from the questionnaire of Stoltz (2000) categorized into four dimensions of adversity quotient and each scenario is followed by a question answered in a 5-point bipolar scale.

The score on each item of the four dimensions of the adversity quotient was determined by multiplying the rating by two. Thus, the score for each item can

range from 2 – 10. Consequently, the total score for each dimension is the sum of the individual ratings per item multiplied by two so the total score can range from 10 – 50.

In each dimension, a total score of 45 – 50 is regarded very high, 35 – 44 is high, 25 – 34 is moderate, 15 – 24 is low and 10 – 14 is very low. The overall adversity quotient is computed by adding the scores in the each dimension and then multiplied by two which consequently implies that the total AQ scores can range from 40 to 200.

An individual with a total score greater than 180 is considered to have very high AQ and in a range of 140 – 179 is considered to have high AQ, the individual with a score in the range of 100 – 139 falls in the moderate level and with a score between 60 – 99 is said to have low AQ. An individual who scores between 40 and 59 is said to have very low AQ.

Moreover, a 60-item multiple-choice questionnaire was used for measuring problem-solving skills. In accordance to the PISA 2012 framework, the 12 problems were categorized as exploring and understanding, 12 items involved representing and formulating, 24 items required planning and executing and 12 items demanded monitoring and reflecting skills. There were no deductions for the wrong answer so the overall test will range from 1 – 60. The scores were then converted to percentages and interpreted based on the scale below:

Performance Rating	Qualitative Description	Interpretation
81 – 100	Outstanding	This means the students demonstrate comprehensive problem-solving skills.
61 – 80	Very Satisfactory	This means the students demonstrate substantial problem-solving skills.
41 – 60	Satisfactory	This means the students demonstrate adequate problem-solving skills.
21 – 40	Poor	This means the students demonstrate evidence of the basic problem-solving skills, but require assistance.
1 – 20	Very Poor	This means the students lack the basic problem-solving skills.

Both instruments were submitted for validation by four experts who have served the academe for more than five years making them truly reliable in their assessment of the research tools. Two of them rated the questionnaire very good while the other two rated it good resulting to an overall validity rating of 3.68

which is interpreted as good. Thus, the prepared research tools are deemed valid and reliable measurements for the attainment of the objectives of this present study.

RESULTS AND DISCUSSION

Adversity Quotient Profile of Students

The overall mean in the adversity quotient is 133.29 or moderate. This indicates that they would tend to quit instead of climbing towards success. Except for their ability to take responsibility towards the improvement of their situation, they have moderate control over the adversities they experienced, less capacity to keep other areas of their lives from the impact of setbacks and have difficulty in enduring hardships and challenges. Hence, this particular group of students demonstrates a moderate capacity to respond to challenges, problems and adversities. Moreover, the observed AQ indicates that these students belong to Campers as described by Stoltz (2000). Campers refer to persons who have some capacity for challenge and change, but tend to get overwhelmed when adversity piles up and resort to blame when tired or tense.

Table 1. Summary of mean scores of respondents in the adversity quotient dimensions

Variables	Mean Score	S.d.	Qualitative Description
Control	32.61	5.924	Moderate
Ownership	37.79	6.010	High
Reach	33.45	6.045	Moderate
Endurance	29.45	6.785	Moderate
Adversity Quotient	133.29	13.618	Moderate

Among the adversity quotient dimensions, ownership obtains the highest mean of 37.79 or high. This means that the students are more likely to take positive action when adversity arises. Instead of submitting to helplessness, they consider the challenge as temporary and work their way out of the dilemma with hope and optimism. Data further reveals that these respondents are somewhat pessimistic. They take adversity and its causes to be permanent. They are likely to lose motivation, reduce persistence and increase the likelihood of depression.

However, the mean score of the respondents in the control dimension is 32.61 or moderate while in reach dimension is 33.45 or moderate. These mean

that they have difficulty in limiting the extent of the impact of adverse situations to other aspects of their lives and they struggle a lot in putting a stop to the repercussions of their adversity-ridden experiences. Also, they are moderately motivated when given problems, sometimes lack energy and persistence, and mostly surrender in perplexing circumstances. When faced with a challenge, they have a tendency to lose their core human drive to ascend and grasp the situation. Problems would make them panicky.

In addition, endurance has the lowest mean of 29.45 or moderate. This denotes that these students mostly attribute their failure to their ability than to their effort. They are overwhelmed by the adversity, challenges and trials.

Level of Problem-solving Skills

The overall mean rating for *problem-solving skills* is 40.81 or satisfactory. This indicates that the students demonstrate adequate problem-solving skills. However, the obtained mean rating is merely 0.31 above the upper limit of a poor rating which means that the students' problem-solving skills still leave much room for improvement. Among the indicators, *exploring and understanding* has the highest mean of 47.48 or satisfactory. This means that they performed satisfactorily in tasks that call for information hunting and understanding problematic situations.

Moreover, the mean score in *monitoring and reflecting* is 42.76 or satisfactory while in *representing and formulating* it is 38.27 or poor. The lowest mean is in *planning and executing* which is 37.78 or poor. This shows that the students have poor computation and analytical skills resulting to unsatisfactory performances in problem-solving tasks.

These results simply suggest that the majority of these students failed to master even the basic problem-solving skills of translating situations into mathematical notations or models leading to difficulty in obtaining the correct and practical answer when the plan is executed.

These indicate that most of our students nowadays have difficulty in solving word problems in mathematics. Finally, these results merely reflect the lackluster performances in local and global assessments of Filipino fifteen-year old students which might be repeated again and again unless necessary initiatives will be put in place in our mathematics classes and curriculum (Ogena et al., 2010).

Table 2. Summary of mean scores of respondents in the problem-solving skills test

Variables	Mean	S.d.	Qualitative Description
Exploring and Understanding	47.48	2.292	Satisfactory
Representing and Formulating	38.27	1.706	Poor
Planning and Executing	37.78	3.348	Poor
Monitoring and Reflecting	42.76	2.119	Satisfactory
Problem-solving Skills	40.81	7.006	Satisfactory

Significance of the Relationship of AQ and Problem-solving Skills

The computed r-value between adversity quotient and exploring is 0.308 with a p-value of 0.007 which suggests a significant relationship between the two variables. Therefore, the null hypothesis is rejected. It shows that there is a moderate positive relationship between adversity quotient and the exploring dimension of problem-solving skills.

Table 3. Significant relationship between indicator variables

Variables		Exploring & Understanding	Representing & Formulating	Planning & Executing	Monitoring & Reflecting	Problem Solving Skills
Reach	r	.219	.348**	.174	.231*	.310**
ADVERSITY QUOTIENT	r	.308**	.300**	.131	.235*	.338**

The computed r-values of each dimension of adversity quotient to representing and formulating are 0.054 (p-value = 0.645) for control, 0.137 (p – value = 0.237) for ownership, 0.348 (p-value = 0.002) for reach, and 0.123 (p – value = 0.289) for endurance. Among the computed r-values, only the relationship between reach score and representing skills is significant.

The data mean that there is a moderate positive relationship between a person’s ability to prevent the adversity to creep into the other areas of his life and proficiency in translating word problems into algebraic notations and representation. Furthermore, the computed r-value between adversity quotient and representing skills is 0.300 with a p-value of 0.009 is also significant. Hence, the adversity quotient of a person is moderately positively correlated with representing and formulating skills in problem-solving.

When problem-solving skill is associated with the four dimensions of adversity quotient, the computed r -values and p -values respectively are as follows: 0.057 and 0.622 for control, 0.107 and 0.358 for ownership, 0.310 and 0.006 for reach, 0.197 and 0.089 for endurance. Hence, the reach score which describes one's capacity to isolate other areas of one's life from the effects of the adversity is significantly correlated with one's problem-solving skills.

Moreover, when adversity quotient is associated with problem-solving skills, the computed Pearson r is 0.338 with a p -value of 0.007. The p -value is less than 0.05, so it suggests a significant relationship between the two variables of the study, and so the null hypothesis that there is no significant relationship between one's adversity quotient and problem-solving skills is rejected.

Furthermore, the data shows that there is a positive low correlation between adversity quotient and problem-solving skills of students, but they are significantly related with one another. It implies that having high problem-solving skills is a reflection that the person has a high-adversity quotient (Deesom, 2011). Also, having low problem-solving skills may imply that the person demonstrates low-adversity quotient. This result, therefore, confirms the construct on self-efficacy that the level of resiliency in the face of adverse situation determines the level of accomplishment that one ultimately achieves in a given task particularly problem-solving tasks (Bandura, 1977). Likewise, it conforms to Stoltz' (1997) theory that adversity quotient and academic success are directly proportional. That is if students can do something positive with the adversity then their ability to succeed in academic pursuits as problem-solving is increased.

Problem solving has been a problem both by the math teachers and their students. The use of diagnostic test as basis for identifying students having difficulties and in planning academic assistance initiatives in math had been noted to be insufficient. Thus, this study was deemed an investigation on the potential use of the contextualized Stoltz' adversity response profile tool in determining students who might have a hard time in meeting the problem solving nature of advanced algebra. Since advanced algebra is intended to be a subject for fourth year students, then they were selected as the respondents. Though, a bigger number of participants would have been preferable but due to time constraints only those currently enrolled in the locale of the study were chosen. All respondents answered the questionnaires at the same time within a strictly followed time frame and chosen classroom.

CONCLUSIONS

After a thorough analysis, the researcher established that the adversity quotient profile of the selected respondents is moderate. Specifically, the level of control, reach and endurance are all moderate while the level of ownership is high.

Moreover, the level of problem-solving skills of the respondents is satisfactory. Particularly, the respondents registered a satisfactory rating in exploring and understanding and monitoring and reflecting while they obtained a poor rating in formulating and representing and planning and executing.

There is a significant relationship between the Adversity Quotient and the Problem-solving Skills of students. Among the four dimensions, the reach score is considered to have the most significant impact on one's problem-solving skills.

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