



“AT-RISK” STUDENTS SELF-EFFICACY LEVEL AND ATTITUDES TOWARDS MATHEMATIC IN THE UPPER EAST REGION OF GHANA

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ABSTRACT: *Several studies exist in literature on the attitude of students towards mathematics and the self-efficacy level of students in mathematics in general. However, little is seen on the attitudes of “At-Risk” students towards mathematics and their self-efficacy level in mathematics, hence this study was conducted to fill the gap in literature by examining the attitudes and self-efficacy level of the “At-Risk” students towards/in mathematics in the Upper East Region of Ghana. This investigation is a quantitative one which made use of a cross-sectional survey design to collect data from 104 “At-Risk” students who were selected using multiple sampling techniques. Adopted attitudes towards mathematics inventory by Tapia (1996) and adapted self-efficacy questionnaire by May (2009) were the instruments of data collection. The data collected were analyzed descriptively (means and standard deviations) which were compared with standard levels of interpretations in literature and judgment made. From the analysis of the data, it was found that “At-Risk” students have low mathematics self-efficacy level and moderate attitudes towards mathematics. It was therefore recommended that mathematics teachers should employ innovative and child-centered teaching approaches which have the potential of actively engaging learners during instruction in the subject to help enhance learners’ attitudes and self-efficacy level in mathematics.*

KEYWORDS: At-Risk students, Attitudes, Self-efficacy.



INTRODUCTION

Students' attitudes towards mathematics and their self-efficacy levels in mathematics are two key topics that have gained much attention and recognition among researchers, teachers, curriculum developers and all other necessary stakeholders in education of late. Research has revealed that students' attitudes towards mathematics and self-efficacy levels in mathematics have a relation with students' academic performance in mathematics. For instance, Nicholaidou and Philippou (2003) study revealed that attitudes towards mathematics and academic achievement in problem solving were dependent on each other. Also, Depaolo and McLaren's (2006) study on the relationship between attitudes and performance in business calculus revealed that there was a strong relationship between negative attitudes and poor performance. They went further and concluded that students' performances can be increased by improving their attitudes. Furthermore, Mullis, Martin and Arora (2012) found that learners with positive attitudes towards mathematics were eager to learn mathematics and showed interest in learning mathematics whilst Cho and Hwang (2019) indicated that students with negative attitudes towards mathematics have hatred for mathematics and hence sees mathematics as not being useful with most of them even shying away from mathematics and its related courses and careers. In addition, Syamsuri and Ramlan-Bahtiar (2023) found a weak but at the same time significant positive relationship between learners' attitudes towards mathematics and mathematics attainments of grade 11 students. Again, literature has proven that attitudes towards mathematics have a significant effect on the acquisition and attainment of students' mathematical skills and academic achievement respectively (Peteros, Columna, Etcuban, Almerino & Almerino, 2019; Cerbito, 2020; Barroso, Ganley, McGraw, Geer, Hart & Daucourt, 2020).

On the part of self-efficacy levels in mathematics, Nicholaidou and Philippou's (2003) study on attitudes towards mathematics, self-efficacy and achievement in problem solving found a stronger relationship between self-efficacy and mathematics achievement. They further indicated that self-efficacy is a stronger predictor of academic performance than attitudes. Also, Skaalvik and Skaalvik's (2006) study revealed that self-efficacy strongly predicted subsequent mathematics attainments of students. Moreso, Ozkal's (2019) study on the relationship between self-efficacy beliefs, engagement and academic attainments in mathematics noted that learners' self-efficacy beliefs significantly and positively determined learners' performance in mathematics. From the previous studies, it was clear that students' attitudes towards mathematics and their self-efficacy level in mathematics are factors that can affect or determine their academic performances in mathematics. This means that when students develop positive attitudes towards mathematics and believe in their ability to do mathematics, their understanding and performance level in mathematics would be increased significantly but literature has however shown that the opposite is the situation on the ground. Students all over the world and across the various levels of education continue to exhibit dislike for mathematics, show low level of interest in studying mathematics, exhibit low self-efficacy level and on a few occasions exhibited neutral attitudes towards mathematics. This statement is supported by Mutai's (2010) study in Kenya which found that high school students showed lack of confidence and low interest in learning mathematics. Also, Erdogan and Yemenli (2019) in Turkey noted that one-third of the 36 fifth graders had a negative and unstable attitude toward mathematics. Again, it was revealed that Philippines Grade 9 students had positive attitudes towards mathematics in terms of its usefulness but had neutral attitudes in terms of their self-confidence, enjoyment and motivation to learn mathematics (Capuno, Necesario, Etcuban,



Espina, Padillo & Manguilimotan, 2019). Furthermore, Mazana, Suero and Olifage's (2019) study on students' attitudes towards learning mathematics in Tanzania revealed that students exhibited positive attitudes towards learning mathematics at the initial stages of their education and that these positive attitudes decline as students climb the academic ladder. In addition, Awanta's (2009) study in Ghana revealed that Junior High School students did not like going for mathematics lessons and performing mathematical tasks. It was further found that students' confidence in numerical calculations and problem solving declined gradually. The rhetorical question one could ask is "what could be the cause of the decline in students' positive attitudes towards mathematics as they progress in their academic pursuit?".

On the part of self-efficacy, Masitoh and Fitriyani (2018) found that students' mathematics self-efficacy was still relatively low. Students were not confident in their ability to solve mathematics problems. The negative attitudes of students towards mathematics and the low self-efficacy levels in mathematics could be the cause of the current trend of students' poor performances in the West African Secondary School Certificate Examinations and Basic Education Certificate Examinations in mathematics.

Though studies in other locations have shown that students' attitudes towards mathematics and their self-efficacy beliefs in mathematics are predictors of their performances and have equally made it clear that students in general exhibit negative attitudes towards mathematics and have low self-efficacy levels in mathematics, little is known in terms of research on the attitudes and self-efficacy levels of the "At-Risk" students towards/in mathematics in the Upper East Region of Ghana. Again, literature made it known that gifted students have positive and stable attitudes towards mathematics (Erdogan & Yemenli, 2019), but the same literature remained silent on the attitudes of "At-Risk" or less gifted students towards mathematics hence the focus of this study.

This study was conducted to address the following research questions;

1. What is the self-efficacy level of At-Risk students in mathematics?
2. What is the attitude of At-Risk students towards mathematics?

"At-Risk" students as used in this study refers to Senior High School students who failed to obtain at least grade five (5) in mathematics in their Basic Education Certificate Examinations.

LITERATURE REVIEW

Self-efficacy, a concept introduced by Bandura (1997), refers to an individual's belief in his or her ability to perform or complete a specific task or goals. In this study, At-Risk students' mathematics self-efficacy refers to the belief in their capability to successfully carry out mathematics assignments with little or no support. Learners with high mathematics self-efficacy are more likely to tackle difficult mathematical tasks with confidence and perseverance, leading to better academic performance in mathematics and its related subjects. Conversely, students with low mathematics self-efficacy may doubt their capabilities and, as a result, may avoid challenging mathematics tasks or exhibit learned helplessness. An investigation conducted by Zimmerman and Schumk, (2020) revealed a positive correlation between learners' academic self-efficacy and their attainments across subjects and grade levels.



Also, Lee and Martinez (2019) noted that learners' self-efficacy beliefs strongly determined their academic attainments, even after controlling for their prior academic performance and socio-economic factors.

Wang and Ertl's (2011) studies have shown that there exists a positive correlation between learners' attitudes towards mathematics and their academic performance. Learners with positive attitudes towards mathematics are more likely to engage in learning mathematics which can lead them into achieving better results in the subject whilst those with negative attitudes are more likely to shy away from the subject which can hinder their ability to learn and excel in mathematics. Also, Benken and Ramirez (2015) noted that students who demonstrate positive attitudes towards mathematics usually find joy in problem-solving, logical reasoning, and discovering patterns. These students tend to be more motivated and enthusiastic about learning mathematics.

In addition, many students view mathematics as a challenging subject, leading to a perception that it is hard to understand and master. This perception can influence their motivation and engagement in learning mathematics (Gunderson, Ramirez, Beilock & Levine, 2012). Some students lack interest in mathematics due to a perceived lack of relevance to their lives or future careers (Hannula, 2011). Such students view mathematics as abstract and disconnected from real-world applications, leading to disengagement with the subject.

METHODOLOGY

This quantitative research employed a cross-sectional survey as its design, using a sample of 104 "At-Risk" students in eight Senior High Schools in the Upper East Region of Ghana. These 104 "At-Risk" students used for the study were selected using multiple sampling techniques. The Senior High Schools were first put into four clusters which are the category A, category B, category C and category D schools. After the clusters were formed, two schools each from each of the clusters were randomly chosen and from these schools only students who could not obtain at least grade five in their BECE mathematics (At-Risk students) were purposely considered. Also, snowball sampling technique was employed to select a number of students who met the selection criteria and these few selected students were in turn used as informants to identify or recommend yet another group of students who qualify for inclusion. At least thirteen (13) "At-Risk" students were chosen from each of the selected schools. Adopted Attitude Towards Mathematics Inventory (ATMI) developed by Tapia (1996) and adapted self-efficacy levels in mathematics questionnaires developed by May (2009) were used to collect data from these 104 "At-Risk" students. The ATMI was used to assess students' attitude toward mathematics in four domains: value or usefulness of mathematics, enjoyment of mathematics, self-confidence in mathematics and motivations to learn mathematics (Marsh, 2004). The ATMI consists of 40 items using a five point-likert scale ranging from "strongly agree" (SA=5) to, "agree" (A=4) to, "neutral" (N=3) to, "disagree" (D=2) to, "strongly disagree" (SD=1) for the students to indicate their level of agreement to all forty items (Tapia & Marsh, 2004). Negatively worded items were reversely scored to minimize extreme response bias and acquiescence bias. The 40 items included in the ATMI consisted of 15 items measuring self-confidence, 10 measuring value, 10 measuring enjoyment, and five measuring motivation (Tapia & Marsh, 2004). Both content and structure of the ATMI were validated (Tapia & Marsh, 2004). The ATMI has been shown to be a reliable and valid questionnaire for gauging



students' perspectives on the subject (Amirali, 2010; Tapia & Marsh, 2004). According to a report by Tapia (1996), the ATMI has a reliability coefficient of 0.90. Furthermore, the Cronbach alphas (measures of internal consistency) for each of the four themes are as follows: 0.95 for the self-confidence subscale, 0.86 for value subscale, 0.88 for enjoyment subscale and 0.89 for motivation subscale (Tapia, 1996).

Also, the researcher adapted the self-efficacy questionnaire from the mathematics anxiety and self-efficacy questionnaire developed by May (2009). The questionnaire was composed of 13 items designed using a five-point likert scale as (Never =1), (Seldom=2), (Sometimes=3), (Often=4) and (Usually=5) (May, 2009). The adapted questionnaire went through peer and expert reviews to establish its validity whilst the reliability was determined by pilot testing the instrument and using the data from the pilot testing to calculate the reliability coefficient which was found to be 0.72.

Students were assured of the confidentiality of their responses and the questionnaires administered to them by the researchers with the help of some teachers in the selected schools. The data collected on students' attitudes towards mathematics and self-efficacy levels in mathematics were analyzed using descriptive statistics such as means and standard deviations. Jamil's (2001) level of interpretation of students' attitudes towards mathematics as cited in Mohd, Mahmood and Ismail (2011) was adopted in the analyses of At-Risk students' attitudes towards mathematics whilst Quek (2006) level of interpretation of students' perceptions as cited in Jumadi and Kanafiah, (2013) was adapted to measure the At-Risk students' self-efficacy levels in mathematics. The levels of interpretation of the attitude towards mathematics is shown in Table 1 whilst the levels of interpretation of self-efficacy level is shown in Table 2.

Table 1: Level of interpretation of students' attitudes towards mathematics

Range of Mean Score	Level
1.00-2.33	Negative
2.34-3.66	moderate
3.67-5.00	Positive

Source: Jamil (2001) as cited in Mohd (2011).

Table 2: Level of interpretation of students' self-efficacy in mathematics

Range of Mean Score	Level
1.00-1.80	Very Low
1.81-2.60	Low
2.61-3.40	Moderate
3.41-4.20	High
4.21-5.00	Very High

Source: Quek (2006) as cited in Jumadi and Kanafiah (2013).



RESULTS AND DISCUSSION

To answer research question one which aimed at measuring the mathematics self-efficacy level of At-Risks students in the Upper East Region of Ghana, the self-efficacy questionnaire data was analyzed descriptively and the means as well as the average of the means compared with the level of interpretation in Table 2 which serves as a benchmark.

Table 3: Descriptive statistics of At-Risk students' responses to the self-efficacy questionnaire.

Items	N	Mean	Std. Deviation
I BELIEVE I WILL BE ABLE TO USE MATHEMATICS IN MY FUTURE CAREER WHEN NEEDED	104	2.87	1.595
I BELIEVE I CAN DO WELL IN MATHEMATICS TEST	104	2.66	1.076
I BELIEVE I CAN LEARN WELL IN ANY MATHEMATICS COURSE	104	2.57	1.364
I BELIEVE I CAN COMPLETE ALL THE ASSIGNMENTS IN A MATHEMATICS COURSE	104	2.55	1.245
I BELIEVE I CAN UNDERSTAND THE CONTENT IN ANY MATHEMATICS COURSE	104	2.49	1.079
I FEEL THAT I WILL BE ABLE TO DO WELL IN FUTURE MATHEMATICS COURSES	104	2.47	1.269
I FEEL CONFIDENT WHEN TAKING A MATHEMATICS TEST	104	2.46	1.174
I TRUST THAT I AM THE TYPE OF LEARNER WHO IS GOOD AT MATHEMATICS	104	2.38	1.176
I HAVE NO FEAR ASKING QUESTIONS IN MATHEMATICS CLASS	104	2.37	1.199
I BELIEVE I CAN GET AN A IN ANY MATHEMATICS COURSE	104	2.34	1.212
I FEEL CONFIDENT WHEN USING MATHEMATICS OUTSIDE OF SCHOOL	104	2.30	1.156
I BELIEVE I CAN EXPLAIN ANY MATHEMATICS CONTENT TO MY COLLEAGUES	104	2.24	1.057
I BELIEVE I AM THE KIND OF STUDENT WHO CAN DO MATHEMATICS	104	2.20	1.056
Valid N (listwise)			
AVERAGE MEAN		2.45	

Source: Survey Data, 2023.

From Table 3, it was found that the mean scores of students in almost all the items measuring their self-efficacy levels in mathematics fell within the range of 1.81-2.60. According to the level of interpretation in table 3, mean scores within that range are considered as low self-efficacy levels in mathematics. It was only the mean scores of the items "I believe that I will be able to use mathematics in my future career when needed" and "I believe that I can do well in the mathematics test" that fell outside the low self-efficacy level in mathematics range. These



two items had their mean scores falling within the moderate self-efficacy region (2.61-4.40). Also, the average of the means which is 2.45 fell in the low self-efficacy region indicating that, the At-Risk students' mathematics self-efficacy level is generally low. This finding validates the findings of Masitoh and Fitriyani (2018). In Masitoh and Fitriyani's study, it was found that students had relatively low self-efficacy levels as found in this study. The main difference between their study and the current study is the fact that in their study, they were interested in the self-efficacy level of all students whilst the current study specifically looked at the self-efficacy level of At-Risk students only. The finding in this study (low self-efficacy level in mathematics) and the low BECE mathematics scores or grades of these students seems to be confirming the findings of Nicolaidou and Philippou (2003), Skaalvik and Skaalvik (2006), Lee and Martinez (2019), Zimmerman and Schunk, (2020) and Ozkal (2019). All these studies found self-efficacy to be a predictor of students' performance.

For research question two which sought to ascertain the attitudes of At-Risk students towards mathematics based on the four themes, the forty items on the questionnaire were transformed using SPSS into the four themes and the data analyzed descriptively. The results are tabulated in table 4.

Table 4: Descriptive statistics of At-Risk students' responses to the attitudes towards mathematics inventory.

Themes	N	Mean	Std. Deviation
VALUE	104	3.9096	.33603
MOTIVATION	104	3.3120	.63889
ENJOYMENT	104	2.6913	.44919
SELF_CONFIDENCE	104	2.1103	.55675
Valid N (listwise)	104		
Average mean		3.006	

Source: Survey Data, 2023.

From table 4, the mean score ($M = 3.9096$) of the value component of At-Risk students attitudes towards mathematics falls within the positive attitude region (3.67-5.00), the mean score ($M = 3.3120$) of the motivation component and the mean score ($M = 2.6913$) of the enjoyment component of their attitudes falls within the moderate region (2.34-3.66) whilst the mean score (2.1103) of the self-confidence component of their attitudes fall within the negative attitude region (1.00-2.33) according to the level of interpretation by Jamil (2001). The results meant that students know the value of mathematics, appreciate its usefulness in academia and in real life situations but have inadequate motivation or lack the necessary motivation to learn the subject which then resulted in their low level of enjoyment during mathematics instruction. The result further revealed that At-Risk students lack the confidence to learn significant mathematics. These students do not believe that they have all it takes to learn mathematics which led them into thinking that mathematics is not for all but for some particular group of students. Also, the average mean ($M = 3.006$) of the four components of students' attitudes towards mathematics falls within the moderate region (2.34-3.66) indicating that At-Risk students have moderate attitudes towards mathematics. This finding supports Mutai (2010) whose study found that high school students exhibited lack of confidence in learning mathematics. It also agrees with Capuno et al. (2019) when they found that students had



positive attitude towards mathematics in terms of its value and neutral attitudes towards mathematics in terms of motivation and enjoyment but disagrees with them in terms of the self-confidence component of the students' attitudes towards mathematics. They found that students had a neutral or moderate attitude towards mathematics in terms of the self-confidence component.

IMPLICATION OF THE STUDY

Many professions and fields require at least a basic understanding of mathematics. Low self-efficacy and moderate attitude in this area can limit career choices and opportunities, preventing students from pursuing careers in fields that involve science, technology, engineering and mathematics (STEM). Again, mathematics is not only about numbers but also about critical thinking and problem-solving. Low self-efficacy and moderate or negative attitude can hinder the development of these skills thereby affecting student's ability to analyze situations, make informed decisions, and find creative solutions.

To address these implications, it is essential to promote positive attitudes towards mathematics and to enhance self-efficacy level in mathematics from an early age, create supportive learning environments, and provide opportunities for individuals to build confidence and proficiency in mathematics. By fostering a culture that values and embraces mathematics, we can help individuals overcome negative attitudes, increase self-efficacy level and unlock their full potential.

CONCLUSIONS

The research findings led to the conclusions that At-Risk students have a low self-efficacy level in mathematics and a moderate attitude towards mathematics. Perhaps the low self-efficacy level in mathematics and the moderate attitudes towards mathematics are responsible for their low performances in the B.E.C.E mathematics.

SUGGESTIONS FOR FUTURE RESEARCH

The researchers suggest that the study be replicated in the other regions using a much larger sample size for enhanced generalization. Also, studies can be conducted to compare the At-Risk students and gifted students' attitudes towards mathematics and self-efficacy level in mathematics.



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